# **Supplemental material**

# One-step estimator paths for concave regularization

# 7 Implementation via coordinate descent

We use Coordinate descent (CD; e.g., Luenberger and Ye, 2008) to minimize (3) at each step along the path. CD is a local optimization algorithm that cycles through minimization of the conditional objective for individual parameters when the remaining parameters are fixed. Algorithms of this type have have become popular in  $L_1$  penalized estimation since the work by Friedman et al. (2007) and Wu and Lange (2008).

Our CD routine, outlined in Algorithm 1, is a solver for penalized weighted-least squares problems as defined in equation (21) below. This applies directly in Gaussian regression, and for non-Gaussian models we follow Friedman et al. (2010) and apply CD inside an outer loop of iteratively re-weighted-least-squares (IRLS; e.g., Green, 1984). Given current parameter values  $\hat{\beta}$ , the Newton-Raphson update for maximum likelihood estimation is  $\beta = \hat{\beta} - \mathbf{H}^{-1}\mathbf{g}$ , where  $\mathbf{H}$  is the information matrix with elements  $h_{jk} = \partial^2 l/\partial \beta_j \partial \beta_k|_{\hat{\beta}}$  and  $\mathbf{g}$  is coefficient gradient (see Appendix 8). For exponential family linear models we can write  $\mathbf{H} = \mathbf{X}'\mathbf{V}\mathbf{X}$  and  $\mathbf{g} = \mathbf{X}'\mathbf{V}(\mathbf{z} - \hat{\boldsymbol{\eta}})$ , where  $\mathbf{V} = \mathrm{diag}(\mathbf{v})$ ,  $\mathbf{v} = [v_1 \dots v_n]$  are 'weights',  $\mathbf{z} = [z_1 \dots z_n]$  are transformed 'response', and  $\hat{\eta}_i = \hat{\alpha} + \mathbf{x}_i \hat{\boldsymbol{\beta}}$ . In Gaussian regression,  $v_i = 1$ ,  $z_i = \hat{\eta}_i - y_i$ , and the update is an exact solution. For binomial regression,  $v_i = q_i(1 - q_i)$  and  $z_i = \hat{\eta}_i - (y_i - q_i)/v_i$ , where  $q_i = (1 + \exp[-\hat{\eta}_i])^{-1}$  is the estimated probability of success.

This yields  $\beta = (\mathbf{X}'\mathbf{V}\mathbf{X})^{-1}\mathbf{X}'\mathbf{V}\mathbf{z}$ , such that the Newton update solves a weighted-least-squares problem. Adding  $L_1$  costs, the minimization objective from (3) becomes

$$\underset{\alpha,\beta_1...\beta_p \in \mathbb{R}}{\operatorname{argmin}} \sum_{i} \frac{v_i}{2} (\alpha + \mathbf{x}_i' \boldsymbol{\beta} - z_i)^2 + n \sum_{j} \omega_j \lambda |\beta_j|.$$
 (21)

Our solver iterates between CD on (21) and, for non-Gaussian models, updates to  $\mathbf{v}$  and  $\mathbf{z}$ . Each  $t^{th}$  segment IRLS routine initializes  $[\hat{\alpha}, \hat{\boldsymbol{\beta}}]$  at solutions for  $\lambda^{t-1}$ , or at  $[\hat{\alpha}, \mathbf{0}]$  for t = 1. In the gamlr implementation, a full pass update of all parameters is done only at the first CD iteration; otherwise coordinates with currently inactive (zero)  $\hat{\beta}_j$  are not updated. Once the descent converges for this *active set*, IRLS  $\mathbf{v}$  and  $\mathbf{z}$  are updated and we begin a new CD loop

with a full pass update. The routine stops when maximum squared change in  $\beta_j$  scaled by its information over one of these full pass updates is less than some tolerance threshold, thresh. The default in gamlr uses a relative tolerance of  $10^{-7}$  times null model deviance.

#### Algorithm 1 Coordinate descent

Set 
$$\operatorname{vh}_{\mathtt{j}} = \sum_{i} v_{i} (x_{ij} - \bar{x}_{j})^{2}$$
 and  $\operatorname{vx}_{\mathtt{j}} = \sum_{i} v_{i} x_{ij}$  for  $j = 1 \dots p$ . while  $\max_{j=1\dots p} \operatorname{vh}_{\mathtt{j}} \Delta_{j}^{2} > \operatorname{thresh}$ : for  $\mathtt{j} = 1 \dots p$ : 
$$\operatorname{set} \operatorname{vg}_{\mathtt{j}} = -\sum_{i} x_{ij} v_{i} (z_{i} - \hat{\eta}_{i}) \text{ and } \operatorname{ghb} = \operatorname{vg}_{\mathtt{j}} - \operatorname{vh}_{\mathtt{j}} \hat{\beta}_{j}$$
 
$$\operatorname{if} |\operatorname{ghb}| < n \lambda^{t} \omega_{j}^{t} \colon \ \Delta_{j} = -\hat{\beta}_{j}$$
 
$$\operatorname{else} \colon \ \Delta_{j} = -(\operatorname{vg}_{\mathtt{j}} - \operatorname{sign}(\operatorname{ghb}) n \lambda^{t} \omega_{j}^{t}) / \operatorname{vh}_{\mathtt{j}}.$$
 
$$\operatorname{update} \ \hat{\beta}_{j} \stackrel{\pm}{=} \Delta_{j}, \ \hat{\alpha} \stackrel{\pm}{=} -\operatorname{vx}_{\mathtt{j}} \Delta_{j}, \ \operatorname{and} \ \hat{\boldsymbol{\eta}} = \hat{\alpha} + \mathbf{X}' \hat{\boldsymbol{\beta}}.$$

#### 7.1 Descent convergence

Despite the non-differentiability of  $|\beta_j|$  at zero, Tseng (2001) establishes local convergence for CD on (21) as a consequence of penalty separability: the non-differentiable part of our objective is a sum of functions on only a single coordinate. Thus CD solves each weighted-least squares problem, and the full algorithm converges if IRLS does. For non-Gaussian models, convergence of such nested  $L_1$ -penalized IRLS algorithms is shown in Lee et al. (2014).

#### 7.2 Quasi-Newton acceleration

Under high collinearity and large  $\gamma$ , one may wish to accelerate convergence via a quasi-Newton step (e.g., Lange, 2010). Acceleration is applied to  $\boldsymbol{\theta} = [\alpha, \beta]$ , and a move is accepted only if it leads to a decrease in the objective. Suppose that  $\hat{\boldsymbol{\theta}}^{(0)}$ ,  $\hat{\boldsymbol{\theta}}^{(-1)}$ , and  $\hat{\boldsymbol{\theta}}^{(-2)}$  are the current, previous, and previous-to-previous parameter estimates. Write  $M(\hat{\boldsymbol{\theta}}^{(t)})$  as the implied CD update map  $\hat{\boldsymbol{\theta}}^{(t)} \to \hat{\boldsymbol{\theta}}^{(t+1)}$ , such that the algorithm converges at  $\hat{\boldsymbol{\theta}} - M(\hat{\boldsymbol{\theta}}) = \mathbf{0}$ . With  $\mathbf{u} = \hat{\boldsymbol{\theta}}^{(-1)} - \hat{\boldsymbol{\theta}}^{(-2)}$  and  $\mathbf{v} = \hat{\boldsymbol{\theta}}^{(0)} - \hat{\boldsymbol{\theta}}^{(-1)}$ , a secant approximation to the gradient of M is  $\partial M/\partial \hat{\theta}_l \approx \mathbf{v}_l/\mathbf{u}_l$ . An approximate Newton-Raphson step to solve for the root of  $\hat{\boldsymbol{\theta}} - M(\hat{\boldsymbol{\theta}})$  updates each coordinate  $\hat{\theta}_l \leftarrow \hat{\theta}_l^{(-1)} - (\hat{\theta}_l^{(-1)} - \hat{\theta}_l^{(0)})/(1 - \mathbf{v}_l/\mathbf{u}_l)$  which can be re-written as  $\hat{\theta}_l = (1 - \mathbf{w}_l)\hat{\theta}_l^{(-1)} + \mathbf{w}_l\hat{\theta}_l^{(0)}$  where  $\mathbf{w}_l = \mathbf{u}_l/(\mathbf{u}_l - \mathbf{v}_l)$ .

### 8 Gradient, curvature, and path starts

The negative log likelihood objective in Gaussian regression is  $l(\alpha, \beta) = 0.5 \sum_i (y_i - \eta_i)^2$  with gradient  $g_j(\beta) = \partial l/\partial \beta_j = -\sum_i x_{ij} (y_i - \eta_i)$ , and coordinate curvature  $h_j(\beta) = \partial^2 l/\partial \beta_j^2 = \sum_i x_{ij}^2$ . In logistic regression, set  $y_i = 1$  for 'success' and  $y_i = 0$  for 'failure' and write  $q_i = (1 + \exp[-\eta_i])^{-1}$  as the probability of success. Then  $l(\alpha, \beta) = \sum_i -y_i \eta_i + \log(1 + \exp[\eta_i])$ ,  $g_j(\beta) = \partial l/\partial \beta_j = -\sum_i x_{ij} (y_i - q_i)$ , and  $h_j(\beta) = \partial^2 l/\partial \beta_j^2 = \sum_i x_{ij}^2 q_i (1 - q_i)$ . In each case, it is implied that  $\hat{\alpha}$  has been set to minimize  $l(\alpha, \hat{\beta})$ .

For  $L_1$  costs  $c_j(|\beta_j|) = |\beta_j|$ , the infimum  $\lambda$  such that  $\hat{\beta} = 0$  is available analytically as  $\lambda^1 = n^{-1} \max\{|g_j(\mathbf{0})|, j = 1 \dots p\}$ , the maximum mean absolute gradient for the null model with  $\beta = 0$ . This formula is used to obtain our starting values for the path algorithms.

# 9 False Discovery Control

A common goal in high-dimensional estimation is support recovery – having the set  $\{j : \hat{\beta}_j \neq 0\}$  of some 'true'  $\beta$ . For standard lasso estimated  $\hat{\beta}$ , many authors have shown (e.g., Buhlmann and van de Geer, 2011; Zou, 2006) that to get exact support recovery asymptotically or with high probability requires an *irrepresentability condition* which limits the size of least-squares projections from 'true support' onto spurious covariates.

DEFINITION 9.1. The  $(\theta, S, \mathbf{v})$ -irrepresentable condition for  $\theta \in [0, 1]$  and  $\mathbf{v} \in \mathbb{R}^s$  holds that,

$$|\mathbf{x}_{j}'\mathbf{X}_{S}(\mathbf{X}_{S}'\mathbf{X}_{S})^{-1}\mathbf{v}| \leq \theta \ \forall j \notin S$$
 (22)

This is often presented with  $\mathbf{v}=\mathbf{1}$ . It can be a strict design restriction; for example, Buhlmann and van de Geer (2011) show a single variable that is highly correlated with many columns of  $\mathbf{X}_S$  leading to failure. Much of the literature on concave penalization has focused on achieving support recovery *without* such conditions; see, e.g., Fan et al. (2014) for a recent overview. Our results will require irrepresentable conditions with  $\mathbf{v}=\boldsymbol{\omega}_S$ , which becomes less restrictive as one is able to shrink weights  $\omega_j$  for  $j \in S$ . See the remarks for more discussion.

Our comparison of interest is between  $\hat{S} = \{j : \hat{\beta}_j \neq 0\}$ , for  $\hat{\beta}$  from weighted- $L_1$  penalized estimation, and  $S = \{j : \beta_j^{\nu} \neq 0\}$  for  $\beta^{\nu}$  the  $L_0$  penalized estimator from Theorem 3.1. Whether looking to an  $L_0$  oracle or a sparse truth, our experience is that exact support recovery does not occur in practice (e.g., see the simulation in Section 5). Thus, we instead focus on ability of the weighted-lasso to minimize false discoveries:  $\hat{\beta}_j \neq 0$  when  $\beta_j^{\nu} = 0$ .

<sup>&</sup>lt;sup>1</sup>Wainwright (2009) shows that (22) with  $\theta = 1$ ,  $\mathbf{v} = \mathbf{1}$  is necessary for lasso sign recovery in the *noiseless* setting.

THEOREM 9.1. Consider the setting of Theorem 3.1. If  $\omega_{S^c}^{\min} = 1$  and  $\lambda > \sqrt{2\nu}$  then

$$\|\mathbf{X}_{S^c}'\mathbf{X}_S(\mathbf{X}_S'\mathbf{X}_S)^{-1}\boldsymbol{\omega}_S\|_{\infty} \le 1 - \frac{\sqrt{2\nu}}{\lambda_t} \implies \hat{S} \cap S^c = \varnothing.$$
 (23)

The result follows directly from the sign recovery lemma 9.1.

#### Remarks

- From Theorem 7.4 in Buhlmann and van de Geer (2011), the irrepresentability condition holds with  $|x_j' \mathbf{X}_S(\mathbf{X}_S' \mathbf{X}_S)^{-1} \boldsymbol{\omega}_S| \leq \frac{\|\boldsymbol{\omega}_S\|}{\sqrt{s}} \theta_{\mathrm{adap}}(S)$  where  $\theta_{\mathrm{adap}}(S)$  is their 'adaptive restricted regression' coefficient. Of interest here, they show that  $\theta_{\mathrm{adap}}(S) \leq \sqrt{s}/\Lambda_{\min}(S)$  where  $\Lambda_{\min}(S)$  is the minimum eigenvalue of  $\mathbf{X}_S' \mathbf{X}_S/n$ . Thus, (i) can be replaced by the restriction  $\Lambda_{\min}(S) \geq \|\boldsymbol{\omega}_S\| (1 \sqrt{2\nu}/(\omega_{S^c}^{\min}\lambda))^{-1} = \sqrt{s}L$ , with L from Theorem 3.1, and small values for L appear key in both predictive performance and support recovery.
- Without irrepresentability, limits on false discovery are more pessimistic. Convergence conditions imply that for  $j \in S^c \cap \hat{S}$  we have  $n\lambda\omega_j = |x_j'(\mathbf{X}\hat{\boldsymbol{\beta}} \mathbf{y})| \leq |x_j'\mathbf{X}(\hat{\boldsymbol{\beta}} \boldsymbol{\beta}^{\nu})| + |x_j'\mathbf{e}^S| \leq n\left(2\|\boldsymbol{\omega}_S\|/\phi(L,S) + \sqrt{2\nu}/\lambda\right) \ \forall \ j.$  Dividing by  $n\lambda\omega_j$  and counting yields

$$|S^c \cap \hat{S}| \le \left| \frac{1}{\boldsymbol{\omega}_{S^c \cap \hat{S}}} \right| \left( \frac{2\|\omega_S\|}{\phi(L, S)} + \frac{\sqrt{2\nu}}{\lambda} \right)$$
 (24)

Without the ability to make  $\omega_j$  very big for  $j \in S^c$  (e.g., as in a thresholding procedure like that of Zhou 2009), the result in (24) has little to say about false discovery control.

### 9.1 Sign Recovery

LEMMA 9.1. Under the setting of Theorem 3.1, with  $\hat{S} = \{j : \hat{\beta}_j \neq 0\}$ , if  $\omega_{S^c}^{\min} \lambda > \sqrt{2\nu}$  then

$$|\boldsymbol{x}_{j}'\mathbf{X}_{S}(\mathbf{X}_{S}'\mathbf{X}_{S})^{-1}\boldsymbol{\omega}_{S}| \leq 1 - \frac{\sqrt{2\nu}}{\lambda\omega_{j}} \ \forall j \in S^{c} \Rightarrow \hat{S} \cap S^{c} = \varnothing.$$
 (25)

If in addition  $|(\mathbf{X}_S'\mathbf{X}_S)^{-1}\mathbf{X}_S'\mathbf{y}|_{\infty} > n\lambda |(\mathbf{X}_S'\mathbf{X}_S)^{-1}\boldsymbol{\omega}_S|_{\infty}$ , then  $\mathrm{sgn}(\hat{\boldsymbol{\beta}}) = \mathrm{sgn}(\boldsymbol{\beta}^{\nu})$ .

*Proof.* The Karush-Kuhn-Tucker (KKT) conditions at weighted- $L_1$  minimization convergence imply that

$$\mathbf{x}_{j}'\mathbf{X}(\hat{\boldsymbol{\beta}} - \boldsymbol{\beta}^{\nu}) + \mathbf{x}_{j}'\mathbf{e}^{S} = -n\lambda\zeta_{j} \text{ for } j = 1\dots p$$
 (26)

where  $|\zeta_j| = \omega_j$  for  $j \in \hat{S}$  and  $|\zeta_j| \leq \omega_j$  for  $j \in \hat{S}^c$ . Following closely related proofs in Wainwright (2006, 2009); Zhou et al. (2009),  $\hat{S} \cap S^c = \emptyset$  occurs if and only if these KKT

conditions hold for projections restricted to S,

$$\mathbf{X}_{S}'\mathbf{X}_{S}(\hat{\boldsymbol{\beta}}_{S} - \boldsymbol{\beta}_{S}^{\nu}) + \mathbf{X}_{S}'\mathbf{e}^{S} = -n\lambda\boldsymbol{\zeta}_{S} \implies \hat{\boldsymbol{\beta}}_{S} - \boldsymbol{\beta}_{S}^{\nu} = -n\lambda(\mathbf{X}_{S}'\mathbf{X}_{S})^{-1}\boldsymbol{\zeta}_{S}. \tag{27}$$

Thus all of the spurious regressors in  $S^c$  will have  $\hat{\beta}_j = 0$  if and only if

$$\boldsymbol{x}_{j}^{\prime}\mathbf{X}_{S}(\hat{\boldsymbol{\beta}}_{S}-\boldsymbol{\beta}_{S}^{\nu})-\boldsymbol{x}_{j}^{\prime}\mathbf{e}^{S}\leq n\lambda\zeta_{j} \iff 1-\frac{|x_{j}^{\prime}\mathbf{e}^{S}|}{n}\geq1-\frac{\sqrt{2\nu}}{\lambda\omega_{j}}\geq|\boldsymbol{x}_{j}^{\prime}\mathbf{X}_{S}(\mathbf{X}_{S}^{\prime}\mathbf{X}_{S})^{-1}\boldsymbol{\omega}_{S}|. (28)$$

Finally, for sign recovery on  $j \in S$  we need  $|\beta_j^{\nu}| - |\beta_j^{\nu} - \hat{\beta}_j| > 0 \ \forall j \in S$ , and our stated condition follows from  $\beta^{\nu}_S = (\mathbf{X}_S' \mathbf{X}_S)^{-1} \mathbf{X}_S' \mathbf{y}$  and  $\beta^{\nu}_S - \hat{\beta}_S = n\lambda (\mathbf{X}_S' \mathbf{X}_S)^{-1} \boldsymbol{\zeta}_S$ .

### 10 Extra proofs

#### 10.1 Stagewise Regression

Theorem 3.1 uses the following simple result for stagewise regression – iterative fitting of new covariates to the residuals of an existing linear model (as in, e.g., Goldberger 1961).

LEMMA 10.1. Say  $MSE_S = \|\mathbf{X}\boldsymbol{\beta}^S - \mathbf{y}\|^2/n$  and  $cov(\boldsymbol{x}_j, \mathbf{e}^S) = \boldsymbol{x}_j'(\mathbf{y} - \mathbf{X}\boldsymbol{\beta}^S)/n$  are sample variance and covariances. Then for any  $j \in 1 ... p$ ,

$$cov^{2}(\boldsymbol{x}_{j}, \mathbf{e}^{S}) \leq MSE_{S} - MSE_{S \cup j}$$

*Proof.* From the well-known property on the correlation coefficient  $(R^2)$  for linear models, in-sample correlation and variances are such that

$$\frac{\operatorname{cov}^{2}(\boldsymbol{x}_{j}, \mathbf{e}^{S})}{\operatorname{var}(\boldsymbol{x}_{j})\operatorname{var}(\mathbf{e}^{S})} = 1 - \frac{\operatorname{var}(\mathbf{e}^{S} - \tilde{\beta}_{j}\boldsymbol{x}_{j})}{\operatorname{var}(\mathbf{e}^{S})}$$

where  $\tilde{\beta}_j = \boldsymbol{x}_j' \mathbf{e}^S/(\boldsymbol{x}_j' \boldsymbol{x}_j)$  is the stagewise coefficient estimate. Since  $\operatorname{var}(\boldsymbol{x}_j) = 1$ , multiplying everything by  $\operatorname{var}(\mathbf{e}^S)$  yields  $\operatorname{cov}^2(\boldsymbol{x}_j, \mathbf{e}^S) = \operatorname{var}(\mathbf{e}^S) - \operatorname{var}(\mathbf{e}^S - \tilde{\beta}_j \boldsymbol{x}_j) \leq \operatorname{var}(\mathbf{e}^S) - \operatorname{var}(\mathbf{e}^{S \cup j})$ . The last inequality holds because  $\mathbf{e}^{S \cup j}$ , residuals from OLS on  $\mathbf{X}_{S \cup j}$ , have the smallest-possible sum of squares for that set of covariates. With  $\operatorname{var}(\mathbf{e}^S) = \operatorname{MSE}_S$ , etc, we are done.

# 10.2 Bayesian MAP

PROPOSITION 10.1.  $\hat{\beta}$  solves (14) if and only if it is also in the solution to (13).

*Proof.* The conditional posterior mode for each  $\tau_j$  given  $\beta_j$  is  $\tau(\beta_j) = \gamma s/(1 + \gamma |\beta_j|)$ . Any joint solution  $[\hat{\beta}, \hat{\tau}]$  for (13) thus consists of  $\hat{\tau}_j = \tau(\hat{\beta}_j)$ ; otherwise, it is always possible to decrease the objective by replacing  $\hat{\tau}_j$ . Setting each  $\tau_j = \tau(\beta_j)$  in (13) and removing constant terms yields (14). Moreover, the solution to (13) solves (14): otherwise, there would need to be a point on the profile slice of (13) defined by  $\tau_j = \tau(\hat{\beta}_j)$  that is lower than its minimum.

For a Bayesian it is odd to be solving for  $\tau$  rather than marginalizing over its uncertainty. However, recognizing the form of a gamma density in (12),  $\pi(\beta_j, \tau_j)$  integrates over  $\tau_j$  to yield the marginal prior  $\pi(\beta_j) = 0.5s \left(1 + \gamma |\beta_j|\right)^{-(s+1)}$ . This is the generalized double Pareto density, as in Armagan et al. (2013). Since  $-\log \pi(\beta_j) \propto (s+1)\log(1+\gamma|\beta_j|)$ , the *profile* MAP solution to (13) is also the *marginal* MAP for  $\beta$  under  $\operatorname{Ga}(s-1,1/\gamma)$  priors on each  $\tau_j$ .

## 11 Stability

A strong form of stability comes from convexity of the penalized objective in (1). This requires that the minimum eigenvalue of  $\mathbf{H}(\boldsymbol{\beta})$ , the Hessian matrix of second derivatives of  $l(\boldsymbol{\beta})$ , is greater than  $|c''(\beta_j)| \, \forall j$ . For penalized least-squares under log costs, this amounts to requiring that the minimum eigenvalue of  $\mathbf{H} = \mathbf{X}'\mathbf{X}$  is greater than  $\lambda \gamma^2$ . In the simple *standardized* orthogonal covariate case, this has an easy interpretation in the context of our Bayesian model from Section 4.1: for Gaussian regression,  $h_j = \sum_i x_{ij}^2 = n$  and the objective is convex if prior variance on each  $\tau_j$  is less than the number of observations. For logistic regression you need  $\operatorname{var}(\tau_j) < n/4$ , since  $\mathbf{H}$  now depends upon the coefficient values.

In real examples, however, we cannot rely upon objective convexity. A more useful definition of stability requires continuity of the implied coefficient function,  $\hat{\beta}(\mathbf{y})$ , in an imagined univariate regression problem (or for orthogonal covariates). This is one of the key requirements of concave penalties listed by Fan and Li (2001). Many popular concave cost functions, such as the SCAD and MCP, have been engineered to have this continuity property. Conveniently, Zou and Li (2008) show that OSE LLA solutions have this property even if the target objective does not. For example, even though the log penalty *does not* generally lead to continuous thresholding, their result implies that the GL solutions are continuous for  $\gamma < \infty$ .

A theoretically richer form of stability is Lipschitz continuity of the implied prediction function,  $\hat{\boldsymbol{y}} = \mathbf{X}\hat{\boldsymbol{\beta}}(\mathbf{y})$ , which requires that  $\|\hat{\mathbf{y}}(\mathbf{y}_1) - \hat{\mathbf{y}}(\mathbf{y}_2)\| \leq L\|\mathbf{y}_1 - \mathbf{y}_2\|$  for some finite constant L on all possible  $\mathbf{y}_1, \mathbf{y}_2$ . Zou et al. (2007) establish Lipschitz continuity for  $L_1$  estimated

If  $\nu$  is an eigenvalue of  $\mathbf{H}$ , then  $(\mathbf{H} - \nu \mathbf{I})\mathbf{v} = 0$  for some nonzero  $\mathbf{v}$ ; the negative log posterior Hessian at zero is  $\mathbf{H} - \lambda \gamma^2 \mathbf{I}$  and  $(\mathbf{H} - \lambda \gamma^2 \mathbf{I} + s \gamma^2 \mathbf{I} - \nu \mathbf{I})\mathbf{v} = 0$  so that  $\nu - s \gamma^2$  is an eigenvalue of the minimization objective.

predictors as part of their derivation of a degrees-of-freedom estimator. Thus, conditional upon values for the coefficient-specific weights, POSE and GL are trivially Lipschitz continuous. Unconditionally, we do not believe that the paths have this guarantee. However, we'll see in the next section that a heuristic degrees-of-freedom estimator that takes such stability for granted performs well as the basis for model selection.

Finally, the basic and most important type of stability is practical path continuity: by this, we mean that solutions change slowly enough along the path so that computational costs are kept within budget. A regularization path can be built from a continuous thresholding function, or perhaps even be Lipschitz stable, but none of that matters if it takes too long to fit. For example, Figure 4 shows timings growing rapidly with large  $\gamma$  for the hockey data of Section 6, even though all of these specifications are theoretically stable by some criteria.

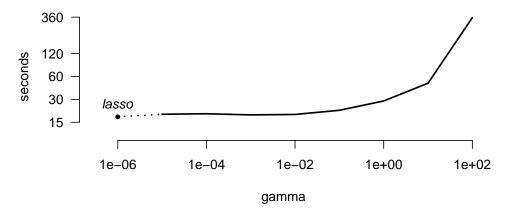


Figure 4: Timings for the hockey data path fits of Section 6 on a length-100 grid with  $\lambda^{100}=0.01\lambda^1$ .

## 12 Information Criteria

We would like to choose a model that performs well in predicting new data. 'Good prediction' can be measured in a variety of ways. A common and coherent framework is to consider minimizing Kullback-Leibler (KL) divergence. Say  $g(\mathbf{y})$  is the true data generating process, and  $f(\mathbf{y}; \boldsymbol{\eta}, \phi)$  is the parametric density under study, which we suppose here is a natural exponential family with  $\mathbb{E}[\mathbf{y}] = \boldsymbol{\eta}$  and dispersion  $\phi$ . Then we wish to minimize

$$KL(\boldsymbol{\eta}, \phi) = \mathbb{E}_g \log g(\mathbf{y}) - \mathbb{E}_g \log f(\mathbf{y}; \boldsymbol{\eta}, \phi), \tag{29}$$

the expected difference between log true density and our parametric approximation. Since  $\mathbb{E}_g \log g(\mathbf{y})$  is constant, this leads one to minimize  $Q(\boldsymbol{\eta}, \phi) = -\mathbb{E}_g \log f(\mathbf{y}; \boldsymbol{\eta}, \phi)$ , the expected

negative log likelihood. There is no requirement that g is a member of the family defined by f.

If parameters are to be estimated as  $[\eta_y, \phi_y]$ , functions of random sample  $y \sim g$ , then  $Q(\eta_y, \phi_y)$  is itself a random variable and one chooses estimators to minimize its expectation. Crucially, we imagine a double-sample expectation, where the minimization objective is

$$\mathbb{E}_{\mathbf{y}|g}\mathbb{E}_{\tilde{\mathbf{y}}|g}\log f(\tilde{\mathbf{y}};\boldsymbol{\eta}_{\mathbf{y}},\phi_{\mathbf{y}}). \tag{30}$$

The notation here indicates that inner and outer expectations are based on two *independent* random samples from g:  $\mathbf{y}$  for training, upon which  $\eta_{\mathbf{y}}$ ,  $\phi_{\mathbf{y}}$  are calculated, and  $\tilde{\mathbf{y}}$  for validation.

Information criteria (IC) are analytic approximations to metrics like (30).<sup>3</sup> They take the form

$$-2\log f(\mathbf{y}; \boldsymbol{\eta}_{\mathbf{v}}, \phi_{\mathbf{v}}) + c(df) \tag{31}$$

where c(df) is cost of the *degrees-of-freedom* used in  $\eta_{\mathbf{y}}$  – e.g., for  $\mathbf{y} \sim (\eta, \sigma^2 \mathbf{I})$ , Efron et al. (2004) defines  $df = \sigma^{-2} \sum_i \operatorname{cov}(\eta_{\mathbf{y}i}, y_i)$ .

Consider a Gaussian regression model where  $\eta_y$  is an estimate for  $\eta = \mathbb{E}y$  using df degrees of freedom, and set  $\phi_y = \sigma_y^2 = \sum_i (y_i - \eta_{yi})^2 / n$ . We'll derive

$$df \frac{n}{n - df - 1} \approx \mathbb{E}_{\mathbf{y}|g} \left[ \log f(\mathbf{y}; \boldsymbol{\eta}_{\mathbf{y}}, \phi_{\mathbf{y}}) - \mathbb{E}_{\tilde{\mathbf{y}}|g} \log f(\tilde{\mathbf{y}}; \boldsymbol{\eta}_{\mathbf{y}}, \phi_{\mathbf{y}}) \right], \tag{32}$$

such that AICc's complexity penalty is the expected bias that results from taking the fitted log likelihood as an estimate for (30). First, by cancellation the inner term of (32) simplifies as

$$\log f(\mathbf{y}; \boldsymbol{\eta}_{\mathbf{y}}, \phi_{\mathbf{y}}) - \mathbb{E}_{\tilde{\mathbf{y}}|g} \log f(\tilde{\mathbf{y}}; \boldsymbol{\eta}_{\mathbf{y}}, \phi_{\mathbf{y}}) = \frac{\mathbb{E}_{\tilde{\mathbf{y}}|g} \sum_{i} (\tilde{y}_{i} - \eta_{\mathbf{y}i})^{2}}{2\sigma_{\mathbf{y}}^{2}} - \frac{n}{2}.$$
 (33)

Now, assume that the *true* model is linear and that the data were generated from  $\mathbf{y} \sim g(\boldsymbol{\eta}, \sigma^2 \mathbf{I})$ . The Mallows (1973)  $C_p$  formula holds that  $n\sigma_{\mathbf{y}}^2 + 2\sigma^2 df$  is an unbiased estimator for expected sum of square errors  $\mathbb{E}_{\tilde{\mathbf{y}}|g} \sum_i (\tilde{y}_i - \eta_{\mathbf{y}i})^2 / n$ , such that

$$\frac{\mathbb{E}_{\tilde{\mathbf{y}}|g} \sum_{i} (\tilde{y}_{i} - \eta_{\mathbf{y}i})^{2}}{2\sigma_{\mathbf{y}}^{2}} - \frac{n}{2} \approx \frac{n\sigma_{\mathbf{y}}^{2} + 2\sigma^{2}df}{2\sigma_{\mathbf{y}}^{2}} - \frac{n}{2} = df \frac{\sigma^{2}}{\sigma_{\mathbf{y}}^{2}}.$$
 (34)

At this point, we see that the standard AIC approximation results from equating  $\sigma^2 \approx \mathbb{E}_{\mathbf{y}|g} \sigma_{\mathbf{y}}^2$ , so that  $df \mathbb{E}_{\mathbf{y}|g} [\sigma^2/\sigma_{\mathbf{y}}^2] \approx df$ . This will underpenalize complexity whenever residual variance

<sup>&</sup>lt;sup>3</sup>Not all IC target (30). For example, the 'Bayesian' BIC, with  $c(df) = \log(n)df$  (Schwarz, 1978), is derived (Kass and Raftery, 1995) as Laplace approximation to the negative log of the *marginal likelihood*. We include the BIC as a comparator to AIC and AICc in our examples.

 $\sigma^2_{\mathbf{y}}$  tends to be smaller than the true variance  $\sigma^2$  – that is, whenever the model is overfit. In contrast, AICc applies the chi-squared goodness of fit result  $n\sigma^2_{\mathbf{y}}/\sigma^2 \sim \chi^2_{n-df-1}$  to obtain

$$\mathbb{E}_{\mathbf{y}|g}\left[\frac{\sigma^2}{\sigma_{\mathbf{y}}^2}df\right] = n\mathbb{E}_{\mathbf{y}|g}\left[\frac{1}{n\sigma_{\mathbf{y}}^2/\sigma^2}\right]df = \frac{n}{n - df - 1}df.$$
 (35)

Multiplying by -2 and subtracting from  $-2 \log f(\mathbf{y}; \boldsymbol{\eta}_{\mathbf{y}}, \sigma_{\mathbf{y}})$  yields the AICc.

#### 13 Full simulation results

Continuous-response data are simulated from a p = 1000 dimensional linear model

$$y \sim N\left(\mathbf{x}'\boldsymbol{\beta}, \sigma^2\right) \text{ where } \beta_j = (-1)^j \exp\left(-\frac{j}{\mathsf{d}}\right) \mathbb{1}_{[j \le J]} \text{ for } j = 1 \dots p$$
 (36)

We consider sample sizes of n=100 and n=1000. For our *dense* simulation models, J=p so that all true coefficients are nonzero. For our *sparse* simulation models, J=n/10. With  $\mathbf{z}_i \sim \mathrm{N}\left(\mathbf{0}, \mathbf{\Sigma}\right)$  for  $i=1\dots n$ , the regression inputs  $\mathbf{x}_i$  are generated as either *continuous*  $x_{ij}=z_{ij}$  or binary  $x_{ij} \stackrel{ind}{\sim} \mathrm{Bern}\left(1/(1+e^{-z_{ij}})\right)$ .

Each simulation draws n means  $\eta_i = \mathbf{x}_i'\boldsymbol{\beta}$ , and two independent response samples  $\mathbf{y}, \tilde{\mathbf{y}} \sim \mathrm{N}(\boldsymbol{\eta}, \sigma^2 \mathbf{I})$ . Residual variance  $\sigma^2$  and covariate correlation  $\boldsymbol{\Sigma}$  are adjusted across runs. In the first case, we define  $\sigma^2$  through *signal-to-noise* ratios  $\mathrm{sd}(\boldsymbol{\eta})/\sigma$  of 1/2, 1, and 2. In the latter case, multicollinearity is parametrized via  $\Sigma_{jk} = \rho^{|j-k|}$ , and we consider  $\rho = 0, 0.5$ , and 0.9. Finally, the coefficient decay rate d controls the effective sparsity: how much  $\boldsymbol{\beta}$  is *measurably* different from zero. See Figure 5 for illustration; we consider d of 10, 50, 100, and 200.

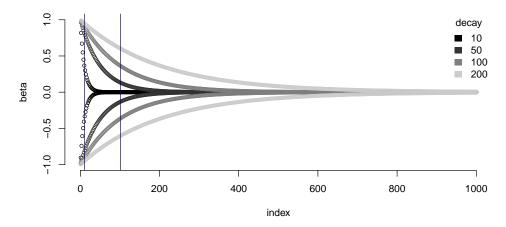


Figure 5: The linear model coefficients for our simulation in 36. Vertical lines mark thresholding points for the *sparse* model simulations, at J = 10 for n = 100 and at J = 100 for n = 1000.

#### References

- Armagan, A., D. B. Dunson, and J. Lee (2013). Generalized Double Pareto Shrinkage. *Statistica Sinica* 23, 119–143.
- Buhlmann, P. and S. van de Geer (2011). Statistics for High-Dimensional Data. Springer.
- Efron, B., T. Hastie, I. Johnstone, and R. Tibshirani (2004). Least Angle Regression. *Annals of Statistics* 32, 407–499.
- Fan, J. and R. Li (2001). Variable Selection via Nonconcave Penalized Likelihood and its Oracle Properties. *Journal of the American Statistical Association* 96, 1348–1360.
- Fan, J., L. Xue, and H. Zou (2014). Strong oracle optimality of folded concave penalized estimation. *The Annals of Statistics* 42(3), 819–849.
- Friedman, J., T. Hastie, H. Hofling, and R. Tibshirani (2007). Pathwise coordinate optimization. *The Annals of Applied Statistics 1*, 302–332.
- Friedman, J., T. Hastie, and R. Tibshirani (2010). Regularization paths for generalized linear models via coordinate descent. *Journal of Statistical Software 33*, 1–22.
- Goldberger, A. S. (1961). Stepwise Least Squares: Residual analysis and specification error. *Journal of the American Statistical Association* 56, 998.
- Green, P. J. (1984). Iteratively Reweighted Least Squares for Maximum Likelihood Estimation, and some Robust and Resistant Alternatives. *Journal of the Royal Statistical Society, Series B* 46, 149–192.
- Kass, R. E. and A. E. Raftery (1995). Bayes factors. *Journal of the American Statistical Association* 90, 773–795.
- Lange, K. (2010). Numerical Analysis for Statisticians (2nd ed.). Springer.
- Lee, J., Y. Sun, and M. Saunders (2014). Proximal newton-type methods for minimizing convex objective functions in composite form. *SIAM Journal on Optimization* 24, 1420–1443.
- Luenberger, D. G. and Y. Ye (2008). *Linear and Nonlinear Programming* (3rd ed.). Springer.
- Mallows, C. L. (1973). Some comments on CP. Technometrics 15, 661–675.
- Schwarz, G. (1978). Estimating the dimension of a model. The Annals of Statistics 6, 461–464.
- Tseng, P. (2001). Convergence of a block coordinate descent method for nondifferentiable minimization. *Journal of Optimization Theory and Applications* 109, 475–494.
- Wainwright, M. J. (2006). Sharp thresholds for high-dimensional and noisy recovery of sparsity. *UC Berkeley Technical Report*.

- Wainwright, M. J. (2009). Sharp thresholds for high-dimensional and noisy sparsity recovery using L1-constrained quadratic programming (Lasso). *IEEE Transactions on Information Theory* 55, 2183–2202.
- Wu, T. T. and K. Lange (2008). Coordinate descent algorithms for lasso penalized regression. *The Annals of Applied Statistics* 2, 1–21.
- Zhou, S. (2009). Thresholding procedures for high-dimensional variable selection and statistical estimation. *Advances in Neural Information Processing Systems* 22.
- Zhou, S., S. van de Geer, and P. Bühlmann (2009). Adaptive lasso for high dimensional regression and Gaussian graphical modeling. *arXiv:0903.2515*.
- Zou, H. (2006). The adaptive lasso and its oracle properties. *Journal of the American Statistical Association 101*, 1418–1429.
- Zou, H., T. Hastie, and R. Tibshirani (2007). On the degrees of freedom of the lasso. *The Annals of Statistics* 35, 2173–2192.
- Zou, H. and R. Li (2008). One-step sparse estimates in nonconcave penalized likelihood models. *The Annals of Statistics* 36, 1509–1533.

Table 3: Predictive  $\mathbb{R}^2$  for 100 observations, binary design with dense covariates. Reported as % worse than the Oracle – MLE fit on the  $C_p$  optimal covariates – across 1000 samples.

|                                |     |     | % Worse than Oracle lasso GL $\gamma=1$ GL $\gamma=10$ marginal AL |     |      |     |      |     |        |      |     |              |
|--------------------------------|-----|-----|--|-----|------|-----|------|-----|--------|------|-----|--------------|
| 1/ )/                          | .1  |     |  |     |      |     |      |     | margii |      | Man | 0 1 02       |
| $sd(\boldsymbol{\eta})/\sigma$ | d   | ρ   | AICc   | CV  | AICc | CV  | AICc | CV  | AICc   | CV   | MCP | Oracle $R^2$ |
|                                |     | 0   | 35   | 22  | 30   | 26  | 17   | 47  | 19     | 14   | 25  | 0.73         |
|                                | 10  | 0.5 | 40   | 28  | 34   | 31  | 17   | 51  | 21     | 14   | 29  | 0.73         |
|                                |     | 0.9 | 43   | 30  | 38   | 34  | 17   | 55  | 23     | 15   | 32  | 0.73         |
|                                |     | 0   | 75   | 68  | 13   | 88  | 6    | 96  | 33     | 4    | 66  | 0.63         |
| 2                              | 50  | 0.5 | 76   | 71  | 16   | 90  | 6    | 97  | 33     | 4    | 71  | 0.63         |
|                                |     | 0.9 | 78   | 73  | 21   | 90  | 6    | 96  | 36     | 5    | 74  | 0.63         |
|                                |     | 0   | 79   | 73  | -1   | 94  | 0    | 97  | 32     | -1   | 72  | 0.59         |
|                                | 100 | 0.5 | 79   | 75  | 0    | 94  | 0    | 98  | 33     | -1   | 76  | 0.60         |
|                                |     | 0.9 | 80   | 76  | 2    | 94  | 0    | 98  | 35     | -1   | 76  | 0.60         |
|                                |     | 0   | 80   | 75  | -3   | 96  | -1   | 98  | 32     | -3   | 73  | 0.59         |
|                                | 200 | 0.5 | 81   | 79  | -3   | 96  | -1   | 98  | 34     | -3   | 78  | 0.59         |
|                                |     | 0.9 | 80   | 79  | -2   | 96  | -1   | 98  | 35     | -2   | 78  | 0.59         |
|                                |     | 0   | 63   | 63  | 64   | 74  | 101  | 90  | 41     | 79   | 65  | 0.37         |
|                                | 10  | 0.5 | 65   | 66  | 67   | 76  | 99   | 91  | 43     | 79   | 69  | 0.37         |
|                                |     | 0.9 | 67   | 68  | 69   | 77  | 98   | 90  | 45     | 78   | 70  | 0.37         |
|                                |     | 0   | 70   | 72  | 62   | 97  | 108  | 103 | 21     | 75   | 75  | 0.20         |
| 1                              | 50  | 0.5 | 72   | 78  | 59   | 98  | 106  | 104 | 22     | 74   | 81  | 0.20         |
|                                |     | 0.9 | 75   | 79  | 61   | 97  | 106  | 102 | 27     | 72   | 80  | 0.20         |
|                                |     | 0   | 57   | 60  | 65   | 102 | 117  | 107 | -29    | 59   | 62  | 0.12         |
|                                | 100 | 0.5 | 63   | 69  | 60   | 102 | 113  | 107 | -23    | 57   | 73  | 0.12         |
|                                |     | 0.9 | 59   | 64  | 58   | 100 | 113  | 106 | -23    | 53   | 65  | 0.12         |
|                                |     | 0   | 7  | 13  | 50   | 109 | 141  | 117 | -201   | 7    | 15  | 0.05         |
|                                | 200 | 0.5 | 18   | 32  | 45   | 108 | 126  | 116 | -164   | 7    | 42  | 0.06         |
|                                |     | 0.9 | 3  | 16  | 44   | 104 | 130  | 114 | -184   | -8   | 24  | 0.05         |
|                                |     | 0   | 115  | 142 | 720  | 149 | 1483 | 152 | 281    | 1198 | 161 | 0.04         |
|                                | 10  | 0.5 | 116  | 141 | 633  | 149 | 1450 | 151 | 287    | 1186 | 158 | 0.05         |
|                                |     | 0.9 | 114  | 147 | 623  | 148 | 1471 | 152 | 295    | 1171 | 156 | 0.04         |
|                                |     | 0   | -74  | -56 | 969  | -53 | 1162 | -49 | 81     | 915  | -49 | -0.05        |
| 0.5                            | 50  | 0.5 | -73  | -56 | 972  | -53 | 1183 | -52 | 72     | 920  | -47 | -0.05        |
|                                |     | 0.9 | -81  | -53 | 979  | -56 | 1206 | -51 | 82     | 909  | -47 | -0.05        |
|                                |     | 0   | -81  | -66 | 827  | -63 | 929  | -61 | 47     | 724  | -56 | -0.06        |
|                                | 100 | 0.5 | -80  | -64 | 824  | -60 | 939  | -61 | 46     | 730  | -57 | -0.06        |
|                                |     | 0.9 | -85  | -68 | 822  | -63 | 945  | -62 | 49     | 707  | -61 | -0.06        |
|                                |     | 0   | -80  | -65 | 843  | -62 | 907  | -60 | 43     | 706  | -57 | -0.06        |
|                                | 200 | 0.5 | -80  | -65 | 854  | -62 | 926  | -62 | 42     | 716  | -58 | -0.06        |
|                                |     | 0.9 | -86  | -71 | 822  | -66 | 896  | -65 | 44     | 670  | -61 | -0.06        |

Table 4: Predictive  $\mathbb{R}^2$  for 100 observations, continuous design with dense covariates. Reported as % worse than the Oracle – MLE fit on the  $C_p$  optimal covariates – across 1000 samples.

|                                       |            |          | % Worse than Oracle lasso ${\rm GL} \ \gamma = 1 \qquad {\rm GL} \ \gamma = 10 \qquad {\rm marginal} \ {\rm AL}$ |          |                            |          |                            |           |                       |              |          |              |
|---------------------------------------|------------|----------|--|----------|----------------------------|----------|----------------------------|-----------|-----------------------|--------------|----------|--------------|
| $\mathrm{sd}(oldsymbol{\eta})/\sigma$ | d          | ho       | lass<br>AICc   | so<br>CV | $\operatorname{GL} \gamma$ | = 1 $CV$ | $\operatorname{GL} \gamma$ | = 10 $CV$ | margir<br><i>AICc</i> | nal AL<br>CV | MCP      | Oracle $R^2$ |
| , .                                   |            | 0        | 35   | 24       | 46                         | 28       | 18                         | 48        | 19                    | 13           | 26       | 0.73         |
|                                       | 10         | 0.5      | 66   | 64       | 81                         | 65       | 29                         | 73        | 39                    | 18           | 57       | 0.74         |
|                                       |            | 0.9      | 40   | 41       | 47                         | 41       | 44                         | 41        | 23                    | 18           | 40       | 0.74         |
|                                       |            | 0        | 74   | 68       | 61                         | 89       | 6                          | 96        | 31                    | 4            | 68       | 0.63         |
| 2                                     | 50         | 0.5      | 83   | 85       | 96                         | 93       | 6                          | 98        | 43                    | 7            | 85       | 0.64         |
|                                       |            | 0.9      | 71   | 75       | 90                         | 76       | 51                         | 83        | 48                    | 36           | 74       | 0.64         |
|                                       |            | 0        | 78   | 72       | 22                         | 94       | 0                          | 97        | 31                    | -2           | 73       | 0.59         |
|                                       | 100        | 0.5      | 85   | 86       | 85                         | 95       | 0                          | 99        | 40                    | 1            | 86       | 0.59         |
|                                       |            | 0.9      | 79   | 84       | 97                         | 87       | 9                          | 94        | 50                    | 35           | 84       | 0.60         |
|                                       | • • •      | 0        | 80   | 75       | 2                          | 96       | -1                         | 98        | 32                    | -3           | 76       | 0.59         |
|                                       | 200        | 0.5      | 84   | 87       | 53                         | 96       | -1                         | 99        | 39                    | 0            | 86       | 0.59         |
|                                       |            | 0.9      | 84   | 88       | 99                         | 92       | -1                         | 98        | 53                    | 36           | 88       | 0.59         |
|                                       | 10         | 0<br>0.5 | 61<br>76   | 64<br>79 | 87<br>92                   | 73<br>82 | 100<br>95                  | 88        | 40<br>53              | 78<br>77     | 64       | 0.37<br>0.37 |
|                                       | 10         | 0.9      | 40   | 79<br>42 | 92<br>49                   | 82<br>40 | 42                         | 90<br>37  | 33                    | 38           | 78<br>35 | 0.37         |
|                                       |            |          |  |          |                            |          |                            |           |                       |              |          |              |
| _                                     |            | 0        | 70   | 74       | 77                         | 96       | 105                        | 102       | 20                    | 73           | 74       | 0.20         |
| 1                                     | 50         | 0.5      | 80   | 87       | 97                         | 96       | 104                        | 104       | 32                    | 67           | 85       | 0.20         |
|                                       |            | 0.9      | 68   | 76       | 95                         | 78       | 93                         | 92        | 40                    | 36           | 75       | 0.22         |
|                                       |            | 0        | 56   | 64       | 63                         | 100      | 112                        | 107       | -29                   | 54           | 66       | 0.12         |
|                                       | 100        | 0.5      | 67   | 77       | 79                         | 98       | 110                        | 107       | -14                   | 42           | 78       | 0.12         |
|                                       |            | 0.9      | 68   | 79       | 102                        | 87       | 99                         | 101       | 17                    | 8            | 79       | 0.13         |
|                                       |            | 0        | 9  | 27       | 53                         | 104      | 132                        | 115       | -184                  | 1            | 27       | 0.05         |
|                                       | 200        | 0.5      | 31   | 49       | 26                         | 104      | 125                        | 116       | -146                  | -33          | 51       | 0.05         |
|                                       |            | 0.9      | 42   | 67       | 108                        | 87       | 111                        | 109       | -62                   | -85          | 69       | 0.06         |
|                                       |            | 0        | 106  | 135      | 282                        | 137      | 1311                       | 146       | 242                   | 1054         | 141      | 0.05         |
|                                       | 10         | 0.5      | 114  | 127      | 131                        | 127      | 1220                       | 139       | 249                   | 924          | 137      | 0.05         |
|                                       |            | 0.9      | 66   | 79       | 90                         | 77       | 560                        | 93        | 125                   | 233          | 79       | 0.08         |
| 0 -                                   | <b>.</b> . | 0        | -81  | -56      | 962                        | -55      | 1224                       | -51       | 74                    | 956          | -41      | -0.05        |
| 0.5                                   | 50         | 0.5      | -77  | -56      | 396                        | -54      | 1288                       | -49       | 86                    | 881          | -51      | -0.04        |
|                                       |            | 0.9      | -68  | -41      | -36                        | -28      | 2652                       | 0         | 210                   | 549          | -24      | -0.02        |
|                                       |            | 0        | -83  | -66      | 857                        | -62      | 969                        | -59       | 44                    | 745          | -57      | -0.06        |
|                                       | 100        | 0.5      | -79  | -62      | 638                        | -62      | 997                        | -62       | 50                    | 678          | -63      | -0.06        |
|                                       |            | 0.9      | -71  | -65      | -61                        | -56      | 1311                       | -49       | 57                    | 241          | -56      | -0.04        |
|                                       |            | 0        | -86  | -70      | 846                        | -66      | 907                        | -62       | 34                    | 703          | -61      | -0.06        |
|                                       | 200        | 0.5      | -80  | -66      | 775                        | -65      | 931                        | -65       | 43                    | 624          | -66      | -0.06        |
|                                       |            | 0.9      | -74  | -71      | -34                        | -61      | 1050                       | -57       | 34                    | 173          | -65      | -0.05        |

Table 5: Predictive  $\mathbb{R}^2$  for 100 observations, binary design with sparse covariates. Reported as % worse than the Oracle – MLE fit on the true nonzero covariates – across 1000 samples.

|                                       |     |     | % Worse than Oracle |          |                           |          |                                  |           |                       |             |     |              |
|---------------------------------------|-----|-----|---------------------|----------|---------------------------|----------|----------------------------------|-----------|-----------------------|-------------|-----|--------------|
| $\mathrm{sd}(oldsymbol{\eta})/\sigma$ | d   | ρ   | las:                | so<br>CV | $\operatorname{GL}\gamma$ | = 1 $CV$ | $\operatorname{GL}_{AICc}\gamma$ | = 10 $CV$ | margin<br><i>AICc</i> | al AL<br>CV | MCP | Oracle $R^2$ |
|                                       |     | 0   | 23                  | 17       | 17                        | 14       | 20                               | 20        | 14                    | 15          | 13  | 0.77         |
|                                       | 10  | 0.5 | 28                  | 19       | 20                        | 17       | 20                               | 26        | 17                    | 16          | 15  | 0.77         |
|                                       |     | 0.9 | 30                  | 20       | 22                        | 19       | 20                               | 29        | 19                    | 16          | 17  | 0.77         |
|                                       |     | 0   | 26                  | 18       | 14                        | 17       | 21                               | 42        | 16                    | 16          | 16  | 0.77         |
| 2                                     | 50  | 0.5 | 34                  | 23       | 17                        | 23       | 21                               | 53        | 19                    | 17          | 21  | 0.77         |
|                                       |     | 0.9 | 37                  | 25       | 20                        | 27       | 21                               | 57        | 22                    | 17          | 23  | 0.77         |
|                                       |     | 0   | 26                  | 18       | 14                        | 17       | 21                               | 45        | 16                    | 16          | 17  | 0.77         |
|                                       | 100 | 0.5 | 34                  | 24       | 16                        | 24       | 21                               | 55        | 19                    | 17          | 21  | 0.77         |
|                                       |     | 0.9 | 37                  | 25       | 19                        | 28       | 21                               | 59        | 21                    | 17          | 23  | 0.77         |
|                                       |     | 0   | 26                  | 19       | 13                        | 17       | 21                               | 44        | 16                    | 16          | 17  | 0.77         |
|                                       | 200 | 0.5 | 34                  | 24       | 16                        | 24       | 21                               | 55        | 19                    | 17          | 21  | 0.77         |
|                                       |     | 0.9 | 37                  | 25       | 19                        | 29       | 21                               | 59        | 21                    | 17          | 23  | 0.77         |
|                                       |     | 0   | 59                  | 59       | 61                        | 67       | 99                               | 83        | 43                    | 79          | 62  | 0.43         |
|                                       | 10  | 0.5 | 63                  | 65       | 66                        | 70       | 98                               | 86        | 47                    | 81          | 66  | 0.43         |
|                                       |     | 0.9 | 65                  | 65       | 67                        | 71       | 98                               | 87        | 48                    | 79          | 67  | 0.43         |
|                                       |     | 0   | 68                  | 67       | 68                        | 81       | 102                              | 94        | 48                    | 83          | 69  | 0.43         |
| 1                                     | 50  | 0.5 | 72                  | 73       | 70                        | 85       | 101                              | 95        | 52                    | 84          | 75  | 0.43         |
|                                       |     | 0.9 | 74                  | 74       | 71                        | 85       | 100                              | 96        | 54                    | 82          | 75  | 0.43         |
|                                       |     | 0   | 68                  | 67       | 68                        | 82       | 102                              | 95        | 49                    | 83          | 69  | 0.43         |
|                                       | 100 | 0.5 | 72                  | 73       | 70                        | 85       | 101                              | 96        | 52                    | 84          | 76  | 0.43         |
|                                       |     | 0.9 | 74                  | 74       | 71                        | 86       | 101                              | 96        | 54                    | 82          | 76  | 0.43         |
|                                       |     | 0   | 68                  | 67       | 68                        | 82       | 102                              | 95        | 49                    | 83          | 69  | 0.43         |
|                                       | 200 | 0.5 | 73                  | 74       | 70                        | 86       | 102                              | 96        | 52                    | 84          | 75  | 0.43         |
|                                       |     | 0.9 | 75                  | 74       | 71                        | 86       | 101                              | 96        | 54                    | 82          | 76  | 0.43         |
|                                       |     | 0   | 106                 | 117      | 345                       | 121      | 734                              | 126       | 180                   | 598         | 126 | 0.10         |
|                                       | 10  | 0.5 | 106                 | 120      | 319                       | 120      | 740                              | 123       | 182                   | 613         | 126 | 0.10         |
|                                       |     | 0.9 | 106                 | 118      | 286                       | 120      | 714                              | 124       | 181                   | 579         | 124 | 0.10         |
|                                       |     | 0   | 109                 | 117      | 526                       | 122      | 744                              | 126       | 182                   | 611         | 129 | 0.10         |
| 0.5                                   | 50  | 0.5 | 108                 | 121      | 506                       | 122      | 748                              | 125       | 183                   | 616         | 127 | 0.10         |
|                                       |     | 0.9 | 108                 | 120      | 489                       | 122      | 734                              | 124       | 189                   | 593         | 127 | 0.10         |
|                                       |     | 0   | 109                 | 118      | 550                       | 123      | 752                              | 127       | 187                   | 616         | 130 | 0.10         |
|                                       | 100 | 0.5 | 108                 | 124      | 533                       | 122      | 753                              | 125       | 185                   | 619         | 127 | 0.10         |
|                                       |     | 0.9 | 107                 | 121      | 511                       | 122      | 740                              | 124       | 188                   | 597         | 126 | 0.10         |
|                                       |     | 0   | 109                 | 117      | 551                       | 122      | 748                              | 127       | 184                   | 612         | 129 | 0.10         |
|                                       | 200 | 0.5 | 108                 | 124      | 542                       | 122      | 759                              | 125       | 185                   | 624         | 129 | 0.09         |
|                                       |     | 0.9 | 108                 | 123      | 523                       | 124      | 743                              | 123       | 189                   | 600         | 126 | 0.10         |

Table 6: Predictive  $\mathbb{R}^2$  for 100 observations, continuous design with sparse covariates. Reported as % worse than the Oracle – MLE fit on the true nonzero covariates – across 1000 samples.

|  |     |     | % Worse than Oracle |     |             |     |             |     |        |     |     |              |
|--|-----|-----|---------------------|-----|-------------|-----|-------------|-----|--------|-----|-----|--------------|
| $\operatorname{ad}(\mathbf{n})/\mathbf{r}$ | d   | 0   | lass                |     | $GL \gamma$ |     | $GL \gamma$ |     | margin |     | МСР | Oracle $R^2$ |
| $sd(\boldsymbol{\eta})/\sigma$             | u   | ρ   | AICc                | CV  | AICc        | CV  | AICc        | CV  | AICc   | CV  |     |              |
|  |     | 0   | 23                  | 17  | 23          | 15  | 21          | 22  | 15     | 15  | 14  | 0.78         |
|  | 10  | 0.5 | 61                  | 58  | 74          | 57  | 36          | 65  | 39     | 22  | 49  | 0.77         |
|  |     | 0.9 | 45                  | 45  | 55          | 45  | 53          | 46  | 29     | 22  | 42  | 0.77         |
|  |     | 0   | 26                  | 18  | 22          | 17  | 20          | 38  | 16     | 15  | 16  | 0.77         |
| 2  | 50  | 0.5 | 71                  | 70  | 88          | 74  | 23          | 86  | 43     | 22  | 68  | 0.77         |
|  |     | 0.9 | 55                  | 53  | 72          | 53  | 62          | 56  | 41     | 32  | 51  | 0.78         |
|  |     | 0   | 26                  | 18  | 21          | 17  | 21          | 41  | 16     | 15  | 16  | 0.77         |
|  | 100 | 0.5 | 72                  | 70  | 88          | 75  | 23          | 87  | 43     | 22  | 69  | 0.77         |
|  |     | 0.9 | 56                  | 53  | 73          | 53  | 61          | 57  | 41     | 33  | 52  | 0.77         |
|  |     | 0   | 26                  | 18  | 21          | 17  | 21          | 39  | 16     | 15  | 16  | 0.77         |
|  | 200 | 0.5 | 72                  | 70  | 89          | 75  | 23          | 87  | 43     | 22  | 69  | 0.78         |
|  |     | 0.9 | 56                  | 53  | 73          | 53  | 59          | 57  | 41     | 33  | 52  | 0.78         |
|  |     | 0   | 58                  | 60  | 79          | 66  | 98          | 83  | 43     | 77  | 62  | 0.44         |
|  | 10  | 0.5 | 75                  | 78  | 90          | 81  | 94          | 88  | 57     | 79  | 77  | 0.44         |
|  |     | 0.9 | 52                  | 55  | 64          | 54  | 59          | 52  | 45     | 49  | 49  | 0.44         |
|  |     | 0   | 66                  | 67  | 87          | 80  | 100         | 93  | 47     | 80  | 69  | 0.44         |
| 1  | 50  | 0.5 | 83                  | 86  | 97          | 91  | 98          | 98  | 62     | 81  | 86  | 0.44         |
|  |     | 0.9 | 72                  | 75  | 91          | 75  | 88          | 83  | 58     | 58  | 72  | 0.44         |
|  |     | 0   | 67                  | 67  | 86          | 81  | 100         | 94  | 48     | 80  | 68  | 0.44         |
|  | 100 | 0.5 | 84                  | 86  | 97          | 92  | 99          | 98  | 62     | 81  | 86  | 0.44         |
|  |     | 0.9 | 73                  | 76  | 93          | 76  | 89          | 84  | 59     | 59  | 73  | 0.44         |
|  |     | 0   | 67                  | 67  | 86          | 81  | 101         | 93  | 48     | 79  | 69  | 0.44         |
|  | 200 | 0.5 | 84                  | 87  | 97          | 92  | 99          | 98  | 62     | 81  | 86  | 0.44         |
|  |     | 0.9 | 73                  | 77  | 93          | 77  | 89          | 85  | 59     | 59  | 73  | 0.44         |
|  |     | 0   | 102                 | 114 | 162         | 117 | 706         | 124 | 167    | 575 | 120 | 0.10         |
|  | 10  | 0.5 | 105                 | 115 | 115         | 116 | 692         | 121 | 175    | 531 | 119 | 0.10         |
|  |     | 0.9 | 82                  | 92  | 99          | 92  | 463         | 102 | 133    | 213 | 92  | 0.10         |
|  |     | 0   | 105                 | 118 | 321         | 122 | 716         | 125 | 173    | 587 | 123 | 0.10         |
| 0.5  | 50  | 0.5 | 108                 | 117 | 134         | 119 | 706         | 123 | 178    | 538 | 122 | 0.10         |
|  |     | 0.9 | 103                 | 111 | 113         | 115 | 662         | 120 | 156    | 241 | 115 | 0.10         |
|  |     | 0   | 105                 | 117 | 354         | 122 | 718         | 125 | 174    | 589 | 124 | 0.10         |
|  | 100 | 0.5 | 108                 | 117 | 141         | 119 | 703         | 123 | 177    | 535 | 122 | 0.10         |
|  |     | 0.9 | 106                 | 111 | 113         | 115 | 673         | 120 | 158    | 243 | 115 | 0.10         |
|  |     | 0   | 105                 | 118 | 368         | 122 | 716         | 125 | 174    | 589 | 125 | 0.10         |
|  | 200 | 0.5 | 108                 | 117 | 147         | 119 | 705         | 123 | 177    | 534 | 121 | 0.10         |
|  |     | 0.9 | 106                 | 112 | 113         | 116 | 674         | 121 | 159    | 243 | 115 | 0.10         |

Table 7: Predictive  $\mathbb{R}^2$  for 1000 observations, binary design with dense covariates. Reported as % worse than the Oracle – MLE fit on the  $C_p$  optimal covariates – across 1000 samples.

|                                       |     |                 | % Worse than Oracle |                           |                           |                   |                            |                   |                   |                   |                       |                       |
|---------------------------------------|-----|-----------------|---------------------|---------------------------|---------------------------|-------------------|----------------------------|-------------------|-------------------|-------------------|-----------------------|-----------------------|
| $\mathrm{sd}(oldsymbol{\eta})/\sigma$ | d   | ρ               | lass<br>AICc        | so<br>CV                  | $\operatorname{GL}\gamma$ | = 1 $CV$          | $\operatorname{GL} \gamma$ | = 10 $CV$         | margin<br>AICc    | al AL<br>CV       | MCP                   | Oracle $\mathbb{R}^2$ |
|                                       | 10  | 0<br>0.5<br>0.9 | 3<br>3<br>3         | 3<br>3<br>3               | 2<br>2<br>2               | 2<br>2<br>2       | 1<br>2<br>2                | 1<br>1<br>2       | 2<br>2<br>2       | 2<br>2<br>2       | 1<br>1<br>1           | 0.79<br>0.79<br>0.79  |
| 2                                     | 50  | 0<br>0.5<br>0.9 | 6<br>7<br>7         | 5<br>5<br>5               | 5<br>5<br>5               | <b>4</b> 5 5      | 5<br>5<br>5                | 5<br>5<br>5       | 5<br>6<br>6       | 5<br>6<br>6       | 4<br>4<br>4           | 0.77<br>0.77<br>0.77  |
|                                       | 100 | 0<br>0.5<br>0.9 | 9<br>10<br>10       | 6<br>6<br>6               | 7<br>8<br>8               | 5<br>6<br>6       | 7<br>7<br>7                | 7<br>8<br>7       | 8<br>9<br>9       | 7<br>8<br>8       | 5<br>6<br>6           | 0.75<br>0.75<br>0.75  |
|                                       | 200 | 0<br>0.5<br>0.9 | 15<br>18<br>18      | 5<br><b>5</b><br><b>5</b> | 10<br>11<br>11            | 6<br>6<br>6       | 8<br>8<br>8                | 12<br>13<br>13    | 11<br>13<br>14    | 7<br>9<br>9       | 4<br>5<br>5           | 0.71<br>0.71<br>0.71  |
|                                       | 10  | 0<br>0.5<br>0.9 | 8<br>9<br>10        | 8<br>9<br>10              | 7<br>7<br>8               | 7<br>7<br>8       | 9<br>9<br>9                | 5<br>6<br>6       | 9<br>9<br>10      | 10<br>10<br>10    | 5<br>6<br>6           | 0.48<br>0.48<br>0.48  |
| 1                                     | 50  | 0<br>0.5<br>0.9 | 19<br>21<br>22      | 17<br>19<br>19            | 16<br>18<br>18            | 17<br>18<br>18    | 31<br>30<br>30             | 23<br>24<br>25    | 17<br>19<br>20    | 18<br>20<br>20    | 17<br><b>18</b><br>19 | 0.44<br>0.44<br>0.44  |
|                                       | 100 | 0<br>0.5<br>0.9 | 26<br>29<br>30      | 21<br>23<br>23            | 22<br>24<br>24            | 25<br>27<br>27    | 41<br>41<br>41             | 52<br>57<br>58    | 22<br>25<br>26    | 22<br>25<br>25    | 21<br>23<br>23        | 0.40<br>0.40<br>0.40  |
|                                       | 200 | 0<br>0.5<br>0.9 | 35<br>41<br>41      | 21<br>26<br>26            | 25<br>27<br>27            | 46<br>55<br>54    | 47<br>48<br>47             | 94<br>96<br>96    | 24<br>27<br>28    | 21<br>24<br>25    | 21<br>25<br>26        | 0.34<br>0.34<br>0.34  |
|                                       | 10  | 0<br>0.5<br>0.9 | 27<br>29<br>30      | 27<br>30<br>30            | 23<br>25<br>26            | 24<br>26<br>26    | 52<br>53<br>55             | 24<br>26<br>28    | 43<br>45<br>46    | 55<br>58<br>57    | 23<br>24<br>25        | 0.17<br>0.17<br>0.17  |
| 0.5                                   | 50  | 0<br>0.5<br>0.9 | 54<br>60<br>61      | 56<br>63<br>65            | 60<br>64<br>64            | 72<br>77<br>78    | 145<br>154<br>146          | 94<br>96<br>96    | 72<br>78<br>79    | 91<br>96<br>96    | 57<br>65<br>66        | 0.13<br>0.13<br>0.13  |
|                                       | 100 | 0<br>0.5<br>0.9 | 62<br>69<br>71      | 69<br>76<br>78            | 87<br>89<br>90            | 93<br>95<br>96    | 150<br>158<br>154          | 101<br>101<br>101 | 85<br>91<br>93    | 113<br>119<br>119 | 68<br>77<br>78        | 0.09<br>0.09<br>0.09  |
|                                       | 200 | 0<br>0.5<br>0.9 | 53<br>65<br>68      | 65<br>75<br>78            | 163<br>156<br>155         | 101<br>101<br>101 | 156<br>162<br>160          | 104<br>104<br>104 | 100<br>109<br>114 | 158<br>169<br>167 | 66<br>76<br>80        | 0.04<br>0.04<br>0.04  |

Table 8: Predictive  $\mathbb{R}^2$  for 1000 observations, continuous design with dense covariates. Reported as % worse than the Oracle – MLE fit on the  $C_p$  optimal covariates – across 1000 samples.

|                                 |     |     | % Worse than Oracle |          |                            |          |                                  |           |                       |             |     |              |
|---------------------------------|-----|-----|---------------------|----------|----------------------------|----------|----------------------------------|-----------|-----------------------|-------------|-----|--------------|
| $\mathrm{sd}({m{\eta}})/\sigma$ | d   | ρ   | las:<br>AICc        | so<br>CV | $\operatorname{GL} \gamma$ | = 1 $CV$ | $\operatorname{GL}_{AICc}\gamma$ | = 10 $CV$ | margin<br><i>AICc</i> | al AL<br>CV | MCP | Oracle $R^2$ |
|                                 |     | 0   | 3                   | 3        | 2                          | 2        | 2                                | 1         | 2                     | 2           | 1   | 0.79         |
|                                 | 10  | 0.5 | 5                   | 5        | 4                          | 4        | 3                                | 2         | 8                     | 8           | 2   | 0.79         |
|                                 |     | 0.9 | 7                   | 6        | 6                          | 5        | 4                                | 4         | 10                    | 10          | 3   | 0.79         |
|                                 |     | 0   | 6                   | 5        | 5                          | 4        | 5                                | 5         | 5                     | 5           | 4   | 0.77         |
| 2                               | 50  | 0.5 | 11                  | 8        | 9                          | 7        | 6                                | 6         | 14                    | 14          | 6   | 0.77         |
|                                 |     | 0.9 | 14                  | 10       | 11                         | 9        | 7                                | 7         | 44                    | 44          | 7   | 0.77         |
|                                 |     | 0   | 9                   | 6        | 7                          | 5        | 7                                | 7         | 8                     | 7           | 5   | 0.75         |
|                                 | 100 | 0.5 | 18                  | 9        | 13                         | 8        | 9                                | 9         | 21                    | 17          | 9   | 0.75         |
|                                 |     | 0.9 | 23                  | 10       | 16                         | 10       | 9                                | 9         | 56                    | 56          | 11  | 0.75         |
|                                 |     | 0   | 16                  | 5        | 11                         | 6        | 8                                | 12        | 11                    | 7           | 4   | 0.71         |
|                                 | 200 | 0.5 | 50                  | 11       | 24                         | 12       | 11                               | 75        | 34                    | 25          | 10  | 0.71         |
|                                 |     | 0.9 | 91                  | 42       | 85                         | 45       | 12                               | 92        | 68                    | 68          | 60  | 0.71         |
|                                 |     | 0   | 9                   | 9        | 7                          | 7        | 8                                | 6         | 9                     | 10          | 5   | 0.48         |
|                                 | 10  | 0.5 | 16                  | 16       | 14                         | 13       | 10                               | 9         | 18                    | 18          | 7   | 0.48         |
|                                 |     | 0.9 | 23                  | 22       | 20                         | 19       | 16                               | 14        | 10                    | 10          | 11  | 0.48         |
|                                 |     | 0   | 19                  | 17       | 17                         | 17       | 27                               | 23        | 17                    | 18          | 17  | 0.44         |
| 1                               | 50  | 0.5 | 38                  | 32       | 32                         | 29       | 28                               | 34        | 39                    | 38          | 25  | 0.44         |
|                                 |     | 0.9 | 70                  | 68       | 70                         | 53       | 66                               | 56        | 46                    | 46          | 31  | 0.44         |
|                                 |     | 0   | 26                  | 20       | 24                         | 25       | 45                               | 52        | 22                    | 22          | 20  | 0.40         |
|                                 | 100 | 0.5 | 64                  | 57       | 56                         | 61       | 51                               | 95        | 51                    | 47          | 57  | 0.40         |
|                                 |     | 0.9 | 86                  | 88       | 90                         | 88       | 89                               | 88        | 65                    | 67          | 85  | 0.40         |
|                                 |     | 0   | 35                  | 21       | 27                         | 47       | 66                               | 94        | 23                    | 21          | 21  | 0.34         |
|                                 | 200 | 0.5 | 84                  | 87       | 93                         | 94       | 84                               | 99        | 58                    | 52          | 87  | 0.34         |
|                                 |     | 0.9 | 91                  | 93       | 95                         | 93       | 96                               | 94        | 81                    | 83          | 93  | 0.34         |
|                                 |     | 0   | 27                  | 28       | 27                         | 24       | 48                               | 25        | 44                    | 57          | 24  | 0.17         |
|                                 | 10  | 0.5 | 49                  | 52       | 46                         | 44       | 62                               | 41        | 71                    | 77          | 29  | 0.17         |
|                                 |     | 0.9 | 44                  | 45       | 44                         | 43       | 42                               | 42        | 29                    | 28          | 39  | 0.18         |
|                                 | _   | 0   | 54                  | 57       | 74                         | 71       | 101                              | 94        | 72                    | 90          | 58  | 0.13         |
| 0.5                             | 50  | 0.5 | 90                  | 95       | 98                         | 96       | 101                              | 100       | 108                   | 117         | 95  | 0.13         |
|                                 |     | 0.9 | 79                  | 80       | 81                         | 79       | 79                               | 77        | 83                    | 81          | 76  | 0.13         |
|                                 |     | 0   | 62                  | 68       | 96                         | 93       | 102                              | 101       | 84                    | 112         | 68  | 0.09         |
|                                 | 100 | 0.5 | 94                  | 98       | 101                        | 100      | 102                              | 101       | 118                   | 132         | 98  | 0.09         |
|                                 |     | 0.9 | 87                  | 89       | 92                         | 88       | 95                               | 89        | 95                    | 92          | 88  | 0.09         |
|                                 |     | 0   | 54                  | 65       | 110                        | 100      | 102                              | 104       | 98                    | 157         | 67  | 0.04         |
|                                 | 200 | 0.5 | 92                  | 98       | 102                        | 102      | 102                              | 103       | 141                   | 169         | 98  | 0.04         |
|                                 |     | 0.9 | 91                  | 94       | 99                         | 95       | 101                              | 99        | 108                   | 103         | 95  | 0.05         |

Table 9: Predictive  $\mathbb{R}^2$  for 1000 observations, binary design with sparse covariates. Reported as % worse than the Oracle – MLE fit on the true nonzero covariates – across 1000 samples.

|                                       |     |                 | % Worse than Oracle |                |                            |                       |                                  |                   |                       |                   |                       |                      |
|---------------------------------------|-----|-----------------|---------------------|----------------|----------------------------|-----------------------|----------------------------------|-------------------|-----------------------|-------------------|-----------------------|----------------------|
| $\mathrm{sd}(oldsymbol{\eta})/\sigma$ | d   | ρ               | las:                | so<br>CV       | $\operatorname{GL} \gamma$ | = 1 $CV$              | $\operatorname{GL}_{AICc}\gamma$ | = 10 $CV$         | margir<br><i>AICc</i> | al AL<br>CV       | MCP                   | Oracle $R^2$         |
|                                       | 10  | 0<br>0.5<br>0.9 | 1<br>1<br>1         | 1<br>1<br>1    | 1<br>1<br>1                | 1<br>1<br>1           | 0<br>0<br>0                      | 0<br>0<br>0       | 1<br>1<br>1           | 1<br>1<br>1       | 0<br>0<br>0           | 0.78<br>0.78<br>0.78 |
| 2                                     | 50  | 0<br>0.5<br>0.9 | 6<br>7<br>7         | 6<br>6<br>6    | 5<br>6<br>6                | 5<br>5<br>5           | 5<br>5<br>5                      | <b>4</b> 5 5      | 6<br>6<br>7           | 5<br>6<br>6       | 4<br>4<br>4           | 0.78<br>0.78<br>0.78 |
|                                       | 100 | 0<br>0.5<br>0.9 | 7<br>7<br>8         | 6<br>6<br>6    | 5<br>5<br>6                | 5<br>5<br>5           | 4<br>4<br>4                      | 3<br>3<br>3       | 6<br>7<br>7           | 6<br>6<br>7       | 3<br>3<br>3           | 0.78<br>0.78<br>0.78 |
|                                       | 200 | 0<br>0.5<br>0.9 | 7<br>7<br>8         | 6<br>6<br>6    | 5<br>5<br>5                | 4<br>5<br>5           | 3<br>3<br>3                      | 2<br>2<br>2       | 5<br>6<br>7           | 5<br>6<br>6       | 1<br>1<br>1           | 0.78<br>0.78<br>0.78 |
|                                       | 10  | 0<br>0.5<br>0.9 | 2<br>3<br>3         | 2<br>3<br>3    | 0<br>1<br>1                | 0<br>1<br>1           | 2<br>2<br>2                      | -1<br>-1<br>-1    | 2<br>3<br>3           | 3<br>4<br>4       | -2<br>-1<br>-1        | 0.45<br>0.45<br>0.45 |
| 1                                     | 50  | 0<br>0.5<br>0.9 | 20<br>22<br>22      | 18<br>20<br>20 | 17<br>18<br>19             | 18<br>19<br><b>19</b> | 31<br>31<br>30                   | 23<br>23<br>24    | 18<br>20<br>20        | 19<br>21<br>21    | 18<br>19<br><b>19</b> | 0.45<br>0.45<br>0.45 |
|                                       | 100 | 0<br>0.5<br>0.9 | 26<br>28<br>29      | 23<br>24<br>25 | 23<br>24<br>24             | 24<br>25<br>25        | 38<br>38<br>38                   | 36<br>38<br>39    | 23<br>26<br>26        | 24<br>26<br>27    | 23<br>24<br>25        | 0.45<br>0.45<br>0.45 |
|                                       | 200 | 0<br>0.5<br>0.9 | 28<br>30<br>31      | 24<br>26<br>26 | 25<br><b>26</b><br>27      | 26<br>28<br>28        | 42<br>42<br>42                   | 45<br>50<br>51    | 25<br>28<br>29        | 26<br>28<br>29    | 24<br>26<br>26        | 0.45<br>0.45<br>0.45 |
|                                       | 10  | 0<br>0.5<br>0.9 | -9<br>-5<br>-4      | -8<br>-4<br>-3 | <b>-14</b><br>-11<br>-10   | -13<br>-10<br>-9      | 29<br>30<br>33                   | -13<br>-11<br>-7  | 16<br>18<br>19        | 34<br>38<br>36    | -14<br>-13<br>-12     | 0.12<br>0.12<br>0.12 |
| 0.5                                   | 50  | 0<br>0.5<br>0.9 | 49<br>55<br>57      | 52<br>59<br>60 | 55<br>59<br>60             | 68<br>72<br>74        | 144<br>158<br>150                | 93<br>95<br>95    | 69<br>75<br>76        | 89<br>95<br>94    | 52<br>60<br>61        | 0.12<br>0.12<br>0.12 |
|                                       | 100 | 0<br>0.5<br>0.9 | 64<br>70<br>71      | 68<br>75<br>76 | 79<br>82<br>82             | 90<br>92<br>93        | 139<br>146<br>141                | 100<br>100<br>101 | 82<br>88<br>89        | 103<br>108<br>108 | 68<br>76<br>77        | 0.12<br>0.12<br>0.12 |
|                                       | 200 | 0<br>0.5<br>0.9 | 69<br>75<br>76      | 73<br>80<br>81 | 94<br>95<br>95             | 95<br>97<br>97        | 127<br>132<br>130                | 101<br>101<br>101 | 86<br>92<br>93        | 107<br>113<br>113 | 73<br>80<br>82        | 0.12<br>0.12<br>0.12 |

Table 10: Predictive  $\mathbb{R}^2$  for 1000 observations, continuous design with sparse covariates. Reported as % worse than the Oracle – MLE fit on the true nonzero covariates – across 1000 samples.

|                                       |     |     | % Worse than Oracle |          |                            |          |                                  |           |                       |             |     |                       |
|---------------------------------------|-----|-----|---------------------|----------|----------------------------|----------|----------------------------------|-----------|-----------------------|-------------|-----|-----------------------|
| $\mathrm{sd}(oldsymbol{\eta})/\sigma$ | d   | ho  | las:                | so<br>CV | $\operatorname{GL} \gamma$ | = 1 $CV$ | $\operatorname{GL}_{AICc}\gamma$ | = 10 $CV$ | margin<br><i>AICc</i> | al AL<br>CV | MCP | Oracle R <sup>2</sup> |
|                                       |     | 0   | 1                   | 1        | 1                          | 1        | 0                                | 0         | 1                     | 1           | 0   | 0.78                  |
|                                       | 10  | 0.5 | 4                   | 3        | 3                          | 2        | 1                                | 1         | 7                     | 7           | 0   | 0.78                  |
|                                       |     | 0.9 | 5                   | 5        | 4                          | 4        | 2                                | 2         | 9                     | 9           | 1   | 0.78                  |
|                                       |     | 0   | 6                   | 6        | 5                          | 5        | 5                                | 4         | 6                     | 5           | 4   | 0.78                  |
| 2                                     | 50  | 0.5 | 11                  | 9        | 9                          | 8        | 6                                | 6         | 15                    | 14          | 5   | 0.78                  |
|                                       |     | 0.9 | 14                  | 10       | 11                         | 9        | 7                                | 7         | 45                    | 44          | 7   | 0.78                  |
|                                       |     | 0   | 7                   | 6        | 5                          | 5        | 4                                | 3         | 6                     | 6           | 3   | 0.78                  |
|                                       | 100 | 0.5 | 12                  | 9        | 9                          | 7        | 4                                | 5         | 17                    | 15          | 3   | 0.78                  |
|                                       |     | 0.9 | 15                  | 11       | 11                         | 9        | 6                                | 6         | 54                    | 53          | 5   | 0.78                  |
|                                       | _   | 0   | 7                   | 6        | 5                          | 4        | 3                                | 2         | 5                     | 5           | 1   | 0.78                  |
|                                       | 200 | 0.5 | 12                  | 9        | 8                          | 7        | 3                                | 3         | 17                    | 15          | 1   | 0.78                  |
|                                       |     | 0.9 | 14                  | 11       | 10                         | 9        | 4                                | 5         | 53                    | 52          | 2   | 0.78                  |
|                                       |     | 0   | 2                   | 2        | 1                          | 0        | 2                                | -1        | 2                     | 3           | -1  | 0.45                  |
|                                       | 10  | 0.5 | 10                  | 10       | 7                          | 7        | 4                                | 3         | 12                    | 12          | 0   | 0.45                  |
|                                       |     | 0.9 | 17                  | 17       | 14                         | 13       | 10                               | 8         | 3                     | 3           | 4   | 0.45                  |
|                                       |     | 0   | 20                  | 18       | 18                         | 17       | 27                               | 23        | 18                    | 19          | 18  | 0.45                  |
| 1                                     | 50  | 0.5 | 38                  | 32       | 32                         | 29       | 29                               | 34        | 39                    | 38          | 25  | 0.45                  |
|                                       |     | 0.9 | 68                  | 65       | 67                         | 51       | 63                               | 52        | 47                    | 46          | 30  | 0.45                  |
|                                       |     | 0   | 26                  | 23       | 24                         | 24       | 36                               | 36        | 23                    | 24          | 23  | 0.45                  |
|                                       | 100 | 0.5 | 53                  | 45       | 42                         | 42       | 40                               | 77        | 50                    | 47          | 39  | 0.45                  |
|                                       |     | 0.9 | 85                  | 86       | 88                         | 83       | 86                               | 87        | 63                    | 64          | 68  | 0.45                  |
|                                       |     | 0   | 28                  | 24       | 26                         | 26       | 43                               | 45        | 25                    | 26          | 24  | 0.45                  |
|                                       | 200 | 0.5 | 65                  | 55       | 48                         | 57       | 46                               | 96        | 54                    | 51          | 54  | 0.45                  |
|                                       |     | 0.9 | 87                  | 89       | 91                         | 88       | 90                               | 90        | 71                    | 73          | 87  | 0.45                  |
|                                       |     | 0   | -8                  | -7       | -8                         | -12      | 23                               | -11       | 16                    | 35          | -13 | 0.12                  |
|                                       | 10  | 0.5 | 25                  | 28       | 20                         | 18       | 44                               | 12        | 57                    | 66          | -5  | 0.12                  |
|                                       |     | 0.9 | 16                  | 17       | 16                         | 15       | 12                               | 12        | -7                    | -8          | 7   | 0.12                  |
|                                       |     | 0   | 49                  | 52       | 70                         | 67       | 101                              | 93        | 68                    | 88          | 52  | 0.12                  |
| 0.5                                   | 50  | 0.5 | 89                  | 94       | 98                         | 96       | 101                              | 100       | 107                   | 119         | 94  | 0.12                  |
|                                       |     | 0.9 | 76                  | 77       | 79                         | 76       | 76                               | 74        | 80                    | 78          | 73  | 0.12                  |
|                                       |     | 0   | 63                  | 68       | 91                         | 90       | 102                              | 100       | 81                    | 102         | 67  | 0.12                  |
|                                       | 100 | 0.5 | 94                  | 98       | 100                        | 100      | 101                              | 101       | 113                   | 124         | 98  | 0.12                  |
|                                       |     | 0.9 | 87                  | 88       | 91                         | 88       | 93                               | 88        | 93                    | 91          | 87  | 0.12                  |
|                                       |     | 0   | 69                  | 73       | 97                         | 95       | 101                              | 101       | 86                    | 107         | 73  | 0.12                  |
|                                       | 200 | 0.5 | 96                  | 98       | 101                        | 100      | 101                              | 101       | 114                   | 126         | 99  | 0.12                  |
|                                       |     | 0.9 | 91                  | 93       | 96                         | 93       | 99                               | 95        | 97                    | 94          | 93  | 0.12                  |

Table 11: Predictive MSE for n=100, binary design, dense covariates, and decay 10.

|                   | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL   | MCP  | CVbest | ICbest |                                     |
|-------------------|-------------|--------------------------------|---------------------------------|------|------|--------|--------|-------------------------------------|
| CV.1se            | 0.99        | 0.94                           | 1.06                            | 0.53 | 0.87 |        |        |                                     |
| CV.min            | 0.59        | 0.63                           | 0.84                            | 0.51 | 0.62 | 0.61   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.72        | 0.67                           | 0.54                            | 0.56 |      |        | 0.54   | $\rho = 0$                          |
| AIC               | 0.55        | 0.55                           | 0.56                            | 0.52 |      |        |        | Oracle: 0.37                        |
| BIC               | 0.55        | 0.55                           | 0.56                            | 0.53 |      |        |        | 01466.0.37                          |
| CV.1se            | 0.97        | 0.92                           | 0.99                            | 0.49 | 0.83 |        |        |                                     |
| CV.min            | 0.58        | 0.60                           | 0.79                            | 0.46 | 0.59 | 0.59   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.69        | 0.64                           | 0.48                            | 0.52 |      |        | 0.48   | $\rho = 0.5$                        |
| AIC               | 0.49        | 0.49                           | 0.50                            | 0.47 |      |        |        | Oracle : 0.33                       |
| BIC               | 0.49        | 0.49                           | 0.50                            | 0.48 |      |        |        | Oracie: 0.55                        |
| CV.1se            | 0.93        | 0.89                           | 0.96                            | 0.47 | 0.80 |        |        |                                     |
| CV.min            | 0.56        | 0.59                           | 0.78                            | 0.44 | 0.58 | 0.58   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.67        | 0.63                           | 0.46                            | 0.50 |      |        | 0.46   | $\rho = 0.9$                        |
| AIC               | 0.46        | 0.47                           | 0.47                            | 0.45 |      |        |        | 0 1 021                             |
| BIC               | 0.46        | 0.47                           | 0.47                            | 0.46 |      |        |        | Oracle: 0.31                        |
| CV.1se            | 2.18        | 2.18                           | 2.20                            | 1.79 | 2.17 |        |        |                                     |
| CV.min            | 1.91        | 2.00                           | 2.13                            | 2.03 | 1.93 | 1.92   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 1.91        | 1.92                           | 2.21                            | 1.73 |      |        | 2.20   | $\rho = 0$                          |
| AIC               | 2.21        | 2.22                           | 2.24                            | 2.15 |      |        |        | ,                                   |
| BIC               | 2.20        | 2.21                           | 2.24                            | 2.15 |      |        |        | Oracle: 1.40                        |
| CV.1se            | 1.98        | 1.98                           | 1.99                            | 1.64 | 1.97 |        |        |                                     |
| CV.min            | 1.75        | 1.82                           | 1.93                            | 1.83 | 1.77 | 1.75   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 1.74        | 1.76                           | 1.97                            | 1.57 |      |        | 1.97   | $\rho = 0.5$                        |
| AIC               | 1.98        | 1.99                           | 2.01                            | 1.93 |      |        | 1.77   | ,                                   |
| BIC               | 1.98        | 1.98                           | 2.01                            | 1.93 |      |        |        | Oracle: 1.26                        |
| CV.1se            | 1.88        | 1.87                           | 1.88                            | 1.54 | 1.86 |        |        |                                     |
| CV.rise<br>CV.min | 1.66        | 1.72                           | 1.82                            | 1.72 | 1.67 | 1.67   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 1.66        | 1.67                           | 1.86                            | 1.5  | 1.07 | 1.07   | 1.86   | $\rho = 0.9$                        |
| AIC               | 1.87        | 1.88                           | 1.90                            | 1.83 |      |        | 1.00   | ,                                   |
| BIC               | 1.87        | 1.88                           | 1.90                            | 1.82 |      |        |        | Oracle: 1.19                        |
| CV.1se            | 5.67        | 5.67                           | 5.68                            | 6.91 | 5.67 |        |        |                                     |
| CV.1sc<br>CV.min  | 5.68        | 5.70                           | 5.71                            | 8.23 | 5.72 | 5.72   |        | $sd(\mu)/\sigma = 0.5$              |
| AICc              | <b>5.61</b> | 7.11                           | 8.94                            | 6.01 | 3.12 | 3.12   | 8.94   | $\rho = 0$                          |
| AIC               | 8.88        | 8.93                           | 9.00                            | 8.74 |      |        | 0.74   | $\rho = 0$                          |
| BIC               | 8.87        | 8.92                           | 9.00                            | 8.73 |      |        |        | Oracle: 5.30                        |
| CV.1se            | 5.08        | 5.08                           | 5.08                            | 6.21 | 5.08 |        |        |                                     |
| CV.1se<br>CV.min  |             | 5.11                           |                                 |      |      | 5.13   |        | ad()/- 05                           |
|                   | 5.09        |                                | 5.11                            | 7.39 | 5.13 | 3.13   | 7.00   |                                     |
| AICc              | 5.03        | 6.20                           | 7.98                            | 5.41 |      |        | 7.99   | $\rho = 0.5$                        |
| AIC<br>BIC        | 7.93        | 7.98                           | 8.04                            | 7.81 |      |        |        | Oracle: 4.74                        |
|                   | 7.93        | 7.97                           | 8.04                            | 7.81 | 4.02 |        |        |                                     |
| CV.1se            | 4.82        | 4.83                           | 4.83                            | 5.84 | 4.83 | 4.00   |        | -1()/ 05                            |
| CV.min            | 4.84        | 4.85                           | 4.86                            | 6.96 | 4.86 | 4.89   | 7.56   | $sd(\mu)/\sigma = 0.5$              |
| AICc              | <b>4.77</b> | 5.83                           | 7.57                            | 5.14 |      |        | 7.56   | $\rho = 0.9$                        |
| AIC               | 7.53        | 7.57                           | 7.63                            | 7.41 |      |        |        | <i>Oracle</i> : 4.52                |
| BIC               | 7.52        | 7.56                           | 7.63                            | 7.40 |      |        |        |                                     |

Table 12: Predictive MSE for n=100, binary design, dense covariates, and decay 50.

|                  | lasso          | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL             | MCP   | CVbest | ICbest |                                       |
|------------------|----------------|--------------------------------|------------------------------|----------------|-------|--------|--------|---------------------------------------|
| CV.1se           | 7.33           | 7.44                           | 7.46                         | 3.26           | 7.34  |        |        |                                       |
| CV.min           | 5.91           | 6.93                           | 7.27                         | 2.95           | 5.82  | 6.07   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 6.28           | 3.35                           | 3.02                         | 4.31           |       |        | 3.02   | $\rho = 0$                            |
| AIC              | 2.98           | 3.00                           | 3.03                         | 2.94           |       |        |        | Oracle: 2.73                          |
| BIC              | 2.98           | 3.00                           | 3.03                         | 2.94           |       |        |        | 01 acic . 2.13                        |
| CV.1se           | 6.67           | 6.68                           | 6.71                         | 2.96           | 6.66  |        |        |                                       |
| CV.min           | 5.46           | 6.27                           | 6.57                         | 2.64           | 5.45  | 5.56   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 5.70           | 3.11                           | 2.70                         | 3.86           |       |        | 2.71   | $\rho = 0.5$                          |
| AIC              | 2.67           | 2.68                           | 2.71                         | 2.63           |       |        |        | Oracle: 2.45                          |
| BIC              | 2.67           | 2.68                           | 2.71                         | 2.63           |       |        |        | Oracie . 2.43                         |
| CV.1se           | 6.28           | 6.30                           | 6.35                         | 2.89           | 6.29  |        |        |                                       |
| CV.min           | 5.24           | 5.94                           | 6.21                         | 2.51           | 5.27  | 5.32   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 5.46           | 3.15                           | 2.55                         | 3.77           |       |        | 2.55   | $\rho = 0.9$                          |
| AIC              | 2.52           | 2.54                           | 2.56                         | 2.49           |       |        |        | 0 1 221                               |
| BIC              | 2.52           | 2.54                           | 2.56                         | 2.49           |       |        |        | Oracle: 2.31                          |
| CV.1se           | 12.07          | 12.11                          | 12.12                        | 10.25          | 12.07 |        |        |                                       |
| CV.min           | 11.33          | 11.94                          | 12.07                        | 11.32          | 11.41 | 11.48  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 11.31          | 11.06                          | 12.10                        | 10.12          |       |        | 12.09  | $\rho = 0$                            |
| AIC              | 11.96          | 12.05                          | 12.14                        | 11.78          |       |        |        | ,                                     |
| BIC              | 11.96          | 12.04                          | 12.14                        | 11.77          |       |        |        | Oracle: 9.58                          |
| CV.1se           | 10.82          | 10.84                          | 10.85                        | 9.17           | 10.82 |        |        |                                       |
| CV.min           | 10.25          | 10.69                          | 10.82                        | 10.09          | 10.33 | 10.36  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 10.15          | 9.82                           | 10.78                        | 9.06           | 10.00 | 10.00  | 10.78  | $\rho = 0.5$                          |
| AIC              | 10.66          | 10.73                          | 10.82                        | 10.49          |       |        | 10.70  | ,                                     |
| BIC              | 10.65          | 10.72                          | 10.82                        | 10.49          |       |        |        | Oracle: 8.54                          |
| CV.1se           | 10.25          | 10.72                          | 10.27                        | 8.73           | 10.26 |        |        |                                       |
| CV.13C<br>CV.min | 9.73           | 10.12                          | 10.23                        | 9.51           | 9.75  | 9.80   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 9.66           | 9.31                           | 10.20                        | 8.66           | 7.13  | 7.00   | 10.21  | $\rho = 0.9$                          |
| AIC              | 10.09          | 10.16                          | 10.24                        | 9.93           |       |        | 10.21  | $\rho = 0.3$                          |
| BIC              | 10.08          | 10.15                          | 10.24                        | 9.93           |       |        |        | Oracle: 8.05                          |
| CV.1se           | 30.53          | 30.55                          | 30.60                        | 37.75          | 30.56 |        |        |                                       |
| CV.1se<br>CV.min | 30.55          | 30.33                          | 30.82                        | 44.89          | 30.81 | 30.94  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 30.09          | 45.69                          | 48.52                        | 32.65          | 30.61 | 30.94  | 48.53  | $\rho = 0$                            |
| AICC             | 47.87          | 48.29                          | 48.60                        | 47.19          |       |        | 40.33  | $\rho = 0$                            |
| BIC              |                |                                |                              |                |       |        |        | Oracle: 31.48                         |
| CV.1se           | 47.84<br>27.31 | 48.27<br>27.33                 | 48.60<br>27.33               | 47.17<br>33.73 | 27.33 |        |        |                                       |
|                  |                |                                |                              |                |       | 27.71  |        | -1()/- 0.5                            |
| CV.min           | 27.44          | 27.49                          | 27.51                        | 39.84          | 27.55 | 27.71  | 12.20  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 27.22          | 40.56                          | 43.22                        | 29.07          |       |        | 43.30  | $\rho = 0.5$                          |
| AIC              | 42.66          | 43.03                          | 43.30                        | 42.06          |       |        |        | Oracle: 28.08                         |
| BIC              | 42.64          | 43.01                          | 43.30                        | 42.04          |       |        |        |                                       |
| CV.1se           | 25.85          | 25.87                          | 25.88                        | 31.38          | 25.87 |        |        |                                       |
| CV.min           | 26.00          | 25.97                          | 26.03                        | 37.38          | 26.07 | 26.25  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 25.67          | 38.25                          | 40.92                        | 27.59          |       |        | 41.08  | $\rho = 0.9$                          |
| AIC              | 40.38          | 40.73                          | 40.99                        | 39.78          |       |        |        | Oracle : 26.61                        |
| BIC              | 40.36          | 40.71                          | 40.99                        | 39.76          |       |        |        | 2.400.01                              |

Table 13: Predictive MSE for n=100, binary design, dense covariates, and decay 100.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|---------------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 14.97 | 15.13                          | 15.17                           | 6.70  | 15.02 |        |        |                                       |
| CV.min | 12.62 | 14.61                          | 14.91                           | 5.99  | 12.53 | 12.89  |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 13.31 | 6.05                           | 6.12                            | 9.01  |       |        | 6.14   | $\rho = 0$                            |
| AIC    | 6.04  | 6.08                           | 6.13                            | 5.96  |       |        |        | Oracle: 6.12                          |
| BIC    | 6.04  | 6.08                           | 6.13                            | 5.96  |       |        |        | 07 acte : 0.12                        |
| CV.1se | 13.48 | 13.54                          | 13.55                           | 6.03  | 13.50 |        |        |                                       |
| CV.min | 11.56 | 13.10                          | 13.37                           | 5.35  | 11.65 | 11.77  |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 11.88 | 5.49                           | 5.44                            | 8.14  |       |        | 5.46   | $\rho = 0.5$                          |
| AIC    | 5.37  | 5.41                           | 5.45                            | 5.31  |       |        |        | <i>Oracle</i> : 5.45                  |
| BIC    | 5.37  | 5.41                           | 5.45                            | 5.3   |       |        |        | 074000.5.45                           |
| CV.1se | 12.74 | 12.81                          | 12.84                           | 5.92  | 12.80 |        |        |                                       |
| CV.min | 10.99 | 12.38                          | 12.67                           | 5.11  | 10.93 | 11.21  |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 11.29 | 5.27                           | 5.17                            | 7.86  |       |        | 5.16   | $\rho = 0.9$                          |
| AIC    | 5.10  | 5.14                           | 5.18                            | 5.04  |       |        |        | <i>Oracle</i> : 5.16                  |
| BIC    | 5.10  | 5.13                           | 5.18                            | 5.04  |       |        |        | 07466.5.10                            |
| CV.1se | 24.48 | 24.56                          | 24.57                           | 20.88 | 24.50 |        |        |                                       |
| CV.min | 23.19 | 24.40                          | 24.52                           | 22.96 | 23.24 | 23.46  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 23.11 | 23.13                          | 24.53                           | 20.63 |       |        | 24.52  | $\rho = 0$                            |
| AIC    | 24.21 | 24.42                          | 24.58                           | 23.85 |       |        |        | <i>Oracle</i> : 21.34                 |
| BIC    | 24.20 | 24.41                          | 24.58                           | 23.84 |       |        |        | Oracle . 21.34                        |
| CV.1se | 21.91 | 21.95                          | 21.95                           | 18.66 | 21.94 |        |        |                                       |
| CV.min | 20.91 | 21.80                          | 21.92                           | 20.46 | 21.03 | 21.13  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 20.78 | 20.54                          | 21.87                           | 18.48 |       |        | 21.87  | $\rho = 0.5$                          |
| AIC    | 21.58 | 21.76                          | 21.91                           | 21.26 |       |        |        | Oracle: 19.00                         |
| BIC    | 21.57 | 21.76                          | 21.91                           | 21.25 |       |        |        | Oracle . 19.00                        |
| CV.1se | 20.67 | 20.71                          | 20.72                           | 17.65 | 20.70 |        |        |                                       |
| CV.min | 19.66 | 20.53                          | 20.67                           | 19.21 | 19.67 | 19.78  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 19.53 | 19.34                          | 20.61                           | 17.53 |       |        | 20.58  | $\rho = 0.9$                          |
| AIC    | 20.35 | 20.51                          | 20.66                           | 20.05 |       |        |        | <i>Oracle</i> : 17.97                 |
| BIC    | 20.34 | 20.50                          | 20.66                           | 20.04 |       |        |        | Oracle . 17.97                        |
| CV.1se | 61.84 | 61.86                          | 61.92                           | 76.46 | 61.85 |        |        |                                       |
| CV.min | 62.12 | 62.25                          | 62.34                           | 90.65 | 62.44 | 62.36  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 61.54 | 94.48                          | 98.16                           | 66.07 |       |        | 98.14  | $\rho = 0$                            |
| AIC    | 96.74 | 97.74                          | 98.25                           | 95.38 |       |        |        | Oracle : 64.46                        |
| BIC    | 96.70 | 97.70                          | 98.25                           | 95.35 |       |        |        | 07466.04.40                           |
| CV.1se | 55.33 | 55.40                          | 55.36                           | 68.27 | 55.34 |        |        |                                       |
| CV.min | 55.59 | 55.77                          | 55.74                           | 80.79 | 55.83 | 56.06  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 55.07 | 83.89                          | 87.52                           | 59.02 |       |        | 87.55  | $\rho = 0.5$                          |
| AIC    | 86.29 | 87.15                          | 87.62                           | 85.08 |       |        |        | Oracle : 57.58                        |
| BIC    | 86.25 | 87.11                          | 87.62                           | 85.05 |       |        |        | Oracle . 37.36                        |
| CV.1se | 52.31 | 52.35                          | 52.39                           | 63.43 | 52.34 |        |        |                                       |
| CV.min | 52.51 | 52.62                          | 52.66                           | 75.65 | 52.69 | 52.76  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 51.93 | 79.08                          | 82.74                           | 55.84 |       |        | 82.80  | $\rho = 0.9$                          |
| AIC    | 81.57 | 82.38                          | 82.83                           | 80.38 |       |        |        | Oracle : 54.48                        |
| BIC    | 81.52 | 82.35                          | 82.83                           | 80.28 |       |        |        | 01 acic . 34.40                       |

Table 14: Predictive MSE for n=100, binary design, dense covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL     | MCP    | CVbest | ICbest |                                     |
|--------|--------|--------------------------------|------------------------------|--------|--------|--------|--------|-------------------------------------|
| CV.1se | 30.33  | 30.56                          | 30.60                        | 13.61  | 30.38  |        |        |                                     |
| CV.min | 26.07  | 29.77                          | 30.17                        | 12.06  | 25.72  | 26.61  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 27.01  | 12.04                          | 12.33                        | 18.27  |        |        | 12.32  | $\rho = 0$                          |
| AIC    | 12.15  | 12.26                          | 12.34                        | 12     |        |        |        | <i>Oracle</i> : 12.55               |
| BIC    | 12.15  | 12.26                          | 12.34                        | 12     |        |        |        | 07acte . 12.33                      |
| CV.1se | 27.21  | 27.33                          | 27.35                        | 12.36  | 27.28  |        |        |                                     |
| CV.min | 23.89  | 26.73                          | 27.01                        | 10.79  | 23.88  | 24.36  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 24.26  | 10.74                          | 10.99                        | 16.73  |        |        | 11.03  | $\rho = 0.5$                        |
| AIC    | 10.83  | 10.93                          | 11.00                        | 10.7   |        |        |        | Oracle: 11.21                       |
| BIC    | 10.83  | 10.92                          | 11.00                        | 10.7   |        |        |        | Oracie: 11.21                       |
| CV.1se | 25.68  | 25.79                          | 25.82                        | 11.97  | 25.74  |        |        |                                     |
| CV.min | 22.64  | 25.13                          | 25.46                        | 10.24  | 22.44  | 22.96  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 22.74  | 10.23                          | 10.38                        | 15.86  |        |        | 10.38  | $\rho = 0.9$                        |
| AIC    | 10.24  | 10.33                          | 10.39                        | 10.12  |        |        |        | 0110-60                             |
| BIC    | 10.23  | 10.32                          | 10.39                        | 10.12  |        |        |        | Oracle: 10.60                       |
| CV.1se | 49.21  | 49.37                          | 49.37                        | 42.14  | 49.29  |        |        |                                     |
| CV.min | 46.77  | 49.09                          | 49.30                        | 46.25  | 46.84  | 47.45  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 46.69  | 47.26                          | 49.34                        | 41.64  |        |        | 49.49  | $\rho = 0$                          |
| AIC    | 48.63  | 49.11                          | 49.40                        | 47.93  |        |        |        | •                                   |
| BIC    | 48.61  | 49.09                          | 49.40                        | 47.91  |        |        |        | <i>Oracle</i> : 46.19               |
| CV.1se | 44.03  | 44.14                          | 44.15                        | 37.50  | 44.11  |        |        |                                     |
| CV.min | 42.08  | 43.93                          | 44.11                        | 41.17  | 42.30  | 42.64  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 41.73  | 42.04                          | 43.94                        | 37.24  |        |        | 43.91  | $\rho = 0.5$                        |
| AIC    | 43.31  | 43.73                          | 43.99                        | 42.68  |        |        |        | ·                                   |
| BIC    | 43.29  | 43.72                          | 43.99                        | 42.67  |        |        |        | Oracle: 41.04                       |
| CV.1se | 41.58  | 41.69                          | 41.70                        | 35.58  | 41.60  |        |        |                                     |
| CV.min | 39.52  | 41.37                          | 41.58                        | 38.66  | 39.66  | 39.88  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 39.23  | 39.74                          | 41.49                        | 35.18  |        |        | 41.47  | $\rho = 0.9$                        |
| AIC    | 40.90  | 41.29                          | 41.54                        | 40.32  |        |        |        | ·                                   |
| BIC    | 40.88  | 41.27                          | 41.54                        | 40.30  |        |        |        | Oracle: 38.90                       |
| CV.1se | 124.66 | 124.81                         | 124.79                       | 154.61 | 124.68 |        |        |                                     |
| CV.min | 125.32 | 125.62                         | 125.84                       | 182.91 | 125.93 | 126.26 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 124.15 | 193.36                         | 198.18                       | 133.05 |        |        | 198.35 | $\rho = 0$                          |
| AIC    | 195.19 | 197.42                         | 198.29                       | 192.44 |        |        |        | 0 1 120 14                          |
| BIC    | 195.11 | 197.36                         | 198.28                       | 192.34 |        |        |        | Oracle: 130.14                      |
| CV.1se | 111.25 | 111.38                         | 111.34                       | 136.84 | 111.28 |        |        |                                     |
| CV.min | 111.79 | 112.04                         | 112.02                       | 162.37 | 112.21 | 112.54 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 110.75 | 171.44                         | 176.10                       | 118.55 |        |        | 175.96 | $\rho = 0.5$                        |
| AIC    | 173.46 | 175.42                         | 176.20                       | 171.07 |        |        |        | 0 1 116.02                          |
| BIC    | 173.39 | 175.35                         | 176.19                       | 171.01 |        |        |        | <i>Oracle</i> : 116.03              |
| CV.1se | 105.14 | 105.23                         | 105.25                       | 127.70 | 105.21 |        |        |                                     |
| CV.min | 105.41 | 105.68                         | 105.77                       | 152.09 | 105.93 | 105.96 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 104.31 | 161.77                         | 166.42                       | 112.41 |        |        | 166.20 | $\rho = 0.9$                        |
| AIC    | 163.88 | 165.73                         | 166.50                       | 161.47 |        |        |        | ŕ                                   |
| BIC    | 163.80 | 165.66                         | 166.50                       | 161.41 |        |        |        | Oracle: 109.94                      |
|        |        |                                |                              |        |        |        |        |                                     |

Table 15: Predictive MSE for n=100, continuous design, dense covariates, and decay 10.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|---------------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 4.07  | 3.93                           | 4.31                            | 2.11  | 3.58  |        |        |                                       |
| CV.min | 2.44  | 2.60                           | 3.40                            | 2.03  | 2.52  | 2.53   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 2.89  | 3.36                           | 2.23                            | 2.24  |       |        | 2.39   | $\rho = 0$                            |
| AIC    | 2.20  | 2.21                           | 2.24                            | 2.10  |       |        |        | Oracle: 1.48                          |
| BIC    | 2.20  | 2.20                           | 2.23                            | 2.15  |       |        |        | 07 acre : 1.40                        |
| CV.1se | 2.01  | 1.97                           | 1.89                            | 1.04  | 1.82  |        |        |                                       |
| CV.min | 1.54  | 1.55                           | 1.68                            | 0.84  | 1.44  | 1.50   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.57  | 1.81                           | 1.01                            | 1.16  |       |        | 1.26   | $\rho = 0.5$                          |
| AIC    | 0.83  | 0.84                           | 0.84                            | 0.82  |       |        |        | Oracle: 0.56                          |
| BIC    | 0.83  | 0.84                           | 0.84                            | 0.91  |       |        |        | 07 acre : 0.50                        |
| CV.1se | 0.40  | 0.39                           | 0.34                            | 0.29  | 0.37  |        |        |                                       |
| CV.min | 0.32  | 0.32                           | 0.32                            | 0.22  | 0.31  | 0.32   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.32  | 0.35                           | 0.33                            | 0.25  |       |        | 0.32   | $\rho = 0.9$                          |
| AIC    | 0.22  | 0.22                           | 0.22                            | 0.2   |       |        |        | Oracle: 0.15                          |
| BIC    | 0.24  | 0.23                           | 0.22                            | 0.32  |       |        |        | 07 acre : 0.15                        |
| CV.1se | 8.82  | 8.80                           | 8.92                            | 7.23  | 8.80  |        |        |                                       |
| CV.min | 7.73  | 8.04                           | 8.56                            | 8.16  | 7.76  | 7.79   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.66  | 8.50                           | 8.88                            | 6.93  |       |        | 8.56   | $\rho = 0$                            |
| AIC    | 8.87  | 8.91                           | 9.00                            | 8.65  |       |        |        | Oracle: 5.62                          |
| BIC    | 8.87  | 8.91                           | 9.00                            | 8.63  |       |        |        | Oracic . 5.02                         |
| CV.1se | 3.39  | 3.38                           | 3.36                            | 2.83  | 3.36  |        |        |                                       |
| CV.min | 3.11  | 3.16                           | 3.26                            | 3.07  | 3.11  | 3.10   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 3.08  | 3.29                           | 3.31                            | 2.79  |       |        | 3.20   | $\rho = 0.5$                          |
| AIC    | 3.35  | 3.36                           | 3.39                            | 3.28  |       |        |        | Oracle: 2.11                          |
| BIC    | 3.35  | 3.36                           | 3.39                            | 3.27  |       |        |        | Oracic . 2.11                         |
| CV.1se | 0.84  | 0.82                           | 0.74                            | 0.72  | 0.79  |        |        |                                       |
| CV.min | 0.71  | 0.71                           | 0.69                            | 0.70  | 0.69  | 0.69   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.70  | 0.74                           | 0.71                            | 0.68  |       |        | 0.70   | $\rho = 0.9$                          |
| AIC    | 0.89  | 0.89                           | 0.91                            | 0.80  |       |        |        | Oracle: 0.56                          |
| BIC    | 0.89  | 0.89                           | 0.91                            | 0.70  |       |        |        | 07 acre : 0.50                        |
| CV.1se | 22.83 | 22.84                          | 22.85                           | 27.74 | 22.85 |        |        |                                       |
| CV.min | 22.87 | 22.91                          | 23.01                           | 33.04 | 22.94 | 22.99  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 22.53 | 24.53                          | 35.87                           | 24.03 |       |        | 33.38  | $\rho = 0$                            |
| AIC    | 35.61 | 35.81                          | 36.11                           | 35.06 |       |        |        | <i>Oracle</i> : 21.25                 |
| BIC    | 35.59 | 35.80                          | 36.10                           | 35.04 |       |        |        | Oracic . 21.23                        |
| CV.1se | 8.59  | 8.59                           | 8.60                            | 10.06 | 8.59  |        |        |                                       |
| CV.min | 8.58  | 8.59                           | 8.64                            | 12.07 | 8.62  | 8.65   |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 8.52  | 8.61                           | 13.38                           | 9.09  |       |        | 11.49  | $\rho = 0.5$                          |
| AIC    | 13.39 | 13.44                          | 13.56                           | 13.17 |       |        |        | <i>Oracle</i> : 7.97                  |
| BIC    | 13.38 | 13.44                          | 13.56                           | 13.15 |       |        |        | 01466.1.71                            |
| CV.1se | 2.33  | 2.32                           | 2.32                            | 2.29  | 2.32  |        |        |                                       |
| CV.min | 2.26  | 2.26                           | 2.29                            | 2.53  | 2.26  | 2.26   |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 2.24  | 2.28                           | 3.11                            | 2.34  |       |        | 2.28   | $\rho = 0.9$                          |
| AIC    | 3.61  | 3.62                           | 3.67                            | 3.44  |       |        |        | Oracle: 2.11                          |
| BIC    | 3.60  | 3.62                           | 3.67                            | 2.66  |       |        |        | 07 west . 2.11                        |

Table 16: Predictive MSE for n=100, continuous design, dense covariates, and decay 50.

|                  | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL     | MCP    | CVbest | ICbest |                                     |
|------------------|-------------|--------------------------------|------------------------------|--------|--------|--------|--------|-------------------------------------|
| CV.1se           | 29.84       | 30.21                          | 30.39                        | 13.26  | 29.97  |        |        |                                     |
| CV.min           | 24.06       | 28.29                          | 29.64                        | 11.90  | 24.04  | 24.66  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 25.41       | 22.67                          | 12.22                        | 17.14  |        |        | 14.70  | $\rho = 0$                          |
| AIC              | 12.07       | 12.15                          | 12.26                        | 11.89  |        |        |        | Oracle: 11.08                       |
| BIC              | 12.07       | 12.14                          | 12.26                        | 11.88  |        |        |        | Oracie . 11.00                      |
| CV.1se           | 10.41       | 10.41                          | 10.42                        | 5.40   | 10.39  |        |        |                                     |
| CV.min           | 9.40        | 9.94                           | 10.30                        | 4.26   | 9.42   | 9.43   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 9.31        | 10.16                          | 4.16                         | 6.64   |        |        | 5.91   | $\rho = 0.5$                        |
| AIC              | 4.13        | 4.15                           | 4.18                         | 4.09   |        |        |        | Oracle: 3.78                        |
| BIC              | 4.13        | 4.14                           | 4.18                         | 4.08   |        |        |        | Oracie: 5.78                        |
| CV.1se           | 1.88        | 1.86                           | 1.83                         | 1.54   | 1.85   |        |        |                                     |
| CV.min           | 1.60        | 1.61                           | 1.69                         | 1.12   | 1.59   | 1.58   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 1.55        | 1.78                           | 1.31                         | 1.26   |        |        | 1.53   | $\rho = 0.9$                        |
| AIC              | 0.75        | 0.75                           | 0.76                         | 0.74   |        |        |        | 01060                               |
| BIC              | 0.75        | 0.75                           | 0.76                         | 1.38   |        |        |        | Oracle: 0.68                        |
| CV.1se           | 48.97       | 49.08                          | 49.11                        | 41.41  | 49.03  |        |        |                                     |
| CV.min           | 46.03       | 48.36                          | 48.95                        | 45.64  | 46.16  | 46.53  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | 45.69       | 46.15                          | 48.71                        | 40.67  |        |        | 47.97  | $\rho = 0$                          |
| AIC              | 48.15       | 48.51                          | 48.87                        | 47.37  |        |        |        | •                                   |
| BIC              | 48.13       | 48.49                          | 48.86                        | 47.35  |        |        |        | Oracle: 38.53                       |
| CV.1se           | 16.82       | 16.83                          | 16.85                        | 14.38  | 16.81  |        |        |                                     |
| CV.min           | 16.23       | 16.58                          | 16.82                        | 15.44  | 16.19  | 16.25  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | 16.03       | 16.57                          | 16.64                        | 14.36  |        |        | 16.44  | $\rho = 0.5$                        |
| AIC              | 16.54       | 16.62                          | 16.77                        | 16.30  |        |        |        | •                                   |
| BIC              | 16.53       | 16.61                          | 16.76                        | 16.29  |        |        |        | Oracle: 13.23                       |
| CV.1se           | 3.06        | 3.06                           | 3.06                         | 2.82   | 3.06   |        |        |                                     |
| CV.min           | 2.89        | 2.90                           | 2.99                         | 2.61   | 2.88   | 2.88   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | 2.83        | 3.01                           | 2.98                         | 2.64   |        |        | 2.84   | $\rho = 0.9$                        |
| AIC              | 2.99        | 3.00                           | 3.04                         | 2.88   |        |        |        | •                                   |
| BIC              | 2.99        | 3.00                           | 3.04                         | 2.87   |        |        |        | Oracle: 2.37                        |
| CV.1se           | 123.67      | 123.68                         | 123.80                       | 151.41 | 123.69 |        |        |                                     |
| CV.min           | 124.09      | 124.31                         | 124.59                       | 180.32 | 125.12 | 125.16 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc             | 122.78      | 181.19                         | 195.40                       | 131.22 |        |        | 183.19 | $\rho = 0$                          |
| AIC              | 192.75      | 194.48                         | 195.68                       | 189.98 |        |        |        | •                                   |
| BIC              | 192.67      | 194.40                         | 195.66                       | 189.91 |        |        |        | Oracle: 126.96                      |
| CV.1se           | 42.38       | 42.39                          | 42.42                        | 49.61  | 42.42  |        |        |                                     |
| CV.min           | 42.56       | 42.60                          | 42.70                        | 59.52  | 42.68  | 42.99  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc             | 42.17       | 50.84                          | 66.80                        | 45.06  | .2.00  | ,,     | 59.79  | $\rho = 0.5$                        |
| AIC              | 66.10       | 66.57                          | 67.06                        | 65.12  |        |        | 0,.,,  | •                                   |
| BIC              | 66.07       | 66.53                          | 67.05                        | 65.09  |        |        |        | Oracle: 43.47                       |
| CV.1se           | 7.73        | 7.73                           | 7.74                         | 7.84   | 7.73   |        |        |                                     |
| CV.rse<br>CV.min | 7.71        | 7.73                           | 7.78                         | 8.64   | 7.74   | 7.76   |        | $sd(\mu)/\sigma = 0.5$              |
| AICc             | <b>7.66</b> | 7.72                           | 12.06                        | 8.10   |        |        | 7.97   | $\rho = 0.9$                        |
| AIC              | 11.97       | 12.05                          | 12.19                        | 11.58  |        |        | 1.21   | •                                   |
| BIC              | 11.96       | 12.05                          | 12.13                        | 10.18  |        |        |        | Oracle: 7.75                        |
|                  | 11.90       | 12.03                          | 12.10                        | 10.10  |        |        |        |                                     |

Table 17: Predictive MSE for n=100, continuous design, dense covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL     | MCP    | CVbest | ICbest |                                     |
|--------|--------|--------------------------------|------------------------------|--------|--------|--------|--------|-------------------------------------|
| CV.1se | 61.16  | 61.57                          | 61.63                        | 27.47  | 61.23  |        |        |                                     |
| CV.min | 51.50  | 59.56                          | 60.70                        | 24.23  | 51.80  | 52.42  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 53.49  | 32.73                          | 24.78                        | 36.31  |        |        | 29.58  | $\rho = 0$                          |
| AIC    | 24.45  | 24.64                          | 24.82                        | 24.13  |        |        |        | <i>Oracle</i> : 24.83               |
| BIC    | 24.44  | 24.63                          | 24.82                        | 24.14  |        |        |        | Oracle . 24.63                      |
| CV.1se | 20.83  | 20.84                          | 20.86                        | 10.87  | 20.84  |        |        |                                     |
| CV.min | 19.15  | 20.19                          | 20.68                        | 8.57   | 19.09  | 19.18  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 18.93  | 18.83                          | 8.35                         | 13.38  |        |        | 11.41  | $\rho = 0.5$                        |
| AIC    | 8.26   | 8.30                           | 8.37                         | 8.18   |        |        |        | Oracle: 8.37                        |
| BIC    | 8.25   | 8.30                           | 8.37                         | 8.21   |        |        |        | 01 acte . 6.51                      |
| CV.1se | 3.54   | 3.54                           | 3.53                         | 3.00   | 3.54   |        |        |                                     |
| CV.min | 3.20   | 3.27                           | 3.41                         | 2.17   | 3.21   | 3.20   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 3.11   | 3.48                           | 1.60                         | 2.48   |        |        | 3.07   | $\rho = 0.9$                        |
| AIC    | 1.40   | 1.40                           | 1.42                         | 1.38   |        |        |        | Oracle: 1.42                        |
| BIC    | 1.40   | 1.40                           | 1.42                         | 2.30   |        |        |        | Oracle : 1.42                       |
| CV.1se | 99.62  | 99.74                          | 99.82                        | 84.51  | 99.66  |        |        |                                     |
| CV.min | 94.55  | 98.98                          | 99.72                        | 92.58  | 94.75  | 95.42  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 93.78  | 93.69                          | 99.07                        | 83.67  |        |        | 97.14  | $\rho = 0$                          |
| AIC    | 97.75  | 98.62                          | 99.27                        | 96.27  |        |        |        | Oma ala . 96 16                     |
| BIC    | 97.71  | 98.58                          | 99.26                        | 96.23  |        |        |        | <i>Oracle</i> : 86.46               |
| CV.1se | 33.64  | 33.67                          | 33.71                        | 28.79  | 33.68  |        |        |                                     |
| CV.min | 32.47  | 33.31                          | 33.69                        | 30.80  | 32.52  | 32.68  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 32.08  | 32.43                          | 33.36                        | 28.83  |        |        | 33.03  | $\rho = 0.5$                        |
| AIC    | 33.02  | 33.24                          | 33.49                        | 32.55  |        |        |        | Oma ala . 20 10                     |
| BIC    | 33.00  | 33.22                          | 33.49                        | 32.53  |        |        |        | <i>Oracle</i> : 29.19               |
| CV.1se | 5.73   | 5.73                           | 5.73                         | 5.38   | 5.74   |        |        |                                     |
| CV.min | 5.53   | 5.59                           | 5.70                         | 4.97   | 5.53   | 5.53   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 5.44   | 5.70                           | 5.62                         | 5.05   |        |        | 5.46   | $\rho = 0.9$                        |
| AIC    | 5.58   | 5.61                           | 5.68                         | 5.42   |        |        |        | Oma ala . 4 00                      |
| BIC    | 5.58   | 5.61                           | 5.68                         | 5.44   |        |        |        | Oracle: 4.90                        |
| CV.1se | 250.85 | 250.88                         | 251.03                       | 307.99 | 251.08 |        |        |                                     |
| CV.min | 251.92 | 252.45                         | 253.02                       | 365.30 | 253.21 | 254.15 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 249.33 | 381.45                         | 396.97                       | 266.84 |        |        | 369.87 | $\rho = 0$                          |
| AIC    | 391.16 | 395.18                         | 397.28                       | 385.61 |        |        |        | 01260.02                            |
| BIC    | 390.99 | 395.04                         | 397.25                       | 385.45 |        |        |        | <i>Oracle</i> : 260.93              |
| CV.1se | 84.75  | 84.79                          | 84.80                        | 98.73  | 84.80  |        |        |                                     |
| CV.min | 85.25  | 85.31                          | 85.31                        | 118.99 | 85.26  | 85.82  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 84.43  | 117.72                         | 133.55                       | 90.21  |        |        | 120.78 | $\rho = 0.5$                        |
| AIC    | 131.83 | 132.94                         | 133.82                       | 129.89 |        |        |        | 0 1 07 07                           |
| BIC    | 131.76 | 132.88                         | 133.81                       | 129.82 |        |        |        | <i>Oracle</i> : 87.87               |
| CV.1se | 14.44  | 14.44                          | 14.45                        | 14.67  | 14.45  |        |        |                                     |
| CV.min | 14.44  | 14.49                          | 14.54                        | 16.22  | 14.49  | 14.53  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 14.39  | 14.47                          | 22.61                        | 15.14  |        |        | 15.23  | $\rho = 0.9$                        |
| AIC    | 22.32  | 22.50                          | 22.75                        | 21.62  |        |        |        | ·                                   |
| BIC    | 22.31  | 22.50                          | 22.74                        | 18.94  |        |        |        | <i>Oracle</i> : 14.79               |
|        |        |                                |                              |        |        |        |        |                                     |

Table 18: Predictive MSE for n=100, continuous design, dense covariates, and decay 200.

|                   | lasso        | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL     | MCP     | CVbest | ICbest |                                     |
|-------------------|--------------|--------------------------------|------------------------------|--------|---------|--------|--------|-------------------------------------|
| CV.1se            | 123.78       | 124.17                         | 124.38                       | 55.67  | 123.87  |        |        |                                     |
| CV.min            | 105.81       | 121.52                         | 122.75                       | 48.79  | 106.45  | 108.24 |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 109.36       | 52.25                          | 49.94                        | 74.35  |         |        | 58.01  | $\rho = 0$                          |
| AIC               | 49.18        | 49.63                          | 49.96                        | 48.59  |         |        |        | Oracle: 50.89                       |
| BIC               | 49.16        | 49.61                          | 49.96                        | 48.58  |         |        |        | 07acic . 30.07                      |
| CV.1se            | 41.62        | 41.63                          | 41.66                        | 21.97  | 41.60   |        |        |                                     |
| CV.min            | 38.52        | 40.66                          | 41.36                        | 17.13  | 38.32   | 38.69  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 37.84        | 29.69                          | 16.67                        | 26.77  |         |        | 22.67  | $\rho = 0.5$                        |
| AIC               | 16.46        | 16.57                          | 16.70                        | 16.31  |         |        |        | <i>Oracle</i> : 17.03               |
| BIC               | 16.45        | 16.57                          | 16.69                        | 16.3   |         |        |        | Oracie: 17.03                       |
| CV.1se            | 6.86         | 6.85                           | 6.85                         | 5.93   | 6.86    |        |        |                                     |
| CV.min            | 6.37         | 6.53                           | 6.75                         | 4.25   | 6.36    | 6.35   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 6.19         | 6.79                           | 2.75                         | 4.94   |         |        | 5.95   | $\rho = 0.9$                        |
| AIC               | 2.70         | 2.71                           | 2.74                         | 2.67   |         |        |        | 0 1 200                             |
| BIC               | 2.69         | 2.71                           | 2.74                         | 4.17   |         |        |        | Oracle: 2.80                        |
| CV.1se            | 200.18       | 200.56                         | 200.62                       | 170.55 | 200.38  |        |        |                                     |
| CV.min            | 190.91       | 199.28                         | 200.41                       | 186.30 | 190.80  | 193.05 |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 189.24       | 191.81                         | 199.68                       | 168.56 |         |        | 197.28 | $\rho = 0$                          |
| AIC               | 196.78       | 198.74                         | 199.88                       | 193.84 |         |        |        |                                     |
| BIC               | 196.71       | 198.66                         | 199.87                       | 193.77 |         |        |        | <i>Oracle</i> : 186.60              |
| CV.1se            | 67.24        | 67.30                          | 67.34                        | 57.55  | 67.30   |        |        |                                     |
| CV.min            | 64.84        | 66.87                          | 67.31                        | 61.27  | 64.94   | 65.33  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 64.19        | 63.51                          | 66.78                        | 57.55  |         |        | 66.20  | $\rho = 0.5$                        |
| AIC               | 65.93        | 66.46                          | 66.92                        | 65.00  |         |        |        | ·                                   |
| BIC               | 65.88        | 66.43                          | 66.91                        | 64.97  |         |        |        | Oracle: 62.50                       |
| CV.1se            | 11.08        | 11.07                          | 11.08                        | 10.48  | 11.08   |        |        |                                     |
| CV.min            | 10.75        | 10.89                          | 11.04                        | 9.69   | 10.77   | 10.78  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 10.58        | 11.04                          | 10.92                        | 9.86   |         |        | 10.61  | $\rho = 0.9$                        |
| AIC               | 10.79        | 10.87                          | 10.99                        | 10.50  |         |        |        | ·                                   |
| BIC               | 10.79        | 10.87                          | 10.99                        | 10.60  |         |        |        | Oracle: 10.21                       |
| CV.1se            | 505.57       | 505.68                         | 505.88                       | 621.63 | 505.30  |        |        |                                     |
| CV.min            | 507.03       | 508.25                         | 509.82                       | 736.30 | 509.71  | 511.25 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 502.04       | 779.80                         | 797.64                       | 536.72 |         |        | 735.78 | $\rho = 0$                          |
| AIC               | 787.28       | 796.26                         | 799.84                       | 776.11 |         |        |        |                                     |
| BIC               | 786.99       | 795.99                         | 799.78                       | 775.79 |         |        |        | <i>Oracle</i> : 527.53              |
| CV.1se            | 169.34       | 169.55                         | 169.49                       | 197.63 | 169.47  |        |        |                                     |
| CV.min            | 170.16       | 170.31                         | 170.41                       | 237.39 | 170.31  | 171.26 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 168.77       | 252.44                         | 267.51                       | 180.60 | -, -, - |        | 241.61 | $\rho = 0.5$                        |
| AIC               | 263.70       | 266.29                         | 267.81                       | 259.78 |         |        |        | ,                                   |
| BIC               | 263.52       | 266.19                         | 267.78                       | 259.63 |         |        |        | <i>Oracle</i> : 176.63              |
| CV.1se            | 27.83        | 27.83                          | 27.85                        | 28.27  | 27.84   |        |        |                                     |
| CV.rise<br>CV.min | 27.80        | 27.97                          | 28.03                        | 31.23  | 27.92   | 27.95  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc              | <b>27.75</b> | 28.33                          | 43.63                        | 29.27  | 21.,72  | 2,.,,  | 29.04  | $\rho = 0.9$                        |
| AIC               | 43.01        | 43.43                          | 43.86                        | 41.67  |         |        | 27.01  | ·                                   |
| BIC               | 42.99        | 43.41                          | 43.84                        | 36.55  |         |        |        | Oracle: 28.81                       |
| DIC               | 74,77        | 73.71                          | 75.07                        | 50.55  |         |        |        |                                     |

Table 19: Predictive MSE for n=100, binary design, sparse covariates, and decay 10.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL   | MCP  | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|------------------------------|------|------|--------|--------|---------------------------------------|
| CV.1se | 0.64  | 0.57                           | 0.63                         | 0.4  | 0.47 |        |        |                                       |
| CV.min | 0.42  | 0.4                            | 0.46                         | 0.41 | 0.4  | 0.41   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.48  | 0.43                           | 0.46                         | 0.4  |      |        | 0.45   | $\rho = 0$                            |
| AIC    | 0.47  | 0.47                           | 0.48                         | 0.44 |      |        |        | Oracle: 0.27                          |
| BIC    | 0.47  | 0.47                           | 0.48                         | 0.44 |      |        |        | 07466 . 0.27                          |
| CV.1se | 0.65  | 0.57                           | 0.63                         | 0.38 | 0.46 |        |        |                                       |
| CV.min | 0.40  | 0.38                           | 0.45                         | 0.38 | 0.37 | 0.38   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.47  | 0.41                           | 0.41                         | 0.39 |      |        | 0.41   | $\rho = 0.5$                          |
| AIC    | 0.42  | 0.42                           | 0.43                         | 0.40 |      |        |        | Oracle: 0.24                          |
| BIC    | 0.42  | 0.42                           | 0.43                         | 0.40 |      |        |        | 074666.0.24                           |
| CV.1se | 0.64  | 0.56                           | 0.63                         | 0.36 | 0.45 |        |        |                                       |
| CV.min | 0.39  | 0.38                           | 0.45                         | 0.36 | 0.36 | 0.38   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.46  | 0.40                           | 0.38                         | 0.38 |      |        | 0.38   | $\rho = 0.9$                          |
| AIC    | 0.40  | 0.40                           | 0.41                         | 0.38 |      |        |        | Oracle: 0.23                          |
| BIC    | 0.40  | 0.40                           | 0.41                         | 0.38 |      |        |        | 07 dete : 0.25                        |
| CV.1se | 1.86  | 1.86                           | 1.89                         | 1.52 | 1.84 |        |        |                                       |
| CV.min | 1.58  | 1.65                           | 1.78                         | 1.74 | 1.60 | 1.59   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.58  | 1.60                           | 1.91                         | 1.45 |      |        | 1.91   | $\rho = 0$                            |
| AIC    | 1.91  | 1.92                           | 1.94                         | 1.86 |      |        |        | Oracle : 1.09                         |
| BIC    | 1.91  | 1.92                           | 1.94                         | 1.85 |      |        |        | 074666.1.07                           |
| CV.1se | 1.69  | 1.68                           | 1.70                         | 1.39 | 1.67 |        |        |                                       |
| CV.min | 1.46  | 1.50                           | 1.62                         | 1.57 | 1.47 | 1.46   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.45  | 1.46                           | 1.70                         | 1.32 |      |        | 1.70   | $\rho = 0.5$                          |
| AIC    | 1.71  | 1.72                           | 1.74                         | 1.66 |      |        |        | Oracle: 0.97                          |
| BIC    | 1.71  | 1.72                           | 1.73                         | 1.66 |      |        |        | Oracic . 0.57                         |
| CV.1se | 1.60  | 1.60                           | 1.62                         | 1.31 | 1.58 |        |        |                                       |
| CV.min | 1.39  | 1.43                           | 1.54                         | 1.48 | 1.40 | 1.39   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.39  | 1.40                           | 1.61                         | 1.26 |      |        | 1.61   | $\rho = 0.9$                          |
| AIC    | 1.62  | 1.63                           | 1.64                         | 1.58 |      |        |        | Oracle: 0.92                          |
| BIC    | 1.62  | 1.63                           | 1.64                         | 1.57 |      |        |        | 074666.0.72                           |
| CV.1se | 4.92  | 4.92                           | 4.93                         | 5.99 | 4.92 |        |        |                                       |
| CV.min | 4.92  | 4.94                           | 4.97                         | 7.11 | 4.96 | 4.96   |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 4.87  | 5.98                           | 7.74                         | 5.20 |      |        | 7.74   | $\rho = 0$                            |
| AIC    | 7.69  | 7.74                           | 7.80                         | 7.57 |      |        |        | Oracle : 4.35                         |
| BIC    | 7.69  | 7.73                           | 7.80                         | 7.57 |      |        |        | 07 dete : 1.33                        |
| CV.1se | 4.40  | 4.40                           | 4.41                         | 5.38 | 4.40 |        |        |                                       |
| CV.min | 4.41  | 4.42                           | 4.43                         | 6.39 | 4.44 | 4.44   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.36  | 5.23                           | 6.91                         | 4.66 |      |        | 6.91   | $\rho = 0.5$                          |
| AIC    | 6.87  | 6.91                           | 6.97                         | 6.77 |      |        |        | Oracle : 3.90                         |
| BIC    | 6.87  | 6.91                           | 6.97                         | 6.76 |      |        |        | 3.4000.3.70                           |
| CV.1se | 4.18  | 4.18                           | 4.18                         | 5.02 | 4.18 |        |        |                                       |
| CV.min | 4.18  | 4.19                           | 4.21                         | 6.00 | 4.20 | 4.21   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.13  | 4.86                           | 6.53                         | 4.42 |      |        | 6.54   | $\rho = 0.9$                          |
| AIC    | 6.50  | 6.54                           | 6.59                         | 6.40 |      |        |        | <i>Oracle</i> : 3.69                  |
| BIC    | 6.50  | 6.53                           | 6.59                         | 6.39 |      |        |        |                                       |

Table 20: Predictive MSE for n=100, binary design, sparse covariates, and decay 50.

|                  | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|------------------|-------|--------------------------------|------------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se           | 1.47  | 1.35                           | 1.90                         | 0.84  | 1.13  |        |        |                                       |
| CV.min           | 0.91  | 0.88                           | 1.34                         | 0.86  | 0.87  | 0.87   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 1.06  | 0.83                           | 0.97                         | 0.86  |       |        | 0.97   | $\rho = 0$                            |
| AIC              | 0.98  | 0.98                           | 1.00                         | 0.93  |       |        |        | Oracle : 0.56                         |
| BIC              | 0.98  | 0.98                           | 1.00                         | 0.92  |       |        |        | 01 acte . 0.30                        |
| CV.1se           | 1.54  | 1.43                           | 1.82                         | 0.79  | 1.17  |        |        |                                       |
| CV.min           | 0.89  | 0.89                           | 1.39                         | 0.79  | 0.85  | 0.86   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 1.07  | 0.79                           | 0.86                         | 0.83  |       |        | 0.86   | $\rho = 0.5$                          |
| AIC              | 0.88  | 0.88                           | 0.89                         | 0.84  |       |        |        | Oracle : 0.50                         |
| BIC              | 0.88  | 0.88                           | 0.89                         | 0.84  |       |        |        | Oracie: 0.30                          |
| CV.1se           | 1.50  | 1.40                           | 1.78                         | 0.76  | 1.18  |        |        |                                       |
| CV.min           | 0.87  | 0.90                           | 1.37                         | 0.76  | 0.84  | 0.85   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 1.05  | 0.79                           | 0.81                         | 0.82  |       |        | 0.82   | $\rho = 0.9$                          |
| AIC              | 0.83  | 0.83                           | 0.84                         | 0.79  |       |        |        | 01049                                 |
| BIC              | 0.83  | 0.83                           | 0.84                         | 0.79  |       |        |        | Oracle: 0.48                          |
| CV.1se           | 3.93  | 3.96                           | 4.00                         | 3.22  | 3.93  |        |        |                                       |
| CV.min           | 3.41  | 3.65                           | 3.89                         | 3.67  | 3.44  | 3.45   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 3.43  | 3.42                           | 3.99                         | 3.09  |       |        | 3.99   | $\rho = 0$                            |
| AIC              | 3.97  | 3.99                           | 4.03                         | 3.87  |       |        |        | ,                                     |
| BIC              | 3.96  | 3.99                           | 4.03                         | 3.86  |       |        |        | Oracle: 2.25                          |
| CV.1se           | 3.54  | 3.54                           | 3.58                         | 2.93  | 3.54  |        |        |                                       |
| CV.min           | 3.14  | 3.32                           | 3.49                         | 3.29  | 3.17  | 3.16   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 3.13  | 3.09                           | 3.55                         | 2.82  |       |        | 3.56   | $\rho = 0.5$                          |
| AIC              | 3.54  | 3.56                           | 3.59                         | 3.46  |       |        |        | ,                                     |
| BIC              | 3.54  | 3.55                           | 3.59                         | 3.45  |       |        |        | Oracle: 2.01                          |
| CV.1se           | 3.34  | 3.36                           | 3.38                         | 2.77  | 3.33  |        |        |                                       |
| CV.min           | 2.98  | 3.15                           | 3.30                         | 3.08  | 3.00  | 3.00   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 2.98  | 2.94                           | 3.35                         | 2.68  |       |        | 3.34   | $\rho = 0.9$                          |
| AIC              | 3.34  | 3.35                           | 3.39                         | 3.26  |       |        |        | ,                                     |
| BIC              | 3.33  | 3.35                           | 3.39                         | 3.26  |       |        |        | Oracle: 1.90                          |
| CV.1se           | 10.17 | 10.17                          | 10.19                        | 12.43 | 10.17 |        |        |                                       |
| CV.min           | 10.17 | 10.22                          | 10.26                        | 14.81 | 10.28 | 10.23  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 10.09 | 14.04                          | 16.09                        | 10.77 |       |        | 16.07  | $\rho = 0$                            |
| AIC              | 15.93 | 16.04                          | 16.16                        | 15.68 |       |        |        | ,                                     |
| BIC              | 15.92 | 16.03                          | 16.16                        | 15.66 |       |        |        | Oracle: 9.00                          |
| CV.1se           | 9.09  | 9.10                           | 9.11                         | 11.13 | 9.10  |        |        |                                       |
| CV.min           | 9.13  | 9.13                           | 9.16                         | 13.22 | 9.18  | 9.18   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 9.02  | 12.34                          | 14.33                        | 9.64  | 7.10  | 7.10   | 14.32  | $\rho = 0.5$                          |
| AIC              | 14.20 | 14.29                          | 14.40                        | 13.98 |       |        | 11.52  | ,                                     |
| BIC              | 14.19 | 14.29                          | 14.40                        | 13.97 |       |        |        | Oracle: 8.05                          |
| CV.1se           | 8.59  | 8.60                           | 8.60                         | 10.43 | 8.59  |        |        |                                       |
| CV.13C<br>CV.min | 8.62  | 8.64                           | 8.65                         | 12.40 | 8.66  | 8.71   |        | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 8.52  | 11.58                          | 13.53                        | 9.14  | 0.00  | 0.71   | 13.53  | $\rho = 0.9$                          |
| AICC             | 13.40 | 13.49                          | 13.60                        | 13.19 |       |        | 10.00  | ,                                     |
| BIC              | 13.40 | 13.48                          | 13.59                        | 13.19 |       |        |        | Oracle: 7.61                          |
|                  | 13.37 | 13.40                          | 13.37                        | 15.10 |       |        |        |                                       |

Table 21: Predictive MSE for n=100, binary design, sparse covariates, and decay 100.

|                   | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\;\gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|-------------------|-------|--------------------------------|--------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se            | 1.64  | 1.52                           | 2.13                     | 0.93  | 1.27  |        |        |                                       |
| CV.min            | 1.01  | 0.98                           | 1.54                     | 0.96  | 0.97  | 0.98   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 1.18  | 0.92                           | 1.08                     | 0.96  |       |        | 1.08   | $\rho = 0$                            |
| AIC               | 1.09  | 1.09                           | 1.11                     | 1.03  |       |        |        | Oracle: 0.62                          |
| BIC               | 1.09  | 1.09                           | 1.11                     | 1.02  |       |        |        | 07466 . 0.02                          |
| CV.1se            | 1.73  | 1.61                           | 2.07                     | 0.88  | 1.31  |        |        |                                       |
| CV.min            | 1.00  | 1.00                           | 1.58                     | 0.88  | 0.95  | 0.96   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 1.19  | 0.86                           | 0.96                     | 0.92  |       |        | 0.96   | $\rho = 0.5$                          |
| AIC               | 0.97  | 0.97                           | 0.99                     | 0.93  |       |        |        | Oracle : 0.56                         |
| BIC               | 0.97  | 0.97                           | 0.99                     | 0.93  |       |        |        | Oracle . 0.30                         |
| CV.1se            | 1.68  | 1.57                           | 2.00                     | 0.85  | 1.33  |        |        |                                       |
| CV.min            | 0.97  | 1.02                           | 1.56                     | 0.84  | 0.93  | 0.95   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 1.17  | 0.86                           | 0.91                     | 0.90  |       |        | 0.91   | $\rho = 0.9$                          |
| AIC               | 0.92  | 0.92                           | 0.93                     | 0.88  |       |        |        | Oracle : 0.53                         |
| BIC               | 0.92  | 0.92                           | 0.93                     | 0.88  |       |        |        | Oracie: 0.55                          |
| CV.1se            | 4.37  | 4.39                           | 4.44                     | 3.57  | 4.36  |        |        |                                       |
| CV.min            | 3.79  | 4.08                           | 4.32                     | 4.07  | 3.83  | 3.85   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 3.81  | 3.81                           | 4.44                     | 3.44  |       |        | 4.44   | $\rho = 0$                            |
| AIC               | 4.41  | 4.43                           | 4.48                     | 4.30  |       |        |        |                                       |
| BIC               | 4.40  | 4.43                           | 4.48                     | 4.29  |       |        |        | Oracle: 2.50                          |
| CV.1se            | 3.93  | 3.94                           | 3.97                     | 3.25  | 3.93  |        |        |                                       |
| CV.min            | 3.50  | 3.70                           | 3.89                     | 3.66  | 3.54  | 3.54   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 3.48  | 3.43                           | 3.95                     | 3.13  |       |        | 3.95   | $\rho = 0.5$                          |
| AIC               | 3.93  | 3.95                           | 3.99                     | 3.84  |       |        |        |                                       |
| BIC               | 3.93  | 3.95                           | 3.99                     | 3.84  |       |        |        | Oracle: 2.23                          |
| CV.1se            | 3.72  | 3.74                           | 3.76                     | 3.08  | 3.71  |        |        |                                       |
| CV.min            | 3.31  | 3.52                           | 3.68                     | 3.43  | 3.34  | 3.34   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 3.32  | 3.26                           | 3.73                     | 2.98  |       |        | 3.73   | $\rho = 0.9$                          |
| AIC               | 3.71  | 3.73                           | 3.77                     | 3.63  |       |        |        |                                       |
| BIC               | 3.71  | 3.73                           | 3.77                     | 3.63  |       |        |        | Oracle: 2.11                          |
| CV.1se            | 11.29 | 11.30                          | 11.32                    | 13.82 | 11.30 |        |        |                                       |
| CV.min            | 11.31 | 11.36                          | 11.41                    | 16.47 | 11.43 | 11.40  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 11.21 | 15.81                          | 17.90                    | 11.99 |       |        | 17.88  | $\rho = 0$                            |
| AIC               | 17.71 | 17.84                          | 17.97                    | 17.43 |       |        |        | '                                     |
| BIC               | 17.70 | 17.83                          | 17.97                    | 17.42 |       |        |        | Oracle: 9.99                          |
| CV.1se            | 10.09 | 10.09                          | 10.10                    | 12.37 | 10.09 |        |        |                                       |
| CV.min            | 10.15 | 10.14                          | 10.17                    | 14.68 | 10.19 | 10.25  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 10    | 13.91                          | 15.92                    | 10.71 |       |        | 15.95  | $\rho = 0.5$                          |
| AIC               | 15.76 | 15.87                          | 15.99                    | 15.52 |       |        |        | ,                                     |
| BIC               | 15.76 | 15.86                          | 15.99                    | 15.51 |       |        |        | Oracle: 8.94                          |
| CV.1se            | 9.54  | 9.55                           | 9.56                     | 11.59 | 9.54  |        |        |                                       |
| CV.rise<br>CV.min | 9.59  | 9.59                           | 9.61                     | 13.78 | 9.62  | 9.66   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 9.46  | 13.05                          | 15.04                    | 10.15 | ,.02  | 2.00   | 15.03  | $\rho = 0.9$                          |
| AIC               | 14.89 | 14.99                          | 15.10                    | 14.65 |       |        | 15.05  |                                       |
| BIC               | 14.88 | 14.98                          | 15.10                    | 14.65 |       |        |        | Oracle: 8.45                          |
| DIC               | 17.00 | 17.70                          | 13.10                    | 17.03 |       |        |        |                                       |

Table 22: Predictive MSE for n=100, binary design, sparse covariates, and decay 200.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\;\gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|--------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 1.73  | 1.60                           | 2.24                     | 0.98  | 1.33  |        |        |                                       |
| CV.min | 1.07  | 1.04                           | 1.63                     | 1.01  | 1.03  | 1.02   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.24  | 0.96                           | 1.14                     | 1.01  |       |        | 1.14   | $\rho = 0$                            |
| AIC    | 1.15  | 1.15                           | 1.17                     | 1.09  |       |        |        | Oracle: 0.66                          |
| BIC    | 1.15  | 1.15                           | 1.17                     | 1.08  |       |        |        | 07 acic . 0.00                        |
| CV.1se | 1.83  | 1.71                           | 2.19                     | 0.92  | 1.39  |        |        |                                       |
| CV.min | 1.05  | 1.06                           | 1.68                     | 0.93  | 1.00  | 1.02   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.25  | 0.9                            | 1.02                     | 0.97  |       |        | 1.02   | $\rho = 0.5$                          |
| AIC    | 1.03  | 1.03                           | 1.04                     | 0.98  |       |        |        | Oracle: 0.59                          |
| BIC    | 1.03  | 1.03                           | 1.04                     | 0.98  |       |        |        | Oracie: 0.39                          |
| CV.1se | 1.77  | 1.66                           | 2.11                     | 0.89  | 1.41  |        |        |                                       |
| CV.min | 1.02  | 1.08                           | 1.65                     | 0.89  | 0.99  | 1.01   |        | $sd(\mu)/\sigma = 2$                  |
| AICc   | 1.24  | 0.90                           | 0.96                     | 0.95  |       |        | 0.96   | $\rho = 0.9$                          |
| AIC    | 0.97  | 0.97                           | 0.99                     | 0.93  |       |        |        | <i>Oracle</i> : 0.56                  |
| BIC    | 0.97  | 0.97                           | 0.99                     | 0.93  |       |        |        | Oracie: 0.30                          |
| CV.1se | 4.60  | 4.63                           | 4.68                     | 3.77  | 4.60  |        |        |                                       |
| CV.min | 4.00  | 4.31                           | 4.56                     | 4.29  | 4.04  | 4.06   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 4.02  | 4.02                           | 4.68                     | 3.62  |       |        | 4.68   | $\rho = 0$                            |
| AIC    | 4.64  | 4.67                           | 4.72                     | 4.53  |       |        |        | -                                     |
| BIC    | 4.64  | 4.67                           | 4.72                     | 4.52  |       |        |        | Oracle: 2.63                          |
| CV.1se | 4.15  | 4.16                           | 4.20                     | 3.44  | 4.15  |        |        |                                       |
| CV.min | 3.69  | 3.92                           | 4.11                     | 3.86  | 3.73  | 3.75   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 3.68  | 3.62                           | 4.18                     | 3.31  |       |        | 4.18   | $\rho = 0.5$                          |
| AIC    | 4.15  | 4.18                           | 4.22                     | 4.06  |       |        |        | 0 1 226                               |
| BIC    | 4.15  | 4.17                           | 4.22                     | 4.06  |       |        |        | Oracle: 2.36                          |
| CV.1se | 3.92  | 3.95                           | 3.97                     | 3.25  | 3.91  |        |        |                                       |
| CV.min | 3.50  | 3.71                           | 3.88                     | 3.62  | 3.53  | 3.53   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 3.51  | 3.44                           | 3.94                     | 3.14  |       |        | 3.93   | $\rho = 0.9$                          |
| AIC    | 3.91  | 3.94                           | 3.97                     | 3.83  |       |        |        | 0 1 222                               |
| BIC    | 3.91  | 3.93                           | 3.97                     | 3.82  |       |        |        | Oracle: 2.23                          |
| CV.1se | 11.92 | 11.93                          | 11.95                    | 14.58 | 11.93 |        |        |                                       |
| CV.min | 11.93 | 11.99                          | 12.04                    | 17.34 | 12.05 | 12.01  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 11.84 | 16.71                          | 18.88                    | 12.64 |       |        | 18.88  | $\rho = 0$                            |
| AIC    | 18.67 | 18.80                          | 18.95                    | 18.38 |       |        |        | ·                                     |
| BIC    | 18.66 | 18.80                          | 18.95                    | 18.37 |       |        |        | <i>Oracle</i> : 10.54                 |
| CV.1se | 10.65 | 10.66                          | 10.67                    | 13.06 | 10.65 |        |        |                                       |
| CV.min | 10.72 | 10.71                          | 10.73                    | 15.50 | 10.77 | 10.78  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 10.57 | 14.75                          | 16.82                    | 11.29 |       |        | 16.83  | $\rho = 0.5$                          |
| AIC    | 16.65 | 16.76                          | 16.89                    | 16.39 |       |        |        | ,                                     |
| BIC    | 16.64 | 16.75                          | 16.89                    | 16.38 |       |        |        | Oracle: 9.44                          |
| CV.1se | 10.06 | 10.07                          | 10.07                    | 12.21 | 10.06 |        |        |                                       |
| CV.min | 10.12 | 10.13                          | 10.12                    | 14.51 | 10.13 | 10.21  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 9.97  | 13.86                          | 15.85                    | 10.70 |       |        | 15.87  | $\rho = 0.9$                          |
| AIC    | 15.69 | 15.79                          | 15.92                    | 15.44 |       |        |        | •                                     |
| BIC    | 15.68 | 15.79                          | 15.91                    | 15.43 |       |        |        | Oracle: 8.92                          |
|        | 15.00 | 10.17                          | 10.71                    | 10.10 |       |        |        |                                       |

Table 23: Predictive MSE for n=100, continuous design, sparse covariates, and decay 10.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|---|--------|-------|--------------------------------|------------------------------|-------|-------|--------|--------|---------------------------------------|
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        |       |                                |                              |       |       |        |        |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min |       |                                |                              |       | 1.61  | 1.65   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC 1.89 1.89 1.92 1.77   |        |       |                                |                              | 1.63  |       |        | 1.85   | $\rho = 0$                            |
| BIC   1.89   1.89   1.92   1.17   1.18  |        |       |                                |                              |       |       |        |        | $Oracle \cdot 1.09$                   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 1.89  | 1.89                           |                              | 1.77  |       |        |        | 07 acic . 1.07                        |
| AICc 1.32 1.51 0.95 1.00 1.08 $\rho = 0.5$ AIC 0.75 0.75 0.76 0.76 0.73 $\rho = 0.5$ AIC 0.75 0.75 0.76 0.85 $\rho = 0.5$ Oracle : 0.43 $\rho = 0.5$ Oracle : 0.44 $\rho = 0.5$ Oracle : 0.41 $\rho = 0.5$ Oracle : 0.42 $\rho = 0.5$ Oracle : 0.43 $\rho = 0.5$ Oracle : 0.45 $\rho = 0.5$ Oracle : 0. |        | 1.76  | 1.68                           | 1.59                         | 0.92  | 1.46  |        |        |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min | 1.27  |                                | 1.37                         | 0.75  | 1.13  | 1.22   |        |                                       |
| BIC         0.75         0.75         0.76         0.85         Oracle : 0.43           CV.Ise         0.38         0.36         0.32         0.26         0.33 $cc{0.39}$ $cc{0.29}$ 0.29         0.29         0.28         0.28 $cc{0.29}$ $cc{0.29}$ $cc{0.29}$ 0.29 $cc{0.29}$ 0.29 $cc{0.29}$  | AICc   | 1.32  | 1.51                           | 0.95                         | 1.00  |       |        | 1.08   | $\rho = 0.5$                          |
| BIC         0.75         0.76         0.85           CV.Isie         0.38         0.36         0.32         0.26         0.33         0.28         sd(μ)/σ = 2           AICc         0.29         0.29         0.29         0.20         0.28         0.28         sd(μ)/σ = 2           AICc         0.19         0.19         0.20         0.18         0.29         0.29         ρ = 0.9           AIC         0.19         0.19         0.20         0.30         0.29         ρ = 0.9           CV.lse         7.53         7.48         7.59         6.10         7.45         0.745           CV.min         6.40         6.61         7.19         6.97         6.46         6.47         sd(μ)/σ = 1           AIC         6.55         7.08         7.66 <b>5.83</b> 7.24         ρ = 0           AIC         7.67         7.71         7.80         7.42         0racle : 4.37           CV.lse         3.04         3.03         3.00         2.54         3.00           CV.min         2.76         2.79         2.88         2.75         2.75         2.74         sd(μ)/σ = 1           AIC         3.01         3.02 <td< td=""><td>AIC</td><td>0.75</td><td>0.75</td><td>0.76</td><td>0.73</td><td></td><td></td><td></td><td><math>O_{magle} \cdot 0.43</math></td></td<>  | AIC    | 0.75  | 0.75                           | 0.76                         | 0.73  |       |        |        | $O_{magle} \cdot 0.43$                |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 0.75  | 0.75                           | 0.76                         | 0.85  |       |        |        | Oracle . 0.43                         |
| AICc 0.29 0.33 0.32 0.22 0.29 $\rho = 0.9$ AIC 0.19 0.19 0.20 0.18 BIC 0.20 0.20 0.20 0.30 $\rho = 0.9$ AIC 0.19 0.19 0.20 0.30 $\rho = 0.9$ AIC 0.20 0.20 0.20 0.20 0.20 0.30 $\rho = 0.9$ AIC 0.29 0.20 0.30 0.30 0.254 0.30 $\rho = 0.9$ AIC 0.27 0.29 0.28 0.29 0.27 0.28 0.29 0.29 0.28 0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29   | CV.1se | 0.38  | 0.36                           | 0.32                         | 0.26  | 0.33  |        |        |                                       |
| AIC 0.19 0.19 0.20 0.20 0.30  | CV.min | 0.29  | 0.29                           | 0.29                         | 0.20  | 0.28  | 0.28   |        |                                       |
| BIC 0.20 0.20 0.20 0.30   | AICc   | 0.29  | 0.33                           | 0.32                         | 0.22  |       |        | 0.29   | $\rho = 0.9$                          |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | AIC    | 0.19  | 0.19                           | 0.20                         | 0.18  |       |        |        | $O_{magle} \cdot 0.11$                |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 0.20  | 0.20                           | 0.20                         | 0.30  |       |        |        | Oracle . 0.11                         |
| AICc 6.35 7.08 7.66 5.83 7.45 $\rho = 0$ AIC 7.68 7.71 7.80 7.45 $\rho = 0$ AIC 7.67 7.71 7.80 7.42 $\rho = 0$ BIC 7.67 7.71 7.80 7.42 $\rho = 0$ CV.lse 3.04 3.03 3.00 2.54 3.00 $\rho = 0$ CV.min 2.76 2.79 2.88 2.75 2.75 2.74 $\rho = 0.5$ AIC 3.01 3.02 3.05 2.93 $\rho = 0.5$ BIC 3.00 3.01 3.04 2.92 $\rho = 0.5$ CV.lse 0.76 0.74 0.68 0.65 0.71 $\rho = 0.5$ AIC 0.64 0.68 0.66 0.61 0.64 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 $\rho = 0.9$ AIC 19.79 19.80 19.81 23.84 19.80 $\rho = 0.9$ AIC 30.82 30.99 31.25 30.32 $\rho = 0.5$ AIC 30.82 30.99 31.25 30.32 $\rho = 0.5$ AIC 30.81 30.98 31.25 30.30 $\rho = 0.5$ AIC 7.68 7.76 7.76 7.77 9.11 7.76 $\rho = 0.5$ AIC 7.68 7.76 7.76 7.77 9.11 7.76 $\rho = 0.5$ AIC 12.08 12.13 12.24 11.88 $\rho = 0.5$ AIC 12.08 12.13 12.24 11.88 $\rho = 0.5$ AIC 1.208 12.13 12.24 11.88 $\rho = 0.5$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$   | CV.1se | 7.53  | 7.48                           | 7.59                         | 6.10  | 7.45  |        |        |                                       |
| AIC 7.68 7.71 7.80 7.45 $Oracle: 4.37$ $Oracle: 4.38$ $Oracle: 4.38$ $Oracle: 4.38$ $Oracle: 4.38$ $Oracle: 4.38$ $Oracle: 4.39$ $Oracle: 4$   | CV.min | 6.40  | 6.61                           | 7.19                         | 6.97  | 6.46  | 6.47   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         7.67         7.71         7.80         7.42         Oracle : 4.37           CV.1se         3.04         3.03         3.00         2.54         3.00 $sd(\mu)/\sigma = 1$ AICc         2.72         2.92         2.94         2.47         2.85 $\rho = 0.5$ AIC         3.01         3.02         3.05         2.93         Oracle : 1.71           CV.1se         0.76         0.74         0.68         0.65         0.71           CV.min         0.65         0.64         0.63         0.62         0.63         0.63 $sd(\mu)/\sigma = 1$ AICc         0.78         0.78         0.80         0.71         0.64  | AICc   | 6.35  | 7.08                           | 7.66                         | 5.83  |       |        | 7.24   | $\rho = 0$                            |
| BIC         7.67         7.71         7.80         7.42           CV.1se         3.04         3.03         3.00         2.54         3.00           CV.min         2.76         2.79         2.88         2.75         2.75         2.74 $sd(\mu)/\sigma = 1$ AIC         2.72         2.92         2.94         2.47         2.85 $\rho = 0.5$ AIC         3.01         3.02         3.05         2.93         Oracle: 1.71           CV.1se         0.76         0.74         0.68         0.65         0.71         Occupant           CV.min         0.65         0.64         0.63         0.62         0.63         0.63 $sd(\mu)/\sigma = 1$ AIC         0.78         0.78         0.80         0.71         Oracle: 0.45           CV.1se         19.79         19.80         19.81         23.84         19.80         19.92 $sd(\mu)/\sigma = 0.5$ AIC         19.54         20.74         31.03         20.74         28.50 $\rho = 0$ AIC         19.54         20.74         31.03         20.74         28.50 $\rho = 0.5$ AIC         30.82         30.99         31.25  | AIC    | 7.68  | 7.71                           | 7.80                         | 7.45  |       |        |        | Oma ala . 4 27                        |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 7.67  | 7.71                           | 7.80                         | 7.42  |       |        |        | Oracie: 4.37                          |
| AICc 2.72 2.92 2.94 2.47 2.85 $\rho = 0.5$ AIC 3.01 3.02 3.05 2.93 $Oracle : 1.71$ $Oracle : 1.$  | CV.1se | 3.04  | 3.03                           | 3.00                         | 2.54  | 3.00  |        |        |                                       |
| AIC 3.01 3.02 3.05 2.93 $Oracle : 1.71$ BIC 3.00 3.01 3.04 2.92 $Oracle : 1.71$ CV.1se 0.76 0.74 0.68 0.65 0.71 $Oracle : 1.71$ CV.min 0.65 0.64 0.63 0.62 0.63 0.63 $Oracle : 1.71$ AICc 0.64 0.68 0.66 0.61 0.64 $Oracle : 0.45$ BIC 0.78 0.78 0.80 0.71 $Oracle : 0.45$ CV.1se 19.79 19.80 19.81 23.84 19.80 $Oracle : 0.45$ CV.min 19.76 19.83 19.97 28.51 19.86 19.92 $Oracle : 0.45$ AICc 19.54 20.74 31.03 20.74 28.50 $Oracle : 17.46$ BIC 30.81 30.98 31.25 30.32 $Oracle : 17.46$ CV.1se 7.76 7.77 9.11 7.76 $Oracle : 17.46$ CV.1se 7.76 7.77 7.81 10.85 7.79 7.80 $Oracle : 17.46$ AIC 12.08 12.13 12.24 11.88 $Oracle : 1.71$ BIC 12.07 12.12 12.23 11.86 $Oracle : 1.71$  | CV.min | 2.76  | 2.79                           | 2.88                         | 2.75  | 2.75  | 2.74   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 3.00 3.01 3.04 2.92   | AICc   | 2.72  | 2.92                           | 2.94                         | 2.47  |       |        | 2.85   | $\rho = 0.5$                          |
| BIC         3.00         3.01         3.04         2.92           CV.1se         0.76         0.74         0.68         0.65         0.71           CV.min         0.65         0.64         0.63         0.62         0.63         0.63           AICc         0.64         0.68         0.66 <b>0.61</b> 0.64 $\rho = 0.9$ AIC         0.78         0.78         0.80         0.71         0.64         0.62         0.45           CV.1se         19.79         19.80         19.81         23.84         19.80         19.92         sd(μ)/ $\sigma = 0.5$ AICc <b>19.54</b> 20.74         31.03         20.74         28.50 $\rho = 0$ AIC         30.82         30.99         31.25         30.32         0.74         28.50 $\rho = 0$ BIC         30.81         30.98         31.25         30.30         0.72         0.72         0.72           CV.1se         7.76         7.76         7.77         9.11         7.76         7.80         sd( $\mu$ )/ $\sigma = 0.5$ AIC         12.08         12.13         12.24         11.88         10.37 $\rho = 0.5$ AI   | AIC    | 3.01  | 3.02                           | 3.05                         | 2.93  |       |        |        | Omada i 1 71                          |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 3.00  | 3.01                           | 3.04                         | 2.92  |       |        |        | Oracie: 1.71                          |
| AICc 0.64 0.68 0.66 0.61 0.64 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 BIC 0.78 0.78 0.80 0.64 $\rho = 0.9$ Oracle : 0.45 CV.1se 19.79 19.80 19.81 23.84 19.80 CV.min 19.76 19.83 19.97 28.51 19.86 19.92 $\rho = 0.5$ AICc 19.54 20.74 31.03 20.74 28.50 $\rho = 0.5$ AIC 30.82 30.99 31.25 30.32 BIC 30.81 30.98 31.25 30.30 $\rho = 0.5$ AICc 7.76 7.77 9.11 7.76 CV.min 7.76 7.77 7.81 10.85 7.79 7.80 $\rho = 0.5$ AIC 12.08 12.13 12.24 11.88 BIC 12.07 12.12 12.23 11.86 CV.1se 2.04 2.04 2.04 2.02 2.04 CV.min 2.00 2.00 2.00 2.02 2.23 2.00 2.01 $\rho = 0.5$ AIC 1.98 2.01 2.75 2.08 $\rho = 0.5$ AIC 3.16 3.17 3.21 3.02 $\rho = 0.5$ AIC 1.80 $\rho = 0.5$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.5$ AIC 1.98 2.01 3.17 3.21 3.02 $\rho = 0.5$  | CV.1se | 0.76  | 0.74                           | 0.68                         | 0.65  | 0.71  |        |        |                                       |
| AIC 0.78 0.78 0.78 0.80 0.71  | CV.min | 0.65  | 0.64                           | 0.63                         | 0.62  | 0.63  | 0.63   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         0.78         0.78         0.80         0.64           CV.1se         19.79         19.80         19.81         23.84         19.80           CV.min         19.76         19.83         19.97         28.51         19.86         19.92 $sd(\mu)/\sigma = 0.5$ AICc         19.54         20.74         31.03         20.74         28.50 $\rho = 0$ AIC         30.82         30.99         31.25         30.32         Oracle: 17.46           EV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79         7.80           AIC         12.08         12.13         12.24         11.88         0racle: 6.84           BIC         12.07         12.12         12.23         11.86         0racle: 6.84           CV.1se         2.04         2.04         2.02         2.04         2.01 $sd(\mu)/\sigma = 0.5$ AIC         1.98         2.01         2.75         2.08         2.01 $\rho = 0.9$ AIC         3.16         3.17         3.21         3.02   | AICc   | 0.64  | 0.68                           | 0.66                         | 0.61  |       |        | 0.64   | $\rho = 0.9$                          |
| BIC $0.78$ $0.78$ $0.80$ $0.64$ CV.1se         19.79         19.80         19.81         23.84         19.80           CV.min         19.76         19.83         19.97         28.51         19.86         19.92 $sd(\mu)/\sigma = 0.5$ AICc         19.54         20.74         31.03         20.74         28.50 $\rho = 0$ AIC         30.82         30.99         31.25         30.32         Oracle: 17.46           EV.1se         7.76         7.76         7.77         9.11         7.76         CV.ise         7.76         7.77         7.81         10.85         7.79         7.80         sd( $\mu$ )/ $\sigma$ = 0.5           AIC         12.08         12.13         12.24         11.88         Dracle: 6.84           EV.1se         2.04         2.04         2.02         2.04         CV.ise         2.04         2.04         2.02         2.04         CV.ise         2.04         2.02         2.23         2.00         2.01         sd( $\mu$ )/ $\sigma$ = 0.5           AIC         1.98         2.01         2.75         2.08         2.01 $\rho$ = 0.9   | AIC    | 0.78  | 0.78                           | 0.80                         | 0.71  |       |        |        | Oma ala + 0.45                        |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 0.78  | 0.78                           | 0.80                         | 0.64  |       |        |        | Oracie: 0.43                          |
| AICc 19.54 20.74 31.03 20.74 28.50 $\rho = 0$ AIC 30.82 30.99 31.25 30.32 BIC 30.81 30.98 31.25 30.30  CV.1se 7.76 7.76 7.77 9.11 7.76  CV.min 7.76 7.77 7.81 10.85 7.79 7.80 $sd(\mu)/\sigma = 0.5$ AICc 7.68 7.76 12.06 8.19 10.37 $\rho = 0.5$ AIC 12.08 12.13 12.24 11.88 BIC 12.07 12.12 12.23 11.86  CV.1se 2.04 2.04 2.04 2.02 2.04  CV.min 2.00 2.00 2.00 2.02 2.23 2.00 2.01 $sd(\mu)/\sigma = 0.5$ AICc 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 3.16 3.17 3.21 3.02   | CV.1se | 19.79 | 19.80                          | 19.81                        | 23.84 | 19.80 |        |        |                                       |
| AIC 30.82 30.99 31.25 30.32 $Oracle: 17.46$ BIC 30.81 30.98 31.25 30.30 $Oracle: 17.46$ CV.1se 7.76 7.76 7.77 9.11 7.76 CV.min 7.76 7.77 7.81 10.85 7.79 7.80 $sd(\mu)/\sigma = 0.5$ AIC 12.08 12.13 12.24 11.88 BIC 12.07 12.12 12.23 11.86 $Oracle: 6.84$ CV.1se 2.04 2.04 2.04 2.02 2.04 CV.min 2.00 2.00 2.02 2.23 2.00 2.01 $sd(\mu)/\sigma = 0.5$ AIC 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$ AIC 3.16 3.17 3.21 3.02 $Oracle: 1.80$  | CV.min | 19.76 | 19.83                          | 19.97                        | 28.51 | 19.86 | 19.92  |        | $sd(\mu)/\sigma = 0.5$                |
| BIC         30.81         30.98         31.25         30.30         Oracle: 17.46           CV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79         7.80 $sd(\mu)/\sigma = 0.5$ AICc         7.68         7.76         12.06         8.19         10.37 $\rho = 0.5$ AIC         12.08         12.13         12.24         11.88         0racle: 6.84           BIC         12.07         12.12         12.23         11.86         0racle: 6.84           CV.1se         2.04         2.04         2.02         2.04         2.01 $sd(\mu)/\sigma = 0.5$ AIC         1.98         2.01         2.75         2.08         2.01 $\rho = 0.9$ AIC         3.16         3.17         3.21         3.02         0racle: 1.80   | AICc   | 19.54 | 20.74                          | 31.03                        | 20.74 |       |        | 28.50  | $\rho = 0$                            |
| BIC         30.81         30.98         31.25         30.30           CV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79         7.80 $sd(\mu)/\sigma = 0.5$ AIC         7.68         7.76         12.06         8.19         10.37 $\rho = 0.5$ AIC         12.08         12.13         12.24         11.88         Oracle: 6.84           BIC         12.07         12.12         12.23         11.86         Oracle: 6.84           CV.1se         2.04         2.04         2.02         2.04         2.04           CV.min         2.00         2.00         2.02         2.23         2.00         2.01 $sd(\mu)/\sigma = 0.5$ AIC         3.16         3.17         3.21         3.02         0racle: 1.80   | AIC    | 30.82 | 30.99                          | 31.25                        | 30.32 |       |        |        | Oma ala . 17 46                       |
| CV.min         7.76         7.77         7.81         10.85         7.79         7.80 $sd(\mu)/\sigma = 0.5$ AIC         7.68         7.76         12.06         8.19         10.37 $\rho = 0.5$ AIC         12.08         12.13         12.24         11.88         Oracle : 6.84           BIC         12.07         12.12         12.23         11.86         Oracle : 6.84           CV.1se         2.04         2.04         2.02         2.04         CV.min         2.00         2.00         2.02         2.23         2.00         2.01         sd( $\mu$ )/ $\sigma$ = 0.5           AIC         3.16         3.17         3.21         3.02         Oracle : 1.80  | BIC    | 30.81 | 30.98                          | 31.25                        | 30.30 |       |        |        | Oracie: 17.40                         |
| AICc 7.68 7.76 12.06 8.19 10.37 $ρ = 0.5$<br>AIC 12.08 12.13 12.24 11.88 $Oracle : 6.84$<br>BIC 12.07 12.12 12.23 11.86 $Oracle : 6.84$<br>CV.1se 2.04 2.04 2.04 2.02 2.04 $Oracle : 6.84$<br>CV.min 2.00 2.00 2.02 2.23 2.00 2.01 $Oracle : 6.84$<br>AICc 1.98 2.01 2.75 2.08 2.01 $Oracle : 1.80$<br>AIC 3.16 3.17 3.21 3.02 $Oracle : 1.80$  | CV.1se | 7.76  | 7.76                           | 7.77                         | 9.11  | 7.76  |        |        |                                       |
| AIC       12.08       12.13       12.24       11.88       Oracle : 6.84         BIC       12.07       12.12       12.23       11.86       Oracle : 6.84         CV.1se       2.04       2.04       2.02       2.04       2.04       2.02       2.04         CV.min       2.00       2.00       2.02       2.23       2.00       2.01 $sd(\mu)/\sigma = 0.5$ AIC       3.16       3.17       3.21       3.02       0racle : 1.80   | CV.min | 7.76  | 7.77                           | 7.81                         | 10.85 | 7.79  | 7.80   |        | $sd(\mu)/\sigma = 0.5$                |
| BIC       12.07       12.12       12.23       11.86       Oracle: 6.84         CV.1se       2.04       2.04       2.02       2.04         CV.min       2.00       2.00       2.02       2.23       2.00       2.01 $sd(\mu)/\sigma = 0.5$ AICc       1.98       2.01       2.75       2.08       2.01 $\rho = 0.9$ AIC       3.16       3.17       3.21       3.02       Oracle: 1.80   | AICc   | 7.68  | 7.76                           | 12.06                        | 8.19  |       |        | 10.37  | $\rho = 0.5$                          |
| BIC       12.07       12.12       12.23       11.86         CV.1se       2.04       2.04       2.02       2.04         CV.min       2.00       2.00       2.02       2.23       2.00       2.01 $sd(\mu)/\sigma = 0.5$ AIC       3.16       3.17       3.21       3.02       2.01 $\rho = 0.9$  | AIC    | 12.08 | 12.13                          | 12.24                        | 11.88 |       |        |        | Oma ala . 6 94                        |
| CV.min       2.00       2.00       2.02       2.23       2.00       2.01 $sd(\mu)/\sigma = 0.5$ AIC       3.16       3.17       3.21       3.02       2.01 $sd(\mu)/\sigma = 0.5$ AIC       3.16       3.17       3.21       3.02 $oracle: 1.80$  | BIC    | 12.07 | 12.12                          | 12.23                        | 11.86 |       |        |        | Oracie: 0.84                          |
| AICc 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$<br>AIC 3.16 3.17 3.21 3.02   | CV.1se | 2.04  | 2.04                           | 2.04                         | 2.02  | 2.04  |        |        |                                       |
| AICc 1.98 2.01 2.75 2.08 2.01 $\rho = 0.9$<br>AIC 3.16 3.17 3.21 3.02   | CV.min | 2.00  | 2.00                           | 2.02                         | 2.23  | 2.00  | 2.01   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| Uracle: 1 XII   | AICc   | 1.98  | 2.01                           | 2.75                         | 2.08  |       |        | 2.01   |                                       |
| Uracle: 1 XII   |        | 3.16  |                                | 3.21                         |       |       |        |        |                                       |
|   | BIC    | 3.16  | 3.17                           | 3.21                         | 2.43  |       |        |        | Oracie: 1.80                          |

Table 24: Predictive MSE for n=100, continuous design, sparse covariates, and decay 50.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}~\gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|-------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 6.03  | 5.47                           | 7.37                    | 3.39  | 4.50  |        |        |                                       |
| CV.min | 3.66  | 3.54                           | 5.12                    | 3.45  | 3.45  | 3.51   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.24  | 3.93                           | 3.83                    | 3.46  |       |        | 3.86   | $\rho = 0$                            |
| AIC    | 3.93  | 3.94                           | 4.01                    | 3.72  |       |        |        | Oracle: 2.26                          |
| BIC    | 3.93  | 3.94                           | 4.00                    | 3.71  |       |        |        | Oracle . 2.20                         |
| CV.1se | 3.71  | 3.68                           | 3.68                    | 1.86  | 3.59  |        |        |                                       |
| CV.min | 2.90  | 3.04                           | 3.39                    | 1.52  | 2.83  | 2.85   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 2.94  | 3.45                           | 1.54                    | 2.11  |       |        | 2.14   | $\rho = 0.5$                          |
| AIC    | 1.51  | 1.51                           | 1.53                    | 1.48  |       |        |        | Oracle: 0.86                          |
| BIC    | 1.51  | 1.51                           | 1.53                    | 1.51  |       |        |        | 01 acte . 0.80                        |
| CV.1se | 0.76  | 0.73                           | 0.66                    | 0.55  | 0.64  |        |        |                                       |
| CV.min | 0.55  | 0.55                           | 0.57                    | 0.41  | 0.54  | 0.54   |        | $sd(\mu)/\sigma = 2$                  |
| AICc   | 0.56  | 0.68                           | 0.61                    | 0.47  |       |        | 0.56   | $\rho = 0.9$                          |
| AIC    | 0.34  | 0.34                           | 0.34                    | 0.33  |       |        |        | Oracle: 0.19                          |
| BIC    | 0.34  | 0.34                           | 0.34                    | 0.55  |       |        |        | Oracie: 0.19                          |
| CV.1se | 15.86 | 15.92                          | 16.11                   | 12.87 | 15.83 |        |        | -                                     |
| CV.min | 13.74 | 14.70                          | 15.65                   | 14.59 | 13.88 | 13.91  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 13.72 | 15.18                          | 16.02                   | 12.39 |       |        | 15.45  | $\rho = 0$                            |
| AIC    | 15.92 | 16.01                          | 16.18                   | 15.51 |       |        |        | 0 1 0.05                              |
| BIC    | 15.91 | 16.00                          | 16.18                   | 15.49 |       |        |        | Oracle: 9.05                          |
| CV.1se | 6.15  | 6.15                           | 6.15                    | 5.16  | 6.14  |        |        |                                       |
| CV.min | 5.74  | 5.87                           | 6.06                    | 5.58  | 5.74  | 5.75   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.67  | 6.04                           | 6.02                    | 5.09  |       |        | 5.91   | $\rho = 0.5$                          |
| AIC    | 6.05  | 6.07                           | 6.13                    | 5.93  |       |        |        | 0 1 2.42                              |
| BIC    | 6.05  | 6.07                           | 6.13                    | 5.92  |       |        |        | Oracle: 3.43                          |
| CV.1se | 1.38  | 1.37                           | 1.35                    | 1.20  | 1.34  |        |        |                                       |
| CV.min | 1.24  | 1.24                           | 1.28                    | 1.13  | 1.21  | 1.21   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.22  | 1.34                           | 1.32                    | 1.13  |       |        | 1.21   | $\rho = 0.9$                          |
| AIC    | 1.36  | 1.37                           | 1.38                    | 1.30  |       |        |        | 0 1 0.70                              |
| BIC    | 1.36  | 1.36                           | 1.38                    | 1.25  |       |        |        | Oracle: 0.78                          |
| CV.1se | 41.10 | 41.10                          | 41.16                   | 49.82 | 41.10 |        |        |                                       |
| CV.min | 41.17 | 41.36                          | 41.49                   | 59.63 | 41.39 | 41.46  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 40.65 | 49.38                          | 64.74                   | 43.30 |       |        | 59.90  | $\rho = 0$                            |
| AIC    | 64.05 | 64.49                          | 65.00                   | 63.04 |       |        |        | ·                                     |
| BIC    | 64.02 | 64.47                          | 64.99                   | 63.01 |       |        |        | <i>Oracle</i> : 36.24                 |
| CV.1se | 15.53 | 15.54                          | 15.54                   | 18.34 | 15.53 |        |        |                                       |
| CV.min | 15.56 | 15.59                          | 15.65                   | 21.83 | 15.63 | 15.68  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 15.41 | 15.84                          | 24.32                   | 16.43 |       |        | 21.33  | $\rho = 0.5$                          |
| AIC    | 24.20 | 24.32                          | 24.53                   | 23.82 |       |        |        | ,                                     |
| BIC    | 24.18 | 24.31                          | 24.52                   | 23.81 |       |        |        | <i>Oracle</i> : 13.70                 |
| CV.1se | 3.54  | 3.54                           | 3.54                    | 3.58  | 3.54  |        |        |                                       |
| CV.min | 3.52  | 3.54                           | 3.55                    | 3.95  | 3.53  | 3.54   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 3.49  | 3.53                           | 5.40                    | 3.67  |       |        | 3.57   | $\rho = 0.9$                          |
| AIC    | 5.47  | 5.49                           | 5.56                    | 5.28  |       |        | 2.0,   |                                       |
| BIC    | 5.46  | 5.49                           | 5.56                    | 4.57  |       |        |        | Oracle: 3.12                          |
|        | 2.10  | 5.17                           | 2.20                    |       |       |        |        |                                       |

Table 25: Predictive MSE for n=100, continuous design, sparse covariates, and decay 100.

|        | lasso | $\operatorname{GL} \gamma = 1$ |       | AL    | MCP   | CVbest | ICbest |                                     |
|--------|-------|--------------------------------|-------|-------|-------|--------|--------|-------------------------------------|
| CV.1se | 6.74  | 6.11                           | 8.34  | 3.77  | 5.04  |        |        |                                     |
| CV.min | 4.07  | 3.93                           | 5.96  | 3.83  | 3.85  | 3.91   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 4.70  | 4.30                           | 4.30  | 3.84  |       |        | 4.30   | $\rho = 0$                          |
| AIC    | 4.38  | 4.39                           | 4.46  | 4.14  |       |        |        | Oracle: 2.52                        |
| BIC    | 4.37  | 4.39                           | 4.46  | 4.13  |       |        |        | 07 acic . 2.32                      |
| CV.1se | 4.12  | 4.10                           | 4.10  | 2.07  | 4.02  |        |        |                                     |
| CV.min | 3.23  | 3.39                           | 3.79  | 1.69  | 3.19  | 3.20   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 3.30  | 3.84                           | 1.71  | 2.35  |       |        | 2.40   | $\rho = 0.5$                        |
| AIC    | 1.67  | 1.68                           | 1.70  | 1.64  |       |        |        | Oracle: 0.95                        |
| BIC    | 1.67  | 1.68                           | 1.70  | 1.69  |       |        |        | 01 acie . 0.93                      |
| CV.1se | 0.84  | 0.81                           | 0.74  | 0.61  | 0.71  |        |        |                                     |
| CV.min | 0.61  | 0.61                           | 0.63  | 0.46  | 0.60  | 0.60   |        | $sd(\mu)/\sigma = 2$                |
| AICc   | 0.62  | 0.75                           | 0.66  | 0.51  |       |        | 0.62   | $\rho = 0.9$                        |
| AIC    | 0.37  | 0.37                           | 0.38  | 0.36  |       |        |        | Oracle: 0.21                        |
| BIC    | 0.37  | 0.38                           | 0.38  | 0.59  |       |        |        | Oracie: 0.21                        |
| CV.1se | 17.65 | 17.73                          | 17.88 | 14.30 | 17.57 |        |        |                                     |
| CV.min | 15.29 | 16.38                          | 17.43 | 16.22 | 15.41 | 15.43  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 15.27 | 16.82                          | 17.83 | 13.78 |       |        | 17.13  | $\rho = 0$                          |
| AIC    | 17.69 | 17.80                          | 17.98 | 17.24 |       |        |        | 0110.05                             |
| BIC    | 17.68 | 17.79                          | 17.98 | 17.21 |       |        |        | Oracle: 10.05                       |
| CV.1se | 6.83  | 6.83                           | 6.83  | 5.74  | 6.82  |        |        |                                     |
| CV.min | 6.38  | 6.54                           | 6.74  | 6.19  | 6.38  | 6.39   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 6.30  | 6.72                           | 6.70  | 5.66  |       |        | 6.54   | $\rho = 0.5$                        |
| AIC    | 6.71  | 6.74                           | 6.80  | 6.59  |       |        |        | 0 1 200                             |
| BIC    | 6.71  | 6.73                           | 6.80  | 6.58  |       |        |        | Oracle: 3.80                        |
| CV.1se | 1.53  | 1.52                           | 1.50  | 1.33  | 1.49  |        |        |                                     |
| CV.min | 1.37  | 1.37                           | 1.43  | 1.25  | 1.35  | 1.35   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 1.35  | 1.49                           | 1.45  | 1.25  |       |        | 1.35   | $\rho = 0.9$                        |
| AIC    | 1.50  | 1.51                           | 1.53  | 1.44  |       |        |        | 0 1 006                             |
| BIC    | 1.50  | 1.51                           | 1.53  | 1.40  |       |        |        | Oracle: 0.86                        |
| CV.1se | 45.57 | 45.59                          | 45.62 | 55.20 | 45.57 |        |        |                                     |
| CV.min | 45.65 | 45.85                          | 45.98 | 66.11 | 45.94 | 46.01  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 45.06 | 56.09                          | 71.78 | 48.00 |       |        | 66.96  | $\rho = 0$                          |
| AIC    | 70.97 | 71.48                          | 72.03 | 69.85 |       |        |        | 0 1 40 10                           |
| BIC    | 70.94 | 71.46                          | 72.01 | 69.82 |       |        |        | Oracle: 40.18                       |
| CV.1se | 17.26 | 17.26                          | 17.27 | 20.38 | 17.26 |        |        |                                     |
| CV.min | 17.28 | 17.32                          | 17.40 | 24.29 | 17.37 | 17.39  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 17.13 | 17.71                          | 27.06 | 18.28 |       |        | 23.99  | $\rho = 0.5$                        |
| AIC    | 26.90 | 27.05                          | 27.27 | 26.48 |       |        |        | 0 1 15 22                           |
| BIC    | 26.89 | 27.04                          | 27.27 | 26.47 |       |        |        | <i>Oracle</i> : 15.23               |
| CV.1se | 3.90  | 3.90                           | 3.90  | 3.96  | 3.90  |        |        |                                     |
| CV.min | 3.89  | 3.90                           | 3.92  | 4.37  | 3.90  | 3.92   |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 3.86  | 3.90                           | 5.99  | 4.06  |       |        | 4.01   | $\rho = 0.9$                        |
| AIC    | 6.03  | 6.06                           | 6.14  | 5.83  |       |        |        | •                                   |
|        | 0.05  | 0.00                           | 0.11  | 5.05  |       |        |        | Oracle: 3.44                        |

Table 26: Predictive MSE for n=100, continuous design, sparse covariates, and decay 200.

|                   | lasso | $\operatorname{GL} \gamma = 1$ |       | AL    | MCP   | CVbest | ICbest |                                       |
|-------------------|-------|--------------------------------|-------|-------|-------|--------|--------|---------------------------------------|
| CV.1se            | 7.14  | 6.46                           | 8.81  | 3.97  | 5.31  |        |        |                                       |
| CV.min            | 4.29  | 4.15                           | 6.14  | 4.04  | 4.07  | 4.12   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 5.01  | 4.53                           | 4.53  | 4.04  |       |        | 4.51   | $\rho = 0$                            |
| AIC               | 4.62  | 4.63                           | 4.71  | 4.36  |       |        |        | Oracle: 2.65                          |
| BIC               | 4.61  | 4.62                           | 4.70  | 4.35  |       |        |        | Oracie . 2.03                         |
| CV.1se            | 4.35  | 4.31                           | 4.32  | 2.18  | 4.24  |        |        |                                       |
| CV.min            | 3.40  | 3.59                           | 4.01  | 1.78  | 3.37  | 3.37   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 3.48  | 4.06                           | 1.81  | 2.47  |       |        | 2.54   | $\rho = 0.5$                          |
| AIC               | 1.77  | 1.77                           | 1.79  | 1.73  |       |        |        | Oracle: 1.00                          |
| BIC               | 1.77  | 1.77                           | 1.79  | 1.79  |       |        |        | Oracie: 1.00                          |
| CV.1se            | 0.89  | 0.85                           | 0.78  | 0.65  | 0.75  |        |        |                                       |
| CV.min            | 0.64  | 0.64                           | 0.67  | 0.49  | 0.63  | 0.63   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.66  | 0.79                           | 0.69  | 0.54  |       |        | 0.66   | $\rho = 0.9$                          |
| AIC               | 0.39  | 0.40                           | 0.40  | 0.38  |       |        |        | 01022                                 |
| BIC               | 0.39  | 0.40                           | 0.40  | 0.62  |       |        |        | Oracle: 0.23                          |
| CV.1se            | 18.66 | 18.75                          | 18.91 | 15.12 | 18.55 |        |        |                                       |
| CV.min            | 16.14 | 17.34                          | 18.41 | 17.11 | 16.33 | 16.36  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 16.16 | 17.75                          | 18.84 | 14.55 |       |        | 18.25  | $\rho = 0$                            |
| AIC               | 18.68 | 18.80                          | 18.99 | 18.21 |       |        |        | ,                                     |
| BIC               | 18.67 | 18.79                          | 18.99 | 18.18 |       |        |        | Oracle: 10.62                         |
| CV.1se            | 7.19  | 7.19                           | 7.19  | 6.05  | 7.19  |        |        |                                       |
| CV.min            | 6.72  | 6.89                           | 7.10  | 6.52  | 6.72  | 6.74   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 6.63  | 7.07                           | 7.06  | 5.96  |       |        | 6.89   | $\rho = 0.5$                          |
| AIC               | 7.07  | 7.10                           | 7.17  | 6.94  |       |        |        | , , , , , , ,                         |
| BIC               | 7.07  | 7.10                           | 7.17  | 6.93  |       |        |        | Oracle: 4.01                          |
| CV.1se            | 1.61  | 1.60                           | 1.58  | 1.40  | 1.56  |        |        |                                       |
| CV.min            | 1.45  | 1.45                           | 1.50  | 1.32  | 1.42  | 1.42   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 1.42  | 1.57                           | 1.53  | 1.32  |       |        | 1.43   | $\rho = 0.9$                          |
| AIC               | 1.59  | 1.59                           | 1.61  | 1.52  |       |        |        | ,                                     |
| BIC               | 1.58  | 1.59                           | 1.61  | 1.47  |       |        |        | Oracle: 0.91                          |
| CV.1se            | 48.12 | 48.15                          | 48.19 | 58.23 | 48.13 |        |        |                                       |
| CV.min            | 48.20 | 48.43                          | 48.57 | 69.84 | 48.51 | 48.58  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 47.6  | 59.96                          | 75.78 | 50.67 |       |        | 70.76  | $\rho = 0$                            |
| AIC               | 74.93 | 75.47                          | 76.04 | 73.75 |       |        |        | ,                                     |
| BIC               | 74.89 | 75.44                          | 76.03 | 73.72 |       |        |        | <i>Oracle</i> : 42.43                 |
| CV.1se            | 18.22 | 18.22                          | 18.23 | 21.49 | 18.22 |        |        |                                       |
| CV.min            | 18.26 | 18.28                          | 18.35 | 25.58 | 18.33 | 18.34  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 18.08 | 18.83                          | 28.56 | 19.27 |       |        | 24.76  | $\rho = 0.5$                          |
| AIC               | 28.38 | 28.53                          | 28.78 | 27.94 |       |        |        | ,                                     |
| BIC               | 28.36 | 28.52                          | 28.77 | 27.92 |       |        |        | Oracle: 16.07                         |
| CV.1se            | 4.11  | 4.11                           | 4.11  | 4.17  | 4.11  |        |        |                                       |
| CV.rise<br>CV.min | 4.10  | 4.11                           | 4.14  | 4.61  | 4.11  | 4.13   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 4.07  | 4.11                           | 6.32  | 4.28  |       | 1.10   | 4.19   | $\rho = 0.9$                          |
| AIC               | 6.36  | 6.39                           | 6.47  | 6.14  |       |        | ,      | ,                                     |
| BIC               | 6.36  | 6.39                           | 6.47  | 5.28  |       |        |        | Oracle: 3.62                          |
| DIC               | 0.50  | 0.57                           | 0.77  | 3.20  |       |        |        |                                       |

Table 27: Predictive MSE for n=1000, binary design, dense covariates, and decay 10.

|                   | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL   | MCP  | CVbest | ICbest |                                       |
|-------------------|-------|--------------------------------|------------------------------|------|------|--------|--------|---------------------------------------|
| CV.1se            | 0.34  | 0.34                           | 0.33                         | 0.33 | 0.32 |        |        |                                       |
| CV.min            | 0.32  | 0.32                           | 0.31                         | 0.32 | 0.31 | 0.31   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.32  | 0.32                           | 0.31                         | 0.32 |      |        | 0.31   | $\rho = 0$                            |
| AIC               | 0.42  | 0.42                           | 0.45                         | 0.32 |      |        |        | Oracle: 0.30                          |
| BIC               | 0.35  | 0.34                           | 0.32                         | 0.33 |      |        |        | 07466.0.50                            |
| CV.1se            | 0.31  | 0.30                           | 0.29                         | 0.30 | 0.29 |        |        |                                       |
| CV.min            | 0.29  | 0.29                           | 0.28                         | 0.29 | 0.28 | 0.28   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.29  | 0.29                           | 0.28                         | 0.29 |      |        | 0.28   | $\rho = 0.5$                          |
| AIC               | 0.37  | 0.38                           | 0.40                         | 0.29 |      |        |        | Oracle : 0.26                         |
| BIC               | 0.32  | 0.31                           | 0.29                         | 0.30 |      |        |        | Oracle : 0.20                         |
| CV.1se            | 0.29  | 0.29                           | 0.28                         | 0.28 | 0.27 |        |        |                                       |
| CV.min            | 0.28  | 0.27                           | 0.26                         | 0.27 | 0.26 | 0.26   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.28  | 0.27                           | 0.26                         | 0.27 |      |        | 0.26   | $\rho = 0.9$                          |
| AIC               | 0.35  | 0.35                           | 0.37                         | 0.27 |      |        |        | Oma ala . 0.25                        |
| BIC               | 0.30  | 0.29                           | 0.27                         | 0.28 |      |        |        | Oracle: 0.25                          |
| CV.1se            | 1.34  | 1.32                           | 1.29                         | 1.25 | 1.27 |        |        |                                       |
| CV.min            | 1.26  | 1.25                           | 1.23                         | 1.28 | 1.23 | 1.23   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 1.26  | 1.25                           | 1.27                         | 1.27 |      |        | 1.26   | $\rho = 0$                            |
| AIC               | 1.85  | 1.87                           | 2.00                         | 1.31 |      |        |        | ·                                     |
| BIC               | 1.35  | 1.31                           | 1.28                         | 1.27 |      |        |        | Oracle: 1.17                          |
| CV.1se            | 1.21  | 1.18                           | 1.15                         | 1.12 | 1.13 |        |        |                                       |
| CV.min            | 1.14  | 1.12                           | 1.1                          | 1.15 | 1.1  | 1.10   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 1.14  | 1.12                           | 1.13                         | 1.13 |      |        | 1.13   | $\rho = 0.5$                          |
| AIC               | 1.65  | 1.67                           | 1.78                         | 1.18 |      |        |        | ·                                     |
| BIC               | 1.22  | 1.18                           | 1.15                         | 1.14 |      |        |        | Oracle: 1.05                          |
| CV.1se            | 1.14  | 1.12                           | 1.09                         | 1.06 | 1.07 |        |        |                                       |
| CV.min            | 1.08  | 1.06                           | 1.04                         | 1.08 | 1.04 | 1.05   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 1.08  | 1.06                           | 1.07                         | 1.08 |      |        | 1.07   | $\rho = 0.9$                          |
| AIC               | 1.55  | 1.57                           | 1.68                         | 1.11 |      |        |        | ·                                     |
| BIC               | 1.16  | 1.12                           | 1.09                         | 1.09 |      |        |        | Oracle: 0.99                          |
| CV.1se            | 5.21  | 5.16                           | 5.11                         | 4.90 | 5.07 |        |        |                                       |
| CV.min            | 4.93  | 4.89                           | 4.90                         | 5.20 | 4.89 | 4.89   |        | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 4.92  | 4.89                           | 5.17                         | 5.08 |      |        | 4.97   | $\rho = 0$                            |
| AIC               | 7.90  | 8.06                           | 8.55                         | 6.07 |      |        |        | ·                                     |
| BIC               | 5.13  | 5.09                           | 5.21                         | 4.95 |      |        |        | Oracle: 4.66                          |
| CV.1se            | 4.68  | 4.62                           | 4.57                         | 4.39 | 4.53 |        |        |                                       |
| CV.min            | 4.42  | 4.38                           | 4.38                         | 4.67 | 4.37 | 4.38   |        | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 4.41  | 4.38                           | 4.62                         | 4.55 |      |        | 4.47   | $\rho = 0.5$                          |
| AIC               | 7.06  | 7.19                           | 7.62                         | 5.44 |      |        |        | ,                                     |
| BIC               | 4.62  | 4.57                           | 4.64                         | 4.46 |      |        |        | Oracle: 4.16                          |
| CV.1se            | 4.43  | 4.38                           | 4.33                         | 4.17 | 4.28 |        |        |                                       |
| CV.rise<br>CV.min | 4.18  | 4.15                           | 4.16                         | 4.40 | 4.14 | 4.15   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 4.18  | 4.15                           | 4.38                         | 4.31 |      |        | 4.23   | $\rho = 0.9$                          |
| AIC               | 6.66  | 6.78                           | 7.20                         | 5.08 |      |        | 1.23   |                                       |
| BIC               | 4.39  | 4.34                           | 4.41                         | 4.23 |      |        |        | Oracle: 3.93                          |
|                   | т.Э./ | T.JT                           | ⊤ <b>.⊤1</b>                 | 7.43 |      |        |        |                                       |

Table 28: Predictive MSE for n=1000, binary design, dense covariates, and decay 50.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |  | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL    | MCP   | CVbest | ICbest |                                       |                      |
|---|--|-------|--------------------------------|---------------------------------|-------|-------|--------|--------|---------------------------------------|----------------------|
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se   | 2.22  | 2.18                           | 2.18                            | 2.15  | 2.10  |        |        |                                       |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min   |       |                                |                                 |       | 2.01  | 2.04   |        |                                       |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |  |       |                                |                                 |       |       |        | 2.04   | $\rho = 0$                            |                      |
| BIC   2.82   2.60   2.38   2.47   2.44   2.48   1.95   1.95   1.88   2.47   2.44   2.48   1.95   1.95   1.88   2.48  | AIC  | 2.52  | 2.56                           | 2.73                            | 2.07  |       |        |        | Oracle : 1.77                         |                      |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC  | 2.82  | 2.60                           | 2.38                            | 2.47  |       |        |        | Oracle . 1.77                         |                      |
| AICc 1.93 1.85 1.82 1.89 1.82 $\rho = 0.5$ AIC 2.25 2.28 2.43 1.87 $\rho = 0.5$ BIC 2.63 2.38 2.13 2.27 $\rho = 0.5$ CV.1se 1.87 1.84 1.83 1.85 1.77 $\rho = 0.5$ AIC 2.17 1.75 1.71 1.72 1.77 1.69 1.72 $\rho = 0.9$ AIC 2.11 2.14 2.28 1.77 $\rho = 0.9$ AIC 2.11 2.14 2.28 1.77 $\rho = 0.9$ AIC 2.11 2.14 2.14 2.28 1.77 $\rho = 0.9$ AIC 2.11 2.14 2.14 2.28 1.77 $\rho = 0.9$ AIC 2.11 2.14 2.14 2.28 1.77 $\rho = 0.9$ AIC 2.11 2.14 2.14 2.28 1.77 $\rho = 0.9$ AIC 2.10 2.17 2.18 8.32 $\rho = 0.9$ AIC 2.10 2.19 11.60 8.54 7.80 8.32 $\rho = 0.9$ AIC 10.67 10.91 11.60 8.52 $\rho = 0.9$ AIC 10.67 10.91 11.60 8.52 $\rho = 0.9$ AIC 10.66 9.64 10.63 8.90 $\rho = 0.9$ AIC 2.11 6.95 7.54 7.05 7.34 $\rho = 0.5$ AIC 7.11 6.95 7.54 7.01 7.75 $\rho = 0.5$ AIC 7.11 6.95 7.54 7.01 7.75 $\rho = 0.5$ AIC 9.49 9.69 10.29 7.65 BIC 9.75 8.86 9.954 8.14 $\rho = 0.5$ AIC 8.92 9.11 9.68 7.18 BIC 9.29 8.44 9.08 7.77 $\rho = 0.5$ AIC 8.92 9.11 9.68 7.18 BIC 9.29 8.44 9.08 7.77 $\rho = 0.5$ AIC 4.19 45.58 47.69 36.58 BIC 30.49 30.51 30.62 28.92 30.45 $\rho = 0.9$ AIC 4.19 45.58 47.69 36.58 BIC 30.59 30.57 30.65 30.31 $\rho = 0.5$ AIC 2.57 25.89 2.90.2 26.38 29.00 $\rho = 0.5$ AIC 2.57 25.89 2.90.2 26.38 29.00 $\rho = 0.5$ AIC 2.57 25.89 2.90.2 26.38 25.96 $\rho = 0.5$ AIC 2.57 25.89 2.90.2 26.38 25.96 $\rho = 0.5$ AIC 3.92 4.44 2.30 32.78 BIC 2.71 7.71 1.71 27.16 27.20 26.98 $\rho = 0.5$ AIC 2.432 24.42 27.06 24.49 25.56 $\rho = 0.5$ AIC 2.432 24.42 27.06 24.49 $\rho = 0.5$ AIC 2.432 24.42 27.06 24.49 $\rho = 0.5$ AIC 2.433 24.44 27.06 24.49 $\rho = 0.5$ AIC 2.432 24.42 27.06 24.49 $\rho = 0.5$ AIC 2.433 24.42 27.06 24.49 $\rho = 0.5$ AIC 2.433 24.44 27.06 24.49 25.56 $\rho = 0.5$ AIC 2.433 24.44 27.06 24.49 25.56 $\rho = 0.5$ AIC 2.433 24.44 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.49 27.06 24.   |  | 1.99  | 1.96                           | 1.95                            | 1.95  | 1.88  |        |        |                                       |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min   | 1.85  | 1.82                           | 1.83                            | 1.87  | 1.79  | 1.82   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |                      |
| BIC         2.63         2.38         2.13         2.27         Oracle : 1.57           CV. Ise         1.87         1.84         1.83         1.85         1.77         1.69         1.72 $sd(\mu)/\sigma = 2$ $sd(\mu)/\sigma = 2$ AICe         1.82         1.75         1.71         1.79         1.71 $\rho = 0.9$ AIC         2.11         2.14         2.28         1.77 $\rho = 0.9$ $\rho = 0.9$ CV.1se         8.48         8.43         8.71         7.83         8.19 $\rho = 0.9$ CV.nin         7.81         7.79         8.13         7.85         7.79         7.81 $sd(\mu)/\sigma = 1$ AIC         7.91         7.76         8.54         7.80         8.32 $\rho = 0$ AIC         10.67         10.91         11.60         8.52 $\rho = 0$ $\rho = 0$ AIC         10.67         10.91         11.60         8.52 $\rho = 0$ $\rho = 0$ V.V.1se         7.64         7.56         7.75         7.05         7.34 $\rho = 0$ CV.nie         7.64         7.56         7.75         7.05         7.34 $\rho = 0$   | AICc   | 1.93  | 1.85                           | 1.82                            | 1.89  |       |        | 1.82   | $\rho = 0.5$                          |                      |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | AIC  | 2.25  | 2.28                           | 2.43                            | 1.87  |       |        |        | Ongolo : 1.57                         |                      |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC  | 2.63  | 2.38                           | 2.13                            | 2.27  |       |        |        | Oracie . 1.57                         |                      |
| AICc 1.82 1.75 1.71 1.79 1.71 $\rho = 0.9$ AIC 2.11 2.14 2.28 1.77 $\rho = 0.9$ AIC 2.50 2.27 2.00 2.16 $\rho = 0.9$ AIC $\rho = 0.9$ AIC 10.67 10.91 11.60 8.52 $\rho = 0.9$ AIC 10.67 10.91 11.60 8.52 $\rho = 0.9$ AIC 10.46 9.64 10.63 8.90 $\rho = 0.9$ AIC 2.11 6.95 7.54 7.05 7.34 $\rho = 0.9$ AIC 7.11 6.95 7.54 7.01 7.47 $\rho = 0.5$ AIC 9.49 9.69 10.29 7.65 $\rho = 0.5$ AIC 9.49 9.69 10.29 7.65 $\rho = 0.5$ AIC 9.49 9.69 10.29 7.65 $\rho = 0.5$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.9$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.9$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.9$ AIC 8.91 29.91 8.44 9.08 7.77 $\rho = 0.9$ AIC 2.891 29.51 30.38 30.23 28.94 29.01 $\rho = 0.9$ AIC 4.19 45.58 47.69 36.58 $\rho = 0.9$ AIC 4.19 45.58 47.69 36.58 $\rho = 0.9$ AIC 4.19 45.58 47.69 36.58 $\rho = 0.9$ AIC 2.8.81 29.04 32.33 29.50 29.02 $\rho = 0.9$ AIC 3.9.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $\rho = 0.5$ AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $\rho = 0.5$ AIC 24.45 24.87 25.89 25.48 25.45 24.47 24.52 $\rho = 0.9$ AIC 24.43 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 24.43 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 24.33 38.04 39.80 30.65  | CV.1se   | 1.87  | 1.84                           | 1.83                            | 1.85  | 1.77  |        |        |                                       |                      |
| AIC 2.11 2.14 2.28 1.77 BIC 2.50 2.27 2.00 2.16   | CV.min   | 1.75  | 1.71                           | 1.72                            | 1.77  | 1.69  | 1.72   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |                      |
| BIC 2.50 2.27 2.00 2.16   | AICc   | 1.82  | 1.75                           | 1.71                            | 1.79  |       |        | 1.71   | $\rho = 0.9$                          |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | AIC  | 2.11  | 2.14                           | 2.28                            | 1.77  |       |        |        | Ong alo . 1 49                        |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC  | 2.50  | 2.27                           | 2.00                            | 2.16  |       |        |        | Oracie : 1.46                         |                      |
| AICc 7.91 7.76 8.54 7.80 8.32 $\rho = 0$ AIC 10.67 10.91 11.60 8.52 BIC 10.46 9.64 10.63 8.90  CV.lse 7.64 7.56 7.75 7.05 7.34 CV.min 7.00 6.96 7.23 7.05 6.98 6.99 AIC 9.49 9.69 10.29 7.65 BIC 9.75 8.86 9.54 8.14  CV.lse 7.20 7.13 7.36 6.69 6.92 CV.min 6.61 6.57 6.86 6.67 6.59 6.59 AIC 8.92 9.11 9.68 7.18 BIC 9.29 8.44 9.08 7.77  CV.lse 30.41 30.51 30.62 28.92 30.45 CV.min 28.91 29.51 30.38 30.23 28.94 29.01 AIC 44.19 45.58 47.69 36.58 BIC 30.59 30.57 30.65 30.31  CV.lse 27.07 27.11 27.19 25.86 27.08 CV.min 25.89 26.35 27.03 27.01 25.93 25.96 AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 CV.min 24.45 24.87 25.48 25.45 24.47 25.56 CV.min 24.32 24.42 27.06 24.91 AIC 36.90 38.04 39.80 30.65  CV.racle : 6.88  R.32 $\rho = 0$ Oracle : 6.88 $\rho = 0$ Oracle : 6.88 $\rho = 0$ | CV.1se   | 8.48  | 8.43                           | 8.71                            | 7.83  | 8.19  |        |        |                                       |                      |
| AIC 10.67 10.91 11.60 8.52 $Oracle: 6.88$ BIC 10.46 9.64 10.63 8.90 $Oracle: 6.88$ CV.1se 7.64 7.56 7.75 7.05 7.34 $Oracle: 6.88$ CV.min 7.00 6.96 7.23 7.05 6.98 6.99 $Oracle: 6.88$ AIC 27.11 6.95 7.54 7.01 7.47 $Oracle: 6.88$ BIC 9.49 9.69 10.29 7.65 BIC 9.75 8.86 9.54 8.14 $Oracle: 6.11$ CV.1se 7.20 7.13 7.36 6.69 6.92 $Oracle: 6.11$ CV.min 6.61 6.57 6.86 6.67 6.59 6.59 $Oracle: 6.11$ AIC 8.92 9.11 9.68 7.18 $Oracle: 6.72$ 6.56 7.11 6.64 7.05 $Oracle: 5.75$ CV.1se 30.41 30.51 30.62 28.92 30.45 $Oracle: 5.75$ CV.min 28.91 29.51 30.38 30.23 28.94 29.01 $Oracle: 5.75$ AIC 28.81 29.04 32.33 29.50 29.02 $Oracle: 26.71$ BIC 30.59 30.57 30.65 30.31 $Oracle: 26.71$ CV.1se 27.07 27.11 27.19 25.86 27.08 $Oracle: 26.71$ CV.1se 27.07 27.11 27.19 25.86 27.08 $Oracle: 26.71$ CV.1se 27.07 27.11 27.19 25.86 27.08 $Oracle: 23.69$ AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $Oracle: 23.69$ CV.1se 25.52 25.57 25.62 24.47 25.56 $Oracle: 23.69$ AIC 24.32 24.42 27.06 24.91 24.43 $Oracle: 23.33$ AIC 24.43 $Oracle: 23.34$ AIC 36.90 38.04 39.80 30.65   | CV.min   | 7.81  | 7.79                           | 8.13                            | 7.85  | 7.79  | 7.81   |        | $sd(\mu)/\sigma = 1$                  |                      |
| BIC 10.46 9.64 10.63 8.90   | AICc   | 7.91  | 7.76                           | 8.54                            | 7.80  |       |        | 8.32   |                                       |                      |
| BIC         10.46         9.64         10.63         8.90           CV.1se         7.64         7.56         7.75         7.05         7.34           CV.min         7.00         6.96         7.23         7.05         6.98         6.99           AIC         7.11 <b>6.95</b> 7.54         7.01         7.47 $\rho = 0.5$ AIC         9.49         9.69         10.29         7.65         Oracle: 6.11           EV.1se         7.20         7.13         7.36         6.69         6.92           CV.min         6.61         6.57         6.86         6.67         6.59         6.59           AIC         8.92         9.11         9.68         7.18         Oracle: 5.75           CV.1se         30.41         30.51         30.62         28.92         30.45           CV.nin         28.91         29.91         30.38         30.23         28.94         29.01         sd(μ)/σ = 0.5           AIC         28.81         29.04         32.33         29.50         29.02         ρ = 0           AIC         44.19         45.58         47.69         36.58         Oracle: 26.71           BIC         30.59 </td <td>AIC</td> <td>10.67</td> <td>10.91</td> <td>11.60</td> <td>8.52</td> <td></td> <td></td> <td></td> <td>016-00</td>  | AIC  | 10.67 | 10.91                          | 11.60                           | 8.52  |       |        |        | 016-00                                |                      |
| CV.min         7.00         6.96         7.23         7.05         6.98         6.99 $sd(\mu)/\sigma = 1$ AICc         7.11 <b>6.95</b> 7.54         7.01         7.47 $\rho = 0.5$ AIC         9.49         9.69         10.29         7.65         Oracle : 6.11           BIC         9.75         8.86         9.54         8.14         Oracle : 6.11           CV.Ise         7.20         7.13         7.36         6.69         6.92         CV.min         6.61         6.57         6.86         6.67         6.59         6.59         sd( $\mu$ )/ $\sigma$ = 1           AIC         6.72 <b>6.56</b> 7.11         6.64         7.05 $\rho$ = 0.9           AIC         8.92         9.11         9.68         7.18         Oracle : 5.75           CV.Ise         30.41         30.51         30.62         28.92         30.45         CV.Ise         29.09         sd( $\mu$ )/ $\sigma$ = 0.5           AIC         28.81         29.04         32.33         29.50         29.02 $\rho$ = 0           AIC         44.19         45.58         47.69         36.58 <td rowspan<="" td=""><td>BIC</td><td>10.46</td><td>9.64</td><td>10.63</td><td>8.90</td><td></td><td></td><td></td><td><i>Oracle</i> : 6.88</td></td>   | <td>BIC</td> <td>10.46</td> <td>9.64</td> <td>10.63</td> <td>8.90</td> <td></td> <td></td> <td></td> <td><i>Oracle</i> : 6.88</td> | BIC   | 10.46                          | 9.64                            | 10.63 | 8.90  |        |        |                                       | <i>Oracle</i> : 6.88 |
| AICc 7.11 6.95 7.54 7.01 7.47 $\rho = 0.5$ AIC 9.49 9.69 10.29 7.65 $\rho = 0.5$ AIC 9.75 8.86 9.54 8.14 $\rho = 0.5$ AIC 9.75 8.86 9.54 8.14 $\rho = 0.5$ AIC CV.1se 7.20 7.13 7.36 6.69 6.92 $\rho = 0.5$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.5$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.5$ AIC 28.91 29.51 30.38 30.23 28.94 29.01 $\rho = 0.5$ AIC 44.19 45.58 47.69 36.58 $\rho = 0.5$ AIC 44.19 45.58 47.69 36.58 $\rho = 0.5$ AIC 25.89 26.35 27.03 27.01 25.93 25.96 $\rho = 0.5$ AIC 25.89 26.35 27.03 27.01 25.93 25.96 $\rho = 0.5$ AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $\rho = 0.5$ AIC 24.45 24.87 25.48 25.45 24.47 25.56 $\rho = 0.5$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.5$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.5$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.5$ AIC 27.20 38.04 39.80 30.65   | CV.1se   | 7.64  | 7.56                           | 7.75                            | 7.05  | 7.34  |        |        |                                       |                      |
| AICc 7.11 6.95 7.54 7.01 7.47 $\rho = 0.5$ AIC 9.49 9.69 10.29 7.65 $\rho = 0.5$ AIC 9.49 9.69 10.29 7.65 $\rho = 0.5$ AIC 9.75 8.86 9.54 8.14 $\rho = 0.5$ AIC 9.75 8.86 9.54 8.14 $\rho = 0.5$ AICc 6.72 6.56 7.11 6.64 7.05 $\rho = 0.9$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.9$ AIC 8.92 9.11 9.68 7.77 $\rho = 0.9$ AIC 8.91 29.51 30.38 30.23 28.94 29.01 $\rho = 0.5$ AICc 28.81 29.04 32.33 29.50 29.02 $\rho = 0.5$ AIC 44.19 45.58 47.69 36.58 $\rho = 0.5$ AIC 44.19 45.58 47.69 36.58 BIC 30.59 30.57 30.65 30.31 $\rho = 0.5$ AICc 25.77 25.89 29.02 26.38 27.03 27.01 25.93 25.96 $\rho = 0.5$ AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $\rho = 0.5$ AICc 24.45 24.87 25.48 25.45 24.47 25.56 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65  | CV.min   | 7.00  | 6.96                           | 7.23                            | 7.05  | 6.98  | 6.99   |        | $sd(\mu)/\sigma = 1$                  |                      |
| BIC 9.75 8.86 9.54 8.14   | AICc   | 7.11  | 6.95                           | 7.54                            | 7.01  |       |        | 7.47   |                                       |                      |
| BIC         9.75         8.86         9.54         8.14           CV.1se         7.20         7.13         7.36         6.69         6.92           CV.min         6.61         6.57         6.86         6.67         6.59         6.59           AIC         8.92         9.11         9.68         7.18         7.05 $\rho = 0.9$ AIC         8.92         9.11         9.68         7.18         0racle: 5.75           CV.1se         30.41         30.51         30.62         28.92         30.45           CV.min         28.91         29.51         30.38         30.23         28.94         29.01         sd(μ)/ $\sigma = 0.5$ AIC         44.19         45.58         47.69         36.58         29.02 $\rho = 0$ BIC         30.59         30.57         30.65         30.31         0racle: 26.71           CV.1se         27.07         27.11         27.19         25.86         27.08           CV.min         25.89         26.35         27.03         27.01         25.93         25.96           AIC         39.26         40.45         42.30         32.78         0racle: 23.69           CV.1se   | AIC  | 9.49  | 9.69                           | 10.29                           | 7.65  |       |        |        | 0 1 (11                               |                      |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC  | 9.75  | 8.86                           | 9.54                            | 8.14  |       |        |        | <i>Oracle</i> : 6.11                  |                      |
| AICc 6.72 <b>6.56</b> 7.11 6.64 7.05 $\rho = 0.9$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.9$ AIC 9.29 8.44 9.08 7.77 $\rho = 0.9$ AIC 28.91 30.41 30.51 30.62 28.92 30.45 $\rho = 0.9$ AIC 28.81 29.04 32.33 29.50 29.02 $\rho = 0$ AIC 44.19 45.58 47.69 36.58 BIC 30.59 30.57 30.65 30.31 $\rho = 0.5$ AICc 27.07 27.11 27.19 25.86 27.08 $\rho = 0.5$ AIC 25.77 25.89 29.02 26.38 $\rho = 0.5$ AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $\rho = 0.5$ AIC 24.32 24.45 24.87 25.56 $\rho = 0.5$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.5$ AIC 36.90 38.04 39.80 30.65 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65 $\rho = 0.9$ AIC 27.20 26.98 $\rho = 0.5$ AIC 36.90 38.04 39.80 30.65 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65   | CV.1se   | 7.20  | 7.13                           | 7.36                            | 6.69  | 6.92  |        |        |                                       |                      |
| AICc 6.72 <b>6.56</b> 7.11 6.64 7.05 $\rho = 0.9$ AIC 8.92 9.11 9.68 7.18 $\rho = 0.9$ AIC 9.29 8.44 9.08 7.77 $\rho = 0.9$ AIC 7.05 $\rho = 0.9$ AIC 9.29 8.44 9.08 7.77 $\rho = 0.9$ AIC 28.91 29.51 30.38 30.23 28.94 29.01 $\rho = 0.5$ AIC 28.81 29.04 32.33 29.50 29.02 $\rho = 0$ AIC 44.19 45.58 47.69 36.58 BIC 30.59 30.57 30.65 30.31 $\rho = 0.5$ AIC 27.07 27.11 27.19 25.86 27.08 $\rho = 0.5$ AIC 25.77 25.89 29.02 26.38 $\rho = 0.5$ AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $\rho = 0.5$ AIC 24.32 24.45 24.87 25.56 $\rho = 0.5$ AIC 24.32 24.42 27.06 24.91 24.43 $\rho = 0.5$ AIC 36.90 38.04 39.80 30.65 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65   | CV.min   | 6.61  | 6.57                           | 6.86                            | 6.67  | 6.59  | 6.59   |        | $sd(\mu)/\sigma = 1$                  |                      |
| AIC 8.92 9.11 9.68 7.18 $Oracle: 5.75$ $BIC$ 9.29 8.44 9.08 7.77 $Oracle: 5.75$  |  |       |                                |                                 |       |       |        | 7.05   |                                       |                      |
| BIC         9.29         8.44         9.08         7.77         Oracle: 5./5           CV.1se         30.41         30.51         30.62         28.92         30.45           CV.min         28.91         29.51         30.38         30.23         28.94         29.01 $sd(\mu)/\sigma = 0.5$ AICc         28.81         29.04         32.33         29.50         29.02 $\rho = 0$ AIC         44.19         45.58         47.69         36.58         00racle: 26.71           BIC         30.59         30.57         30.65         30.31         0racle: 26.71           CV.1se         27.07         27.11         27.19         25.86         27.08           CV.min         25.89         26.35         27.03         27.01         25.93         25.96 $sd(\mu)/\sigma = 0.5$ AIC         39.26         40.45         42.30         32.78         0racle: 23.69           CV.1se         25.52         25.57         25.62         24.47         25.56           CV.min         24.45         24.87         25.48         25.45         24.47         24.52 $sd(\mu)/\sigma = 0.5$ AIC         36.90         38.04         39.80 <td>AIC</td> <td>8.92</td> <td>9.11</td> <td>9.68</td> <td>7.18</td> <td></td> <td></td> <td></td> <td>, , , , , , , , ,</td>  | AIC  | 8.92  | 9.11                           | 9.68                            | 7.18  |       |        |        | , , , , , , , , ,                     |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |  |       |                                |                                 |       |       |        |        | <i>Oracle</i> : 5.75                  |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |  |       |                                |                                 |       | 30.45 |        |        |                                       |                      |
| AICc 28.81 29.04 32.33 29.50 29.02 $\rho = 0$ AIC 44.19 45.58 47.69 36.58 BIC 30.59 30.57 30.65 30.31 $Oracle: 26.71$ CV.1se 27.07 27.11 27.19 25.86 27.08 CV.min 25.89 26.35 27.03 27.01 25.93 25.96 AICc 25.77 25.89 29.02 26.38 25.88 $\rho = 0.5$ AIC 39.26 40.45 42.30 32.78 BIC 27.17 27.16 27.20 26.98 $Oracle: 23.69$ CV.1se 25.52 25.57 25.62 24.47 25.56 CV.min 24.45 24.87 25.48 25.45 24.47 24.52 AICc 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65   |  |       |                                |                                 |       |       | 29.01  |        | $sd(\mu)/\sigma = 0.5$                |                      |
| AIC 44.19 45.58 47.69 36.58 $Oracle: 26.71$ BIC 30.59 30.57 30.65 30.31 $Oracle: 26.71$ CV.1se 27.07 27.11 27.19 25.86 27.08 $Oracle: 25.89$ 26.35 27.03 27.01 25.93 25.96 $Oracle: 25.89$ AIC 25.77 25.89 29.02 26.38 25.88 $Oracle: 23.69$ BIC 27.17 27.16 27.20 26.98 $Oracle: 23.69$ CV.1se 25.52 25.57 25.62 24.47 25.56 $Oracle: 23.69$ CV.min 24.45 24.87 25.48 25.45 24.47 24.52 $Oracle: 23.69$ AIC 36.90 38.04 39.80 30.65 $Oracle: 23.39$  | AICc   | 28.81 | 29.04                          | 32.33                           | 29.50 |       |        | 29.02  | . , ,                                 |                      |
| BIC         30.59         30.57         30.65         30.31           CV.1se         27.07         27.11         27.19         25.86         27.08           CV.min         25.89         26.35         27.03         27.01         25.93         25.96 $sd(\mu)/\sigma = 0.5$ AIC         25.77         25.89         29.02         26.38         25.88 $\rho = 0.5$ AIC         39.26         40.45         42.30         32.78         Oracle: 23.69           EV.1se         27.17         27.16         27.20         26.98         Oracle: 23.69           CV.1se         25.52         25.57         25.62         24.47         25.56         Sd.( $\mu$ )/ $\sigma$ = 0.5           AIC         24.45         24.42         27.06         24.91         24.43 $\rho$ = 0.9           AIC         36.90         38.04         39.80         30.65         24.47         24.43 $\rho$  | AIC  | 44.19 | 45.58                          | 47.69                           | 36.58 |       |        |        | ,                                     |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC  | 30.59 | 30.57                          | 30.65                           | 30.31 |       |        |        | <i>Oracle</i> : 26.71                 |                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se   | 27.07 |                                | 27.19                           |       | 27.08 |        |        |                                       |                      |
| AICc 25.77 25.89 29.02 26.38 25.88 $\rho = 0.5$ AIC 39.26 40.45 42.30 32.78 Oracle : 23.69 BIC 27.17 27.16 27.20 26.98 CV.1se 25.52 25.57 25.62 24.47 25.56 CV.min 24.45 24.87 25.48 25.45 24.47 24.52 $\sin(\mu)/\sigma = 0.5$ AICc 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65   |  |       | 26.35                          |                                 |       | 25.93 | 25.96  |        | $sd(\mu)/\sigma = 0.5$                |                      |
| AIC       39.26       40.45       42.30       32.78       Oracle : 23.69         BIC       27.17       27.16       27.20       26.98       Oracle : 23.69         CV.1se       25.52       25.57       25.62       24.47       25.56         CV.min       24.45       24.87       25.48       25.45       24.47       24.52 $sd(\mu)/\sigma = 0.5$ AIC       24.32       24.42       27.06       24.91       24.43 $\rho = 0.9$ AIC       36.90       38.04       39.80       30.65       Oracle : 22.33  |  | 25.77 | 25.89                          |                                 |       |       |        | 25.88  | · //                                  |                      |
| BIC         27.17         27.16         27.20         26.98         Oracle: 23.69           CV.1se         25.52         25.57         25.62         24.47         25.56 $sd(\mu)/\sigma = 0.5$ CV.min         24.45         24.87         25.48         25.45         24.47         24.52 $sd(\mu)/\sigma = 0.5$ AIC         36.90         38.04         39.80         30.65 $Oracle: 22.33$   |  |       |                                |                                 |       |       |        |        | ,                                     |                      |
| CV.1se       25.52       25.57       25.62       24.47       25.56         CV.min       24.45       24.87       25.48       25.45       24.47       24.52 $sd(\mu)/\sigma = 0.5$ AICc       24.32       24.42       27.06       24.91       24.43 $\rho = 0.9$ AIC       36.90       38.04       39.80       30.65       0racle: 22.33  |  |       |                                |                                 |       |       |        |        | <i>Oracle</i> : 23.69                 |                      |
| CV.min 24.45 24.87 25.48 25.45 24.47 24.52 $\sin(\mu)/\sigma = 0.5$ AICc 24.32 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65   | -  |       |                                |                                 |       | 25.56 |        |        |                                       |                      |
| AICc <b>24.32</b> 24.42 27.06 24.91 24.43 $\rho = 0.9$ AIC 36.90 38.04 39.80 30.65  |  |       |                                |                                 |       |       | 24.52  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |                      |
| AIC 36.90 38.04 39.80 30.65   |  |       |                                |                                 |       |       |        | 24.43  | · //                                  |                      |
| $1 \operatorname{Iracle} \cdot 1/33$  |  |       |                                |                                 |       |       |        |        | ,                                     |                      |
| DIC 15.00 15.07 15.05 15.TJ   | BIC  | 25.60 | 25.59                          | 25.63                           | 25.45 |       |        |        | <i>Oracle</i> : 22.33                 |                      |

Table 29: Predictive MSE for n=1000, binary design, dense covariates, and decay 100.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|------------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 4.93  | 4.93                           | 5.13                         | 4.95  | 4.74  |        |        |                                       |
| CV.min | 4.56  | 4.55                           | 4.77                         | 4.69  | 4.54  | 4.56   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.97  | 4.74                           | 4.69                         | 4.82  |       |        | 4.69   | $\rho = 0$                            |
| AIC    | 5.26  | 5.36                           | 5.71                         | 4.65  |       |        |        | Oracle: 3.92                          |
| BIC    | 11.76 | 7.65                           | 5.74                         | 6.80  |       |        |        | 07 acic : 3.72                        |
| CV.1se | 4.43  | 4.41                           | 4.59                         | 4.50  | 4.26  |        |        |                                       |
| CV.min | 4.09  | 4.06                           | 4.25                         | 4.25  | 4.06  | 4.08   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.49  | 4.27                           | 4.16                         | 4.37  |       |        | 4.16   | $\rho = 0.5$                          |
| AIC    | 4.68  | 4.76                           | 5.06                         | 4.19  |       |        |        | Oracle: 3.47                          |
| BIC    | 12.00 | 7.34                           | 5.10                         | 6.48  |       |        |        | 07466.3.47                            |
| CV.1se | 4.17  | 4.16                           | 4.31                         | 4.30  | 4.00  |        |        |                                       |
| CV.min | 3.86  | 3.83                           | 3.99                         | 4.04  | 3.83  | 3.84   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.24  | 4.03                           | 3.93                         | 4.17  |       |        | 3.93   | $\rho = 0.9$                          |
| AIC    | 4.40  | 4.47                           | 4.76                         | 3.97  |       |        |        | Oracle: 3.27                          |
| BIC    | 11.64 | 7.13                           | 4.80                         | 6.31  |       |        |        | 01 acte : 3.21                        |
| CV.1se | 18.86 | 19.46                          | 22.40                        | 17.23 | 18.29 |        |        |                                       |
| CV.min | 16.91 | 17.35                          | 20.03                        | 17.04 | 16.91 | 16.95  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 17.48 | 17.08                          | 18.88                        | 17.04 |       |        | 17.83  | $\rho = 0$                            |
| AIC    | 21.90 | 22.52                          | 23.77                        | 18.38 |       |        |        | Oracle : 14.88                        |
| BIC    | 24.64 | 24.28                          | 24.73                        | 22.96 |       |        |        | Oracie: 14.00                         |
| CV.1se | 17.09 | 17.59                          | 20.25                        | 15.52 | 16.55 |        |        |                                       |
| CV.min | 15.17 | 15.53                          | 18.18                        | 15.31 | 15.17 | 15.21  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 15.75 | 15.30                          | 16.73                        | 15.32 |       |        | 16.25  | $\rho = 0.5$                          |
| AIC    | 19.43 | 19.95                          | 21.04                        | 16.45 |       |        |        | Oma ele . 12 17                       |
| BIC    | 21.85 | 21.67                          | 21.93                        | 20.83 |       |        |        | <i>Oracle</i> : 13.17                 |
| CV.1se | 16.11 | 16.52                          | 19.24                        | 14.72 | 15.62 |        |        |                                       |
| CV.min | 14.32 | 14.64                          | 17.15                        | 14.48 | 14.33 | 14.35  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 14.91 | 14.44                          | 15.77                        | 14.52 |       |        | 15.32  | $\rho = 0.9$                          |
| AIC    | 18.27 | 18.76                          | 19.80                        | 15.47 |       |        |        | . 1 12 42                             |
| BIC    | 20.60 | 20.48                          | 20.64                        | 19.70 |       |        |        | <i>Oracle</i> : 12.42                 |
| CV.1se | 61.85 | 61.95                          | 61.96                        | 59.96 | 61.90 |        |        |                                       |
| CV.min | 60.09 | 61.49                          | 61.94                        | 62.57 | 60.06 | 60.24  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 59.74 | 61.12                          | 64.65                        | 60.97 |       |        | 60.84  | $\rho = 0$                            |
| AIC    | 89.79 | 93.17                          | 96.87                        | 76.06 |       |        |        | 0156.20                               |
| BIC    | 61.93 | 61.94                          | 61.96                        | 61.79 |       |        |        | <i>Oracle</i> : 56.30                 |
| CV.1se | 54.84 | 54.89                          | 54.90                        | 53.43 | 54.87 |        |        |                                       |
| CV.min | 53.63 | 54.59                          | 54.90                        | 55.72 | 53.68 | 53.77  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 53.28 | 54.24                          | 57.69                        | 54.35 |       |        | 53.99  | $\rho = 0.5$                          |
| AIC    | 79.60 | 82.49                          | 85.78                        | 67.95 |       |        |        |                                       |
| BIC    | 54.88 | 54.89                          | 54.90                        | 54.78 |       |        |        | <i>Oracle</i> : 49.87                 |
| CV.1se | 51.68 | 51.71                          | 51.72                        | 50.51 | 51.71 |        |        |                                       |
| CV.min | 50.61 | 51.47                          | 51.72                        | 52.52 | 50.62 | 50.75  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 50.25 | 51.16                          | 54.14                        | 51.30 |       |        | 50.95  | $\rho = 0.9$                          |
| AIC    | 74.83 | 77.59                          | 80.74                        | 63.52 |       |        |        |                                       |
| BIC    | 51.70 | 51.70                          | 51.72                        | 51.63 |       |        |        | <i>Oracle</i> : 46.94                 |
|        |       |                                |                              |       |       |        |        | L                                     |

Table 30: Predictive MSE for n=1000, binary design, dense covariates, and decay 200.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL     | MCP    | CVbest | ICbest |                                     |
|---|--------|--------|--------------------------------|------------------------------|--------|--------|--------|--------|-------------------------------------|
| AICC 12.40 11.26 10.74 11.43 10.74 $\rho = 0$ AICC 10.87 11.12 11.75 10.29 BIC 31.02 30.70 22.48 28.59  CV.lse 10.11 10.55 13.01 10.54 9.67 CV.min 8.99 9.22 10.54 9.69 8.93 9.00 $sd(\mu)/\sigma = 2$ AICC 11.39 10.18 9.56 10.45 9.59 BIC 27.48 27.38 21.35 26.13  CV.lse 9.46 9.91 12.60 10.08 9.07 CV.min 8.46 8.67 9.98 9.21 8.41 8.47 CV.lmin 8.46 8.67 9.98 9.21 8.41 8.47 AICC 10.75 9.61 9.01 9.99 9.01 $\rho = 0.9$ AIC 25.87 25.76 20.43 24.77  CV.lse 42.32 46.60 49.69 37.25 41.22 CV.lsi 36.36 40.66 48.78 36.41 36.32 36.42 AICC 38.68 36.96 40.79 36.80 37.23 $\rho = 0.8$ AIC 44.46 45.96 48.21 38.73 BIC 49.76 49.76 49.81 49.26 CV.lsi 38.81 42.45 44.07 33.54 38.03 CV.lmin 32.89 37.27 43.45 32.7 32.83 32.93 AIC 39.44 40.71 42.68 34.60 BIC 44.09 44.08 44.12 43.75 CV.lse 36.66 39.88 41.48 31.83 36.00 CV.lse 124.61 124.67 124.67 122.31 124.65 CV.lse 135.10 130.39 110.40 108.74 110.39 CV.lse 124.61 124.67 124.67 122.51 124.65 CV.lse 103.91 10.39 110.40 108.74 110.39 CV.lse 103.91 10.39 110.40 108.74 110.39 CV.lse 103.91 103.92 103.92 102.63 103.92 |        |        |                                |                              |        |        |        |        |                                     |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.min | 10.01  | 10.28                          |                              | 10.65  | 9.96   | 10.02  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| BIC 31.02 30.70 22.48 28.59   |        |        | 11.26                          | 10.74                        |        |        |        | 10.74  | $\rho = 0$                          |
| Since   10.11   10.55   13.01   10.54   9.67  |        |        |                                |                              |        |        |        |        | $Oracle \cdot 8.00$                 |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | 31.02  | 30.70                          | 22.48                        |        |        |        |        | 07466.0.77                          |
| AICC 11.39 10.18 9.56 10.45 9.29 BIC 27.48 27.38 21.35 26.13  |        |        |                                |                              |        |        |        |        |                                     |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              | 9.69   | 8.93   | 9.00   |        |                                     |
| BIC 27.48 27.38 21.35 26.13   |        |        |                                |                              |        |        |        | 9.56   | $\rho = 0.5$                        |
| CV.1se   9.46   9.91   12.60   10.08   9.07   Sd( $\mu$ )/ $\sigma$ = 2   AIC   10.75   9.61   9.01   9.99   9.99   9.01   $\rho$ = 0.9   AIC   9.07   9.27   9.78   8.78   BIC   25.87   25.76   20.43   24.77   Oracle : 7.51   |        | 9.65   | 9.86                           | 10.40                        | 9.29   |        |        |        | $Oraclo \cdot 7.07$                 |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    |        |                                | 21.35                        |        |        |        |        | Oracle . 1.91                       |
| AICc 10.75 9.61 9.01 9.99 9.99 9.01 $\rho = 0.9$ AIC 9.07 9.27 9.78 8.78 BIC 25.87 25.76 20.43 24.77 $\rho = 0.9$ CV.1se 42.32 46.60 49.69 37.25 41.22 $\rho = 0.0$ AIC 44.46 45.96 48.21 38.73 $\rho = 0.0$ AIC 49.76 49.81 49.26 $\rho = 0.0$ AIC 35.14 33.13 36.23 33.10 33.54 38.03 $\rho = 0.0$ AIC 39.44 40.71 42.68 34.60 $\rho = 0.0$ AIC 39.44 40.71 42.68 34.60 $\rho = 0.0$ AIC 39.44 40.71 42.68 34.60 $\rho = 0.0$ AIC 30.66 39.88 41.48 31.83 36.00 $\rho = 0.0$ AIC 30.09 31.24 34.04 31.35 $\rho = 0.0$ AIC 37.06 38.26 40.14 32.51 $\rho = 0.0$ AIC 37.06 38.26 40.14 32.51 $\rho = 0.0$ AIC 121.94 127.84 127.54 124.38 124.55 $\rho = 0.9$ AIC 121.94 127.84 127.54 124.38 110.39 110.40 108.74 110.39 $\rho = 0.0$ AIC 103.81 110.39 110.40 108.74 110.39 $\rho = 0.0$ AIC 103.91 103.92 103.92 102.63 103.92 $\rho = 0.0$ AIC 190.74 157.29 162.82 129.44 $\rho = 0.0$ AIC 190.75 103.86 103.98 106.77 102.85 102.94 AIC 190.75 157.29 162.82 129.44 $\rho = 0.0$ AIC 190.75 103.86 103.98 106.77 102.85 102.94 AIC 190.75 105.01 104.97 $\rho = 0.0$ AIC 190.77 157.29 162.82 129.44  | CV.1se | 9.46   | 9.91                           | 12.60                        | 10.08  | 9.07   |        |        |                                     |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min | 8.46   | 8.67                           | 9.98                         | 9.21   | 8.41   | 8.47   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| BIC 25.87 25.76 20.43 24.77   |        |        |                                |                              |        |        |        | 9.01   | $\rho = 0.9$                        |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | AIC    | 9.07   | 9.27                           | 9.78                         | 8.78   |        |        |        | $Oraclo \cdot 7.51$                 |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 25.87  | 25.76                          | 20.43                        | 24.77  |        |        |        | 07466.7.31                          |
| AICc 38.68 36.96 40.79 36.80 37.23 $\rho = 0$ AIC 44.46 45.96 48.21 38.73 BIC 49.76 49.76 49.81 49.26  CV.1se 38.81 42.45 44.07 33.54 38.03  CV.min 32.89 37.27 43.45 32.7 32.83 32.93 $\operatorname{sd}(\mu)/\sigma = 1$ AICc 35.14 33.13 36.23 33.10 33.62 $\rho = 0.5$ AIC 39.44 40.71 42.68 34.60  CV.1se 36.66 39.88 41.48 31.83 36.00  CV.min 31.09 34.94 40.95 30.91 31.05 31.14 $\operatorname{sd}(\mu)/\sigma = 1$ AICc 33.09 31.24 34.04 31.35 31.05 31.14 $\operatorname{sd}(\mu)/\sigma = 1$ AIC 37.06 38.26 40.14 32.51 BIC 41.50 41.50 41.53 41.22  CV.1se 124.61 124.67 124.67 122.31 124.65  CV.min 122.59 124.58 124.76 127.56 122.60 122.83 $\operatorname{AIC}(\mu)/\sigma = 0.5$ AIC 181.11 189.10 195.52 155.43 BIC 124.65 124.67 126.69 124.53  CV.1se 110.36 110.39 110.40 108.74 110.39  CV.min 109.04 110.34 110.47 113.45 109.10 109.19 $\operatorname{sd}(\mu)/\sigma = 0.5$ AIC 108.53 112.85 113.18 110.60 111.39 $\rho = 0.5$ AIC 108.53 112.85 113.18 110.60 111.39 $\rho = 0.5$ AIC 109.04 110.39 110.40 108.74 110.39  CV.1se 103.91 103.92 103.92 102.63 103.92  CV.min 102.75 103.86 103.98 106.77 102.85 102.94  AIC 102.27 106.26 106.53 104.36 102.94  AIC 102.27 106.26 106.53 104.36 104.97 $\rho = 0.9$ AIC 150.74 157.29 162.82 129.44   | CV.1se | 42.32  | 46.60                          | 49.69                        |        |        |        |        |                                     |
| AIC 44.46 45.96 49.76 49.81 49.26 $Oracle: 32.78$ BIC 49.76 49.76 49.81 49.26 $Oracle: 32.78$ CV.1se 38.81 42.45 44.07 33.54 38.03 $Oracle: 32.89$ 37.27 43.45 32.7 32.83 32.93 $oracle: 32.89$ 37.27 43.45 32.7 32.83 32.93 $oracle: 32.89$ $oracle: 32.89$ 37.27 43.45 32.7 32.83 32.93 $oracle: 29.05$ AIC 39.44 40.71 42.68 34.60 $oracle: 29.03$ BIC 44.09 44.08 44.12 43.75 $oracle: 29.03$ CV.1se 36.66 39.88 41.48 31.83 36.00 $oracle: 29.03$ AIC 37.06 38.26 40.14 32.51 $oracle: 29.03$ AIC 37.06 38.26 40.14 32.51 $oracle: 27.37$ BIC 41.50 41.50 41.53 41.22 $oracle: 27.37$ CV.1se 124.61 124.67 124.67 122.31 124.65 $oracle: 27.37$ CV.se 124.61 124.67 124.67 122.31 124.65 $oracle: 28.08$ AIC 181.11 189.10 195.52 155.43 $oracle: 28.08$ AIC 181.11 189.10 195.52 155.43 $oracle: 28.08$ AIC 198.53 112.85 113.18 110.60 108.74 110.39 $oracle: 28.08$ AIC 108.53 112.85 113.18 110.60 111.39 $oracle: 28.08$ AIC 108.53 112.85 113.18 110.60 111.39 $oracle: 29.05$ AIC 108.53 110.39 110.40 108.74 110.39 $oracle: 29.05$ AIC 108.53 112.85 113.18 110.60 111.39 $oracle: 29.05$ AIC 108.53 110.39 110.47 113.45 109.10 109.19 $oracle: 29.05$ AIC 108.53 110.39 110.40 108.74 110.39 $oracle: 29.05$ AIC 108.53 110.39 110.77 110.31 $oracle: 29.05$ AIC 108.57 110.38 110.39 110.77 110.31 $oracle: 29.05$ AIC 108.57 110.38 110.39 110.77 110.31 $oracle: 29.05$ AIC 108.57 103.86 103.98 106.77 102.85 102.94 $oracle: 29.05$ AIC 102.27 106.26 106.53 104.36 104.36 104.97 $oracle: 29.05$ AIC 102.27 106.26 106.53 104.36 104.36 104.97 $oracle: 29.05$ AIC 102.27 106.26 106.53 104.36 104.36 104.97 $oracle: 29.05$ AIC 102.27 106.26 106.53 104.36 104.36 104.97 $oracle: 29.05$ AIC 150.74 157.29 162.82 129.44  | CV.min | 36.36  | 40.66                          | 48.78                        | 36.41  | 36.32  | 36.42  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| BIC 49.76 49.76 49.81 49.26 $Oracle: 32.78$ $CV.Ise$ 38.81 42.45 44.07 33.54 38.03 $CV.min$ 32.89 37.27 43.45 32.7 32.83 32.93 $cV.Min$ 39.44 40.71 42.68 34.60 $cV.Min$ 31.09 44.08 44.12 43.75 $cV.Min$ 31.09 34.94 40.95 30.91 31.05 31.14 $cV.Min$ 31.09 34.94 40.95 30.91 31.05 31.14 $cV.Min$ 31.09 34.94 34.04 31.35 31.75 $cV.Min$ 37.06 38.26 40.14 32.51 $cV.Min$ 37.06 38.26 40.14 32.51 $cV.Min$ 31.25 124.67 124.67 122.31 124.65 $cV.Min$ 122.59 124.58 124.76 127.56 122.60 122.83 $cV.Min$ 122.59 124.58 124.76 127.56 122.60 122.83 $cV.Min$ 122.59 124.58 124.76 127.56 122.60 122.83 $cV.Min$ 122.59 124.67 126.69 124.53 $cV.Min$ 109.04 110.34 110.47 113.45 109.10 109.19 $cV.Min$ 109.04 110.34 110.47 113.45 109.10 109.19 $cV.Min$ 109.04 110.34 110.47 113.45 109.10 109.19 $cV.Min$ 109.04 110.38 110.39 110.40 108.74 110.39 $cV.Min$ 109.04 110.38 110.39 110.40 108.74 110.39 $cV.Min$ 109.04 110.38 110.39 110.40 108.74 110.39 $cV.Min$ 109.04 110.38 110.39 110.77 110.31 $cV.Min$ 102.75 103.86 103.92 102.63 103.92 $cV.Min$ 102.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 102.27 106.26 106.53 104.36 104.97 $cV.Min$ 102.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 102.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.75 103.86 103.98 106.77 102.85 102.94 $cV.Min$ 104.97 $cV.Min$ 105.15 105.46 105.54 104.96 $cV.Min$ 105.15 105.46 105.54 104.96 $cV.Min$ 105.15 105.15 105.86 106.53 104.3                | AICc   | 38.68  | 36.96                          | 40.79                        | 36.80  |        |        | 37.23  | $\rho = 0$                          |
| BIC         49./6         49./6         49.81         49.26           CV.Ise         38.81         42.45         44.07         33.54         38.03 $sd(\mu)/\sigma = 1$ AIC         35.14         33.13         36.23         33.10         33.62 $\rho = 0.5$ AIC         39.44         40.71         42.68         34.60         Oracle : 29.03           BIC         44.09         44.08         44.12         43.75         Oracle : 29.03           CV.Ise         36.66         39.88         41.48         31.83         36.00 $sd(\mu)/\sigma = 1$ AIC         33.09         31.24         34.04         31.35         31.75 $\rho = 0.9$ AIC         37.06         38.26         40.14         32.51         Oracle : 27.37           EV.Ise         124.61         124.67         124.67         122.31         124.65           CV.min         122.59         124.58         124.76         127.56         122.60         122.83 $sd(\mu)/\sigma = 0.5$ AIC         181.11         189.10         195.52         155.43         Oracle : 118.96           CV.Ise         110.36         110.39         110.40         108.74<  | AIC    | 44.46  | 45.96                          | 48.21                        | 38.73  |        |        |        | Oma ala . 22 79                     |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 49.76  | 49.76                          | 49.81                        | 49.26  |        |        |        | Oracie: 32.78                       |
| AICc 35.14 33.13 36.23 33.10 33.62 $\rho = 0.5$ AIC 39.44 40.71 42.68 34.60 $\rho = 0.5$ BIC 44.09 44.08 44.12 43.75 $\rho = 0.5$ CV.1se 36.66 39.88 41.48 31.83 36.00 $\rho = 0.5$ CV.min 31.09 34.94 40.95 30.91 31.05 31.14 $\rho = 0.9$ AIC 37.06 38.26 40.14 32.51 $\rho = 0.9$ AIC 41.50 41.50 41.53 41.22 $\rho = 0.9$ AIC 124.61 124.67 124.67 122.31 124.65 $\rho = 0.9$ AIC 121.94 127.84 127.54 124.38 126.15 $\rho = 0.9$ AIC 181.11 189.10 195.52 155.43 BIC 124.65 124.65 124.67 126.69 124.53 $\rho = 0.9$ AIC 180.36 110.39 110.40 108.74 110.39 $\rho = 0.5$ AICc 108.53 112.85 113.18 110.60 $\rho = 0.5$ AIC 108.53 112.85 113.18 110.60 $\rho = 0.5$ AIC 160.43 167.29 173.04 138.30 $\rho = 0.5$ AIC 10.38 110.39 110.77 110.31 $\rho = 0.5$ AIC 103.91 103.92 103.92 102.63 103.92 $\rho = 0.5$ AIC 102.27 106.26 106.53 104.36 104.36 104.97 $\rho = 0.9$ AIC 150.74 157.29 162.82 129.44 $\rho = 0.5$ AIC 150.74 157.29 162.82 129.44  | CV.1se | 38.81  | 42.45                          | 44.07                        | 33.54  | 38.03  |        |        |                                     |
| AIC 39.44 40.71 42.68 34.60 $Oracle: 29.03$ BIC 44.09 44.08 44.12 43.75 $Oracle: 29.03$ CV.1se 36.66 39.88 41.48 31.83 36.00 $Oracle: 29.03$ AIC 33.09 31.24 34.04 31.35 31.14 $oldsymbol{align} sd(\mu)/\sigma = 1$ AIC 37.06 38.26 40.14 32.51 $oldsymbol{align} oldsymbol{align} oldsymb$        | CV.min | 32.89  | 37.27                          | 43.45                        | 32.7   | 32.83  | 32.93  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| BIC 44.09 44.08 44.12 43.75  CV.1se 36.66 39.88 41.48 31.83 36.00  CV.min 31.09 34.94 40.95 30.91 31.05 31.14 $sd(\mu)/\sigma = 1$ AICc 33.09 31.24 34.04 31.35 31.75 $\rho = 0.9$ AIC 37.06 38.26 40.14 32.51  BIC 41.50 41.50 41.53 41.22  CV.1se 124.61 124.67 124.67 122.31 124.65  CV.min 122.59 124.58 124.76 127.56 122.60 122.83 $sd(\mu)/\sigma = 0.5$ AIC 181.11 189.10 195.52 155.43  BIC 124.65 124.67 126.69 124.53  CV.1se 110.36 110.39 110.40 108.74 110.39  CV.min 109.04 110.34 110.47 113.45 109.10 109.19  AIC 108.53 112.85 113.18 110.60 111.39 $\rho = 0.5$ AIC 160.43 167.29 173.04 138.30  BIC 110.38 110.39 110.77 110.31  CV.1se 103.91 103.92 103.92 102.63 103.92  CV.min 102.75 103.86 103.98 106.77 102.85 102.94  AIC 150.74 157.29 162.82 129.44  Oracle : 29.03  Oracle : 29.03  Oracle : 29.03  Oracle : 29.03  AIC 160.47 157.29 162.82 129.44  Oracle : 99.15  | AICc   | 35.14  | 33.13                          | 36.23                        | 33.10  |        |        | 33.62  | $\rho = 0.5$                        |
| BIC         44.09         44.08         44.12         43./5           CV.1se         36.66         39.88         41.48         31.83         36.00           CV.min         31.09         34.94         40.95         30.91         31.05         31.14 $sd(\mu)/\sigma = 1$ AIC         33.09         31.24         34.04         31.35         31.75 $\rho = 0.9$ AIC         37.06         38.26         40.14         32.51         Oracle : 27.37           BIC         41.50         41.53         41.22         Oracle : 27.37           CV.1se         124.61         124.67         124.67         122.31         124.65 $cv. min$ 122.59         124.58         124.76         127.56         122.60         122.83 $sd(\mu)/\sigma = 0.5$ AIC         181.11         189.10         195.52         155.43 $cv. min$ Dracle : 118.96           CV.1se         110.36         110.39         110.40         108.74         110.39 $cv. min$ $cv. min$ 109.04         110.34         110.47         113.45         109.10         109.19 $sd(\mu)/\sigma = 0.5$ AIC         160.43         167.29         173.04  | AIC    | 39.44  | 40.71                          | 42.68                        | 34.60  |        |        |        | Oma ala . 20 02                     |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 44.09  | 44.08                          | 44.12                        | 43.75  |        |        |        | Oracie : 29.03                      |
| AICc 33.09 31.24 34.04 31.35 31.75 $\rho = 0.9$ AIC 37.06 38.26 40.14 32.51 BIC 41.50 41.50 41.53 41.22  CV.1se 124.61 124.67 124.67 122.31 124.65 CV.min 122.59 124.58 124.76 127.56 122.60 122.83 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 121.94 127.84 127.54 124.38 126.15 $\rho = 0$ AIC 181.11 189.10 195.52 155.43 BIC 124.65 124.67 126.69 124.53  CV.1se 110.36 110.39 110.40 108.74 110.39 CV.min 109.04 110.34 110.47 113.45 109.10 109.19 $\operatorname{sd}(\mu)/\sigma = 0.5$ AIC 186.53 112.85 113.18 110.60 111.39 $\rho = 0.5$ AIC 160.43 167.29 173.04 138.30 BIC 110.38 110.39 110.77 110.31  CV.1se 103.91 103.92 103.92 102.63 103.92 CV.min 102.75 103.86 103.98 106.77 102.85 102.94 AICc 102.27 106.26 106.53 104.36 104.97 $\rho = 0.5$ AIC 150.74 157.29 162.82 129.44   | CV.1se | 36.66  | 39.88                          | 41.48                        | 31.83  | 36.00  |        |        |                                     |
| AIC 37.06 38.26 40.14 32.51 $Oracle: 27.37$   | CV.min | 31.09  | 34.94                          | 40.95                        | 30.91  | 31.05  | 31.14  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| BIC 41.50 41.50 41.53 41.22 $CV.1se$ 124.61 124.67 124.67 122.31 124.65 $CV.min$ 122.59 124.58 124.76 127.56 122.60 122.83 $sd(\mu)/\sigma = 0.5$ AICc 121.94 127.84 127.54 124.38 126.15 $\rho = 0$ AIC 181.11 189.10 195.52 155.43 $CV.1se$ 110.36 110.39 110.40 108.74 110.39 $CV.min$ 109.04 110.34 110.47 113.45 109.10 109.19 $cV.min$ 109.04 110.34 110.47 113.45 109.10 109.19 $cV.min$ 109.05 AIC 160.43 167.29 173.04 138.30 $cV.1se$ 103.91 103.92 103.92 102.63 103.92 $cV.1se$ 103.91 103.92 103.92 102.63 103.92 $cV.1se$ 103.91 103.92 103.92 102.63 103.92 $cV.1se$ 102.75 103.86 103.98 106.77 102.85 102.94 $cV.1se$ 104.97 $cV.1se$ 105.74 157.29 162.82 129.44 $cV.1se$ 104.97 $cV.1se$ 105.41 157.29 162.82 129.44   | AICc   | 33.09  | 31.24                          | 34.04                        | 31.35  |        |        | 31.75  | $\rho = 0.9$                        |
| BIC         41.50         41.50         41.53         41.22           CV.1se         124.61         124.67         124.67         122.31         124.65           CV.min         122.59         124.58         124.76         127.56         122.60         122.83 $sd(\mu)/\sigma = 0.5$ AIC         121.94         127.84         127.54         124.38         126.15 $\rho = 0$ AIC         181.11         189.10         195.52         155.43         0racle: 118.96           EV.1se         110.36         110.39         110.40         108.74         110.39         109.19 $sd(\mu)/\sigma = 0.5$ CV.min         109.04         110.34         110.47         113.45         109.10         109.19 $sd(\mu)/\sigma = 0.5$ AIC         160.43         167.29         173.04         138.30         111.39 $\rho = 0.5$ AIC         160.43         167.29         173.04         138.30         0racle: 105.41           CV.1se         103.91         103.92         103.92         102.63         103.92           CV.min         102.75         103.86         103.98         106.77         102.85         102.94 $sd(\mu)/\sigma = 0.5$ <td>AIC</td> <td>37.06</td> <td>38.26</td> <td>40.14</td> <td>32.51</td> <td></td> <td></td> <td></td> <td>Oma ala . 27 27</td>   | AIC    | 37.06  | 38.26                          | 40.14                        | 32.51  |        |        |        | Oma ala . 27 27                     |
| CV.min         122.59         124.58         124.76         127.56         122.60         122.83 $sd(\mu)/\sigma = 0.5$ AIC         121.94         127.84         127.54         124.38         126.15 $\rho = 0$ AIC         181.11         189.10         195.52         155.43         0racle: 118.96           BIC         124.65         124.67         126.69         124.53         0racle: 118.96           CV.1se         110.36         110.39         110.40         108.74         110.39         109.19 $sd(\mu)/\sigma = 0.5$ AIC         108.53         112.85         113.18         110.60         111.39 $\rho = 0.5$ AIC         160.43         167.29         173.04         138.30         111.39         Oracle: 105.41           CV.1se         103.91         103.92         103.92         102.63         103.92         Oracle: 105.41           CV.min         102.75         103.86         103.98         106.77         102.85         102.94 $sd(\mu)/\sigma = 0.5$ AIC         150.74         157.29         162.82         129.44         104.97 $\rho = 0.9$  | BIC    | 41.50  | 41.50                          | 41.53                        | 41.22  |        |        |        | Oracie : 21.31                      |
| AICc 121.94 127.84 127.54 124.38 126.15 $\rho = 0$ AIC 181.11 189.10 195.52 155.43 BIC 124.65 124.67 126.69 124.53  CV.1se 110.36 110.39 110.40 108.74 110.39 CV.min 109.04 110.34 110.47 113.45 109.10 109.19 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 108.53 112.85 113.18 110.60 111.39 $\rho = 0.5$ AIC 160.43 167.29 173.04 138.30 BIC 110.38 110.39 110.77 110.31  CV.1se 103.91 103.92 103.92 102.63 103.92 CV.min 102.75 103.86 103.98 106.77 102.85 102.94 AICc 102.27 106.26 106.53 104.36 104.97 $\rho = 0.5$ AIC 150.74 157.29 162.82 129.44  | CV.1se | 124.61 | 124.67                         | 124.67                       | 122.31 | 124.65 |        |        |                                     |
| AIC 181.11 189.10 195.52 155.43 $Oracle: 118.96$ BIC 124.65 124.67 126.69 124.53 $Oracle: 118.96$ CV.1se 110.36 110.39 110.40 108.74 110.39 $Oracle: 118.96$ CV.min 109.04 110.34 110.47 113.45 109.10 109.19 $oracle: 118.96$ AIC 160.43 167.29 173.04 138.30 $oracle: 108.53$ 110.39 110.77 110.31 $Oracle: 105.41$ CV.1se 103.91 103.92 103.92 102.63 103.92 $Oracle: 105.41$ CV.1se 103.91 103.92 103.98 106.77 102.85 102.94 $oracle: 106.26$ AIC 160.27 106.26 106.53 104.36 104.97 $oracle: 109.15$ AIC 150.74 157.29 162.82 129.44  | CV.min | 122.59 | 124.58                         | 124.76                       | 127.56 | 122.60 | 122.83 |        | $sd(\mu)/\sigma = 0.5$              |
| BIC         124.65         124.67         126.69         124.53         Oracle: 118.96           CV.1se         110.36         110.39         110.40         108.74         110.39 $10.39$ $10.40$ $10.74$ $110.39$ $10.10.39$ <td>AICc</td> <td>121.94</td> <td>127.84</td> <td>127.54</td> <td>124.38</td> <td></td> <td></td> <td>126.15</td> <td><math>\rho = 0</math></td>  | AICc   | 121.94 | 127.84                         | 127.54                       | 124.38 |        |        | 126.15 | $\rho = 0$                          |
| BIC         124.65         124.67         126.69         124.53           CV.1se         110.36         110.39         110.40         108.74         110.39           CV.min         109.04         110.34         110.47         113.45         109.10         109.19 $sd(\mu)/\sigma = 0.5$ AIC         160.43         167.29         173.04         138.30         111.39         Oracle: 105.41           BIC         110.38         110.39         110.77         110.31         Oracle: 105.41           CV.1se         103.91         103.92         103.92         102.63         103.92           CV.min         102.75         103.86         103.98         106.77         102.85         102.94 $sd(\mu)/\sigma = 0.5$ AIC         102.27         106.26         106.53         104.36         104.97 $\rho = 0.9$ AIC         150.74         157.29         162.82         129.44         Oracle: 99.15  | AIC    | 181.11 | 189.10                         | 195.52                       | 155.43 |        |        |        | Oragle : 118 06                     |
| CV.min         109.04         110.34         110.47         113.45         109.10         109.19 $sd(\mu)/\sigma = 0.5$ AIC         108.53         112.85         113.18         110.60         111.39 $\rho = 0.5$ AIC         160.43         167.29         173.04         138.30         <   | BIC    | 124.65 | 124.67                         | 126.69                       | 124.53 |        |        |        | Oracie . 116.90                     |
| AICc 108.53 112.85 113.18 110.60 111.39 $\rho = 0.5$ AIC 160.43 167.29 173.04 138.30 $\rho = 0.5$ BIC 110.38 110.39 110.77 110.31 $\rho = 0.5$ CV.1se 103.91 103.92 103.92 102.63 103.92 $\rho = 0.5$ CV.min 102.75 103.86 103.98 106.77 102.85 102.94 $\rho = 0.5$ AICc 102.27 106.26 106.53 104.36 104.97 $\rho = 0.5$ AIC 150.74 157.29 162.82 129.44  | CV.1se | 110.36 | 110.39                         | 110.40                       | 108.74 | 110.39 |        |        |                                     |
| AIC 160.43 167.29 173.04 138.30 $Oracle: 105.41$ BIC 110.38 110.39 110.77 110.31 $Oracle: 105.41$ CV.1se 103.91 103.92 103.92 102.63 103.92 $Oracle: 105.41$ CV.min 102.75 103.86 103.98 106.77 102.85 102.94 $oracle: 106.26$ AIC 150.74 157.29 162.82 129.44 $oracle: 99.15$ $Oracle: 99.15$  | CV.min | 109.04 | 110.34                         |                              | 113.45 | 109.10 | 109.19 |        | $sd(\mu)/\sigma = 0.5$              |
| BIC         110.38         110.39         110.77         110.31         Oracle: 105.41           CV.1se         103.91         103.92         103.92         102.63         103.92           CV.min         102.75         103.86         103.98         106.77         102.85         102.94 $sd(\mu)/\sigma = 0.5$ AICc         102.27         106.26         106.53         104.36         104.97 $\rho = 0.9$ AIC         150.74         157.29         162.82         129.44         Oracle: 99.15   | AICc   | 108.53 | 112.85                         | 113.18                       | 110.60 |        |        | 111.39 | $\rho = 0.5$                        |
| BIC       110.38       110.39       110.77       110.31         CV.1se       103.91       103.92       103.92       102.63       103.92         CV.min       102.75       103.86       103.98       106.77       102.85       102.94 $sd(\mu)/\sigma = 0.5$ AIC       102.27       106.26       106.53       104.36       104.97 $\rho = 0.9$ AIC       150.74       157.29       162.82       129.44       Oracle: 99.15   | AIC    | 160.43 | 167.29                         | 173.04                       | 138.30 |        |        |        | Oragle : 105 41                     |
| CV.min 102.75 103.86 103.98 106.77 102.85 102.94 $sd(\mu)/\sigma = 0.5$ AIC 150.74 157.29 162.82 129.44 $sd(\mu)/\sigma = 0.5$ $\rho = 0.9$   | BIC    | 110.38 | 110.39                         | 110.77                       | 110.31 |        |        |        | Oracie . 103.41                     |
| AICc <b>102.27</b> 106.26 106.53 104.36 104.97 $\rho = 0.9$ AIC 150.74 157.29 162.82 129.44   | CV.1se | 103.91 | 103.92                         | 103.92                       | 102.63 | 103.92 |        |        |                                     |
| AIC 150.74 157.29 162.82 129.44 Oracle: 99.15   | CV.min | 102.75 | 103.86                         | 103.98                       | 106.77 | 102.85 | 102.94 |        |                                     |
| Uracle · 99 13  | AICc   | 102.27 | 106.26                         | 106.53                       | 104.36 |        |        | 104.97 | $\rho = 0.9$                        |
| BIC 103.90 103.92 104.37 103.84   | AIC    | 150.74 | 157.29                         | 162.82                       | 129.44 |        |        |        | Ongolo : 00 15                      |
|   | BIC    | 103.90 | 103.92                         | 104.37                       | 103.84 |        |        |        | Oracle : 99.13                      |

Table 31: Predictive MSE for n=1000, continuous design, dense covariates, and decay 10.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|---------------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 1.38  | 1.35                           | 1.31                            | 1.32  | 1.28  |        |        |                                       |
| CV.min | 1.30  | 1.28                           | 1.25                            | 1.27  | 1.24  | 1.25   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.30  | 1.28                           | 1.27                            | 1.27  |       |        | 1.27   | $\rho = 0$                            |
| AIC    | 1.68  | 1.69                           | 1.78                            | 1.27  |       |        |        | Oracle: 1.18                          |
| BIC    | 1.42  | 1.37                           | 1.32                            | 1.32  |       |        |        | 07 acte : 1.10                        |
| CV.1se | 0.56  | 0.55                           | 0.51                            | 0.61  | 0.49  |        |        |                                       |
| CV.min | 0.53  | 0.51                           | 0.49                            | 0.59  | 0.47  | 0.49   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.53  | 0.52                           | 0.49                            | 0.59  |       |        | 0.49   | $\rho = 0.5$                          |
| AIC    | 0.61  | 0.61                           | 0.63                            | 0.59  |       |        |        | Oracle: 0.45                          |
| BIC    | 0.64  | 0.60                           | 0.54                            | 0.61  |       |        |        | Oracle . 0.43                         |
| CV.1se | 0.16  | 0.15                           | 0.14                            | 0.17  | 0.14  |        |        |                                       |
| CV.min | 0.15  | 0.15                           | 0.14                            | 0.17  | 0.13  | 0.14   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.15  | 0.15                           | 0.14                            | 0.17  |       |        | 0.14   | $\rho = 0.9$                          |
| AIC    | 0.15  | 0.14                           | 0.14                            | 0.17  |       |        |        | Oracle: 0.12                          |
| BIC    | 0.20  | 0.19                           | 0.17                            | 0.17  |       |        |        | Oracie: 0.12                          |
| CV.1se | 5.39  | 5.29                           | 5.15                            | 5.00  | 5.10  |        |        |                                       |
| CV.min | 5.08  | 5.01                           | 4.95                            | 5.13  | 4.94  | 4.95   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.08  | 5.02                           | 5.06                            | 5.08  |       |        | 5.05   | $\rho = 0$                            |
| AIC    | 7.41  | 7.50                           | 8.01                            | 5.27  |       |        |        | 0 1 470                               |
| BIC    | 5.41  | 5.32                           | 5.32                            | 5.09  |       |        |        | Oracle: 4.70                          |
| CV.1se | 2.19  | 2.12                           | 2.01                            | 2.08  | 1.94  |        |        |                                       |
| CV.min | 2.04  | 1.99                           | 1.92                            | 2.07  | 1.88  | 1.92   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 2.04  | 1.99                           | 1.94                            | 2.06  |       |        | 1.94   | $\rho = 0.5$                          |
| AIC    | 2.69  | 2.72                           | 2.89                            | 2.07  |       |        |        | 0 1 177                               |
| BIC    | 2.34  | 2.25                           | 2.12                            | 2.23  |       |        |        | Oracle: 1.77                          |
| CV.1se | 0.64  | 0.61                           | 0.56                            | 0.54  | 0.54  |        |        |                                       |
| CV.min | 0.58  | 0.57                           | 0.54                            | 0.52  | 0.53  | 0.54   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.58  | 0.57                           | 0.55                            | 0.52  |       |        | 0.57   | $\rho = 0.9$                          |
| AIC    | 0.61  | 0.61                           | 0.65                            | 0.52  |       |        |        | ,                                     |
| BIC    | 0.69  | 0.68                           | 0.68                            | 0.54  |       |        |        | Oracle: 0.48                          |
| CV.1se | 20.93 | 20.70                          | 20.51                           | 19.70 | 20.35 |        |        |                                       |
| CV.min | 19.78 | 19.65                          | 19.69                           | 20.92 | 19.64 | 19.66  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 19.76 | 19.76                          | 20.60                           | 20.41 |       |        | 19.76  | $\rho = 0$                            |
| AIC    | 31.66 | 32.29                          | 34.25                           | 24.31 |       |        |        |                                       |
| BIC    | 20.61 | 20.65                          | 21.70                           | 19.92 |       |        |        | <i>Oracle</i> : 18.68                 |
| CV.1se | 8.31  | 8.18                           | 8.01                            | 7.93  | 7.74  |        |        |                                       |
| CV.min | 7.81  | 7.71                           | 7.65                            | 8.19  | 7.48  | 7.65   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 7.78  | 7.73                           | 7.97                            | 8.10  |       |        | 7.78   | $\rho = 0.5$                          |
| AIC    | 11.66 | 11.85                          | 12.62                           | 8.89  |       |        |        |                                       |
| BIC    | 8.21  | 8.20                           | 8.22                            | 8.11  |       |        |        | Oracle: 7.04                          |
| CV.1se | 2.18  | 2.17                           | 2.12                            | 2.05  | 2.15  |        |        |                                       |
| CV.min | 2.09  | 2.09                           | 2.08                            | 2.02  | 2.07  | 2.08   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 2.09  | 2.09                           | 2.08                            | 2.03  | ,     |        | 2.08   | $\rho = 0.9$                          |
| AIC    | 2.66  | 2.74                           | 3.05                            | 2.03  |       |        |        | ,                                     |
| BIC    | 2.10  | 2.09                           | 2.08                            | 2.07  |       |        |        | Oracle: 1.91                          |
|        | 2.10  | 2.07                           | 2.00                            | 2.07  |       |        |        |                                       |

Table 32: Predictive MSE for n=1000, continuous design, dense covariates, and decay 50.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL     | MCP    | CVbest | ICbest |                                     |
|--------|--------|--------------------------------|---------------------------------|--------|--------|--------|--------|-------------------------------------|
| CV.1se | 8.89   | 8.75                           | 8.73                            | 8.62   | 8.46   |        |        |                                     |
| CV.min | 8.29   | 8.15                           | 8.22                            | 8.31   | 8.07   | 8.19   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 8.58   | 8.33                           | 8.21                            | 8.36   |        |        | 8.23   | $\rho = 0$                          |
| AIC    | 10.11  | 10.26                          | 10.96                           | 8.32   |        |        |        | Oracle: 7.12                        |
| BIC    | 11.38  | 10.69                          | 10.16                           | 9.86   |        |        |        | Oracle . 1.12                       |
| CV.1se | 3.36   | 3.26                           | 3.14                            | 3.80   | 3.02   |        |        |                                     |
| CV.min | 3.10   | 3.02                           | 2.95                            | 3.53   | 2.89   | 2.95   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 3.36   | 3.18                           | 2.92                            | 3.60   |        |        | 2.91   | $\rho = 0.5$                        |
| AIC    | 3.44   | 3.46                           | 3.65                            | 3.49   |        |        |        | Oracle: 2.44                        |
| BIC    | 7.68   | 5.31                           | 3.78                            | 5.59   |        |        |        | Oracie : 2.44                       |
| CV.1se | 0.63   | 0.61                           | 0.58                            | 1.17   | 0.56   |        |        |                                     |
| CV.min | 0.59   | 0.57                           | 0.55                            | 1.10   | 0.55   | 0.55   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 0.65   | 0.61                           | 0.55                            | 1.10   |        |        | 0.55   | $\rho = 0.9$                        |
| AIC    | 0.59   | 0.57                           | 0.56                            | 1.10   |        |        |        | Oracle: 0.44                        |
| BIC    | 1.67   | 1.66                           | 1.65                            | 1.25   |        |        |        | Oracie : 0.44                       |
| CV.1se | 34.06  | 33.85                          | 34.98                           | 31.42  | 32.94  |        |        |                                     |
| CV.min | 31.34  | 31.26                          | 32.68                           | 31.51  | 31.30  | 31.33  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 31.83  | 31.40                          | 33.52                           | 31.27  |        |        | 31.50  | $\rho = 0$                          |
| AIC    | 42.77  | 43.75                          | 46.49                           | 34.15  |        |        |        | •                                   |
| BIC    | 42.03  | 40.64                          | 48.29                           | 35.76  |        |        |        | Oracle: 27.62                       |
| CV.1se | 13.53  | 12.89                          | 13.06                           | 12.68  | 11.78  |        |        |                                     |
| CV.min | 11.81  | 11.55                          | 11.96                           | 12.24  | 11.26  | 11.61  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 12.25  | 11.78                          | 11.53                           | 12.34  |        |        | 11.74  | $\rho = 0.5$                        |
| AIC    | 14.53  | 14.78                          | 15.67                           | 12.45  |        |        |        | 0 1 0 45                            |
| BIC    | 16.62  | 16.65                          | 16.79                           | 16.24  |        |        |        | Oracle: 9.45                        |
| CV.1se | 2.91   | 2.78                           | 2.71                            | 2.50   | 2.29   |        |        |                                     |
| CV.min | 2.64   | 2.45                           | 2.48                            | 2.35   | 2.15   | 2.39   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 2.67   | 2.67                           | 2.62                            | 2.35   |        |        | 2.56   | $\rho = 0.9$                        |
| AIC    | 2.29   | 2.32                           | 2.52                            | 2.34   |        |        |        | 0 1 170                             |
| BIC    | 2.84   | 2.84                           | 2.82                            | 2.79   |        |        |        | Oracle: 1.72                        |
| CV.1se | 122.32 | 122.70                         | 123.15                          | 116.28 | 122.44 |        |        |                                     |
| CV.min | 116.26 | 118.42                         | 122.17                          | 121.45 | 116.33 | 116.64 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 115.83 | 118.96                         | 123.27                          | 118.51 |        |        | 115.82 | $\rho = 0$                          |
| AIC    | 177.17 | 182.78                         | 191.21                          | 146.86 |        |        |        | 0 1 107.15                          |
| BIC    | 123.05 | 123.19                         | 123.26                          | 121.93 |        |        |        | Oracle: 107.15                      |
| CV.1se | 42.16  | 42.17                          | 42.17                           | 41.75  | 42.16  |        |        |                                     |
| CV.min | 41.82  | 41.91                          | 42.11                           | 43.03  | 41.82  | 41.85  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 41.56  | 42.03                          | 42.18                           | 42.51  |        |        | 41.59  | $\rho = 0.5$                        |
| AIC    | 60.25  | 61.81                          | 64.90                           | 50.74  |        |        |        | 0 1 26.65                           |
| BIC    | 42.13  | 42.15                          | 42.17                           | 42.06  |        |        |        | Oracle: 36.65                       |
| CV.1se | 7.70   | 7.69                           | 7.67                            | 7.60   | 7.70   |        |        |                                     |
| CV.min | 7.50   | 7.49                           | 7.47                            | 7.50   | 7.46   | 7.47   |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 7.49   | 7.51                           | 7.49                            | 7.52   |        |        | 7.48   | $\rho = 0.9$                        |
| AIC    | 9.77   | 10.11                          | 11.15                           | 7.60   |        |        |        | •                                   |
| BIC    | 7.53   | 7.54                           | 7.54                            | 7.48   |        |        |        | Oracle: 6.68                        |
|        |        |                                |                                 |        |        |        |        |                                     |

Table 33: Predictive MSE for n=1000, continuous design, dense covariates, and decay 100.

| AICc 19.91 19.17 18.81 19.30 18.89             | $(\mu)/\sigma = 2$ $\rho = 0$ |
|--|-------------------------------|
| AICc 19.91 19.17 18.81 19.30 18.89             |                               |
|  | $\rho = 0$                    |
|  |                               |
| AIC 21.09 21.49 22.88 18.63                    | cle: 15.73                    |
| BIC 46.55 33.24 24.57 27.18                    | ие. 13.73                     |
| CV.1se 7.50 7.32 7.19 9.12 7.09                |                               |
| CV.min 6.74 <b>6.63</b> 6.69 8.03 6.70 6.65 sd | $(\mu)/\sigma = 2$            |
| AICc 8.11 7.40 6.65 8.66 6.65                  | $\rho = 0.5$                  |
| AIC 7.16 7.24 7.62 7.58                        | acle: 5.31                    |
| BIC 20./8 20.81 1/.61 20.27                    | acie . 5.51                   |
| CV.1se 1.32 1.28 1.23 2.70 1.26                |                               |
|  | $(\mu)/\sigma = 2$            |
| AICc 1.51 1.32 1.16 2.40 1.16                  | $\rho = 0.9$                  |
| AIC 1.18 <b>1.14</b> 1.15 2.36                 | acle: 0.90                    |
| BIC 3.33 3.33 3.31 3.28                        | acie . 0.90                   |
| CV.1se 75.68 78.22 89.56 69.05 73.29           |                               |
|  | $(\mu)/\sigma = 1$            |
| AICc 70.19 69.24 77.65 68.32 69.41             | $\rho = 0$                    |
| AIC 87.75 90.22 95.25 73.65                    | cle: 59.71                    |
| BIC 98.91 98.92 99.42 91.76                    |                               |
| CV.1se 32.61 32.35 33.50 27.99 31.66           |                               |
|  | $(\mu)/\sigma = 1$            |
| AICc 28.71 27.60 27.00 27.01 27.97             | $\rho = 0.5$                  |
| AIC 29.61 30.23 31.88 <b>26.46</b>             | cle: 20.16                    |
| BIC 33.51 33.54 33.58 33.30                    |                               |
| CV.1se 5.69 5.68 5.64 5.37 5.66                |                               |
|  | $(\mu)/\sigma = 1$            |
| AICc 5.41 5.49 5.47 4.92 5.42                  | $\rho = 0.9$                  |
| AIC <b>4.51</b> 4.59 5.00 4.75                 | acle: 3.43                    |
| BIC 5.51 5.48 5.47                             | acic . 5.45                   |
| CV.1se 248.48 248.75 248.83 240.83 248.64      |                               |
|  | $a)/\sigma = 0.5$             |
| AICc <b>239.87</b> 247.57 248.98 244.78 239.94 | $\rho = 0$                    |
| AIC 359.81 373.33 388.16 305.32                | le: 225.74                    |
| BIC 248.75 248.83 260.38 248.16                |                               |
| CV.1se 84.04 84.04 84.04 83.70 84.04           |                               |
|  | $a)/\sigma = 0.5$             |
| AICc <b>83.45</b> 84.01 84.08 85.29 83.43      | $\rho = 0.5$                  |
| AIC 120.66 124.51 130.20 103.48                | cle: 76.23                    |
| BIC 84.03 84.04 84.04 83.99                    |                               |
| CV.1se 14.33 14.33 14.29 14.34                 |                               |
|  | $a)/\sigma = 0.5$             |
| AICc <b>14.13</b> 14.20 14.25 14.25 14.14      | $\rho = 0.9$                  |
| AIC 18.82 19.62 21.33 14.53                    | cle: 12.97                    |
| BIC 14.23 14.25 14.31 14.17                    |                               |

Table 34: Predictive MSE for n=1000, continuous design, dense covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL     | MCP    | CVbest | ICbest |                                     |
|--------|--------|--------------------------------|---------------------------------|--------|--------|--------|--------|-------------------------------------|
| CV.1se | 44.42  | 46.71                          | 56.79                           | 46.06  | 42.76  |        |        |                                     |
| CV.min | 40.06  | 41.17                          | 46.59                           | 42.63  | 39.87  | 40.10  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 49.74  | 45.58                          | 43.24                           | 45.76  |        |        | 44.27  | $\rho = 0$                          |
| AIC    | 43.49  | 44.52                          | 47.03                           | 41.20  |        |        |        | <i>Oracle</i> : 36.05               |
| BIC    | 124.28 | 124.46                         | 72.81                           | 114.38 |        |        |        | 07ace . 30.03                       |
| CV.1se | 20.11  | 21.43                          | 39.27                           | 23.34  | 19.23  |        |        |                                     |
| CV.min | 15.20  | 15.65                          | 34.29                           | 19.50  | 15.17  | 15.14  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 26.86  | 19.33                          | 15.30                           | 22.13  |        |        | 15.30  | $\rho = 0.5$                        |
| AIC    | 14.76  | 14.97                          | 15.68                           | 16.30  |        |        |        | <i>Oracle</i> : 12.09               |
| BIC    | 41.76  | 41.80                          | 41.06                           | 41.46  |        |        |        | Oracie: 12.09                       |
| CV.1se | 5.61   | 5.64                           | 6.78                            | 6.32   | 6.14   |        |        |                                     |
| CV.min | 4.01   | 4.16                           | 6.49                            | 5.32   | 4.91   | 3.73   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 6.40   | 6.11                           | 2.57                            | 5.28   |        |        | 2.57   | $\rho = 0.9$                        |
| AIC    | 2.40   | 2.37                           | 2.43                            | 4.53   |        |        |        | Oracle: 1.98                        |
| BIC    | 6.66   | 6.66                           | 6.64                            | 6.60   |        |        |        | Oracie: 1.98                        |
| CV.1se | 169.30 | 187.88                         | 199.29                          | 149.02 | 165.35 |        |        |                                     |
| CV.min | 145.46 | 163.65                         | 195.22                          | 145.76 | 145.47 | 145.65 |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 155.35 | 149.68                         | 176.34                          | 147.26 |        |        | 151.51 | $\rho = 0$                          |
| AIC    | 178.00 | 184.00                         | 193.01                          | 154.99 |        |        |        |                                     |
| BIC    | 199.52 | 199.72                         | 199.19                          | 197.28 |        |        |        | <i>Oracle</i> : 131.43              |
| CV.1se | 66.93  | 67.00                          | 67.02                           | 59.80  | 66.97  |        |        |                                     |
| CV.min | 64.04  | 65.70                          | 66.87                           | 55.90  | 63.97  | 64.09  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 63.18  | 65.26                          | 63.30                           | 57.33  |        |        | 63.14  | $\rho = 0.5$                        |
| AIC    | 59.68  | 61.25                          | 64.28                           | 54.73  |        |        |        | 0 1 44 00                           |
| BIC    | 66.99  | 67.02                          | 67.02                           | 66.86  |        |        |        | Oracle: 44.09                       |
| CV.1se | 11.00  | 11.00                          | 10.99                           | 10.89  | 11.01  |        |        |                                     |
| CV.min | 10.74  | 10.74                          | 10.76                           | 10.35  | 10.73  | 10.72  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 10.65  | 10.82                          | 10.84                           | 10.27  |        |        | 10.65  | $\rho = 0.9$                        |
| AIC    | 9.05   | 9.31                           | 10.04                           | 9.44   |        |        |        | 0 1 7.22                            |
| BIC    | 10.86  | 10.87                          | 10.92                           | 10.78  |        |        |        | Oracle: 7.22                        |
| CV.1se | 499.75 | 499.92                         | 499.94                          | 490.79 | 499.87 |        |        |                                     |
| CV.min | 491.34 | 499.45                         | 500.31                          | 511.49 | 491.87 | 492.40 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 488.97 | 501.61                         | 499.93                          | 498.68 |        |        | 488.93 | $\rho = 0$                          |
| AIC    | 725.13 | 757.08                         | 782.66                          | 623.41 |        |        |        | 01 476.92                           |
| BIC    | 499.85 | 499.93                         | 702.82                          | 499.40 |        |        |        | <i>Oracle</i> : 476.83              |
| CV.1se | 167.73 | 167.73                         | 167.73                          | 167.37 | 167.73 |        |        |                                     |
| CV.min | 167.35 | 167.70                         | 167.82                          | 172.56 | 167.40 | 167.48 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 166.89 | 167.74                         | 167.73                          | 170.57 |        |        | 166.89 | $\rho = 0.5$                        |
| AIC    | 241.13 | 250.55                         | 260.98                          | 208.44 |        |        |        | 01150.04                            |
| BIC    | 167.72 | 167.73                         | 169.58                          | 167.68 |        |        |        | <i>Oracle</i> : 159.94              |
| CV.1se | 27.55  | 27.55                          | 27.55                           | 27.53  | 27.55  |        |        |                                     |
| CV.min | 27.44  | 27.45                          | 27.50                           | 27.54  | 27.44  | 27.44  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 27.39  | 27.50                          | 27.54                           | 27.60  |        |        | 27.39  | $\rho = 0.9$                        |
| AIC    | 36.95  | 38.80                          | 41.67                           | 28.31  |        |        |        | ,                                   |
| BIC    | 27.52  | 27.53                          | 27.55                           | 27.47  |        |        |        | Oracle: 26.20                       |
|        |        |                                |                                 |        |        |        |        |                                     |

Table 35: Predictive MSE for n=1000, binary design, sparse covariates, and decay 10.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | AL   | MCP  | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|------------------------------|------|------|--------|--------|---------------------------------------|
| CV.1se | 0.34  | 0.34                           | 0.33                         | 0.33 | 0.32 |        |        |                                       |
| CV.min | 0.32  | 0.32                           | 0.31                         | 0.32 | 0.31 | 0.31   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.32  | 0.32                           | 0.31                         | 0.32 |      |        | 0.31   | $\rho = 0$                            |
| AIC    | 0.42  | 0.42                           | 0.45                         | 0.32 |      |        |        | Oracle : <b>0.31</b>                  |
| BIC    | 0.35  | 0.34                           | 0.32                         | 0.33 |      |        |        | 07 actc . <b>0.31</b>                 |
| CV.1se | 0.31  | 0.30                           | 0.29                         | 0.30 | 0.29 |        |        |                                       |
| CV.min | 0.29  | 0.29                           | 0.28                         | 0.29 | 0.28 | 0.28   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.29  | 0.29                           | 0.28                         | 0.29 |      |        | 0.28   | $\rho = 0.5$                          |
| AIC    | 0.37  | 0.38                           | 0.40                         | 0.29 |      |        |        | Oracle : <b>0.28</b>                  |
| BIC    | 0.32  | 0.31                           | 0.29                         | 0.30 |      |        |        | 07acte . <b>0.20</b>                  |
| CV.1se | 0.29  | 0.29                           | 0.28                         | 0.28 | 0.27 |        |        |                                       |
| CV.min | 0.28  | 0.27                           | 0.26                         | 0.27 | 0.26 | 0.26   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.28  | 0.27                           | 0.26                         | 0.27 |      |        | 0.26   | $\rho = 0.9$                          |
| AIC    | 0.35  | 0.35                           | 0.37                         | 0.27 |      |        |        | Oracle : <b>0.26</b>                  |
| BIC    | 0.30  | 0.29                           | 0.27                         | 0.28 |      |        |        | 07 acte . <b>0.20</b>                 |
| CV.1se | 1.34  | 1.32                           | 1.29                         | 1.25 | 1.27 |        |        |                                       |
| CV.min | 1.26  | 1.25                           | 1.23                         | 1.28 | 1.23 | 1.23   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.26  | 1.25                           | 1.27                         | 1.27 |      |        | 1.27   | $\rho = 0$                            |
| AIC    | 1.85  | 1.87                           | 2.00                         | 1.31 |      |        |        | Oracle : 1.24                         |
| BIC    | 1.35  | 1.31                           | 1.29                         | 1.27 |      |        |        | Oracle : 1.24                         |
| CV.1se | 1.21  | 1.18                           | 1.15                         | 1.12 | 1.13 |        |        |                                       |
| CV.min | 1.14  | 1.12                           | 1.1                          | 1.15 | 1.1  | 1.10   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.14  | 1.12                           | 1.13                         | 1.14 |      |        | 1.13   | $\rho = 0.5$                          |
| AIC    | 1.65  | 1.67                           | 1.78                         | 1.18 |      |        |        | Oracle : 1.11                         |
| BIC    | 1.22  | 1.18                           | 1.15                         | 1.14 |      |        |        | Oracle: 1.11                          |
| CV.1se | 1.14  | 1.12                           | 1.09                         | 1.06 | 1.07 |        |        |                                       |
| CV.min | 1.08  | 1.06                           | 1.04                         | 1.08 | 1.04 | 1.05   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.08  | 1.06                           | 1.07                         | 1.08 |      |        | 1.07   | $\rho = 0.9$                          |
| AIC    | 1.55  | 1.57                           | 1.68                         | 1.11 |      |        |        | Oma ala . 1.05                        |
| BIC    | 1.16  | 1.12                           | 1.09                         | 1.09 |      |        |        | Oracle: 1.05                          |
| CV.1se | 5.21  | 5.16                           | 5.11                         | 4.90 | 5.07 |        |        |                                       |
| CV.min | 4.93  | 4.89                           | 4.90                         | 5.20 | 4.89 | 4.90   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.92  | 4.89                           | 5.17                         | 5.08 |      |        | 4.97   | $\rho = 0$                            |
| AIC    | 7.90  | 8.06                           | 8.55                         | 6.07 |      |        |        | 01100                                 |
| BIC    | 5.14  | 5.09                           | 5.21                         | 4.96 |      |        |        | <i>Oracle</i> : 4.98                  |
| CV.1se | 4.68  | 4.62                           | 4.56                         | 4.39 | 4.53 |        |        | -                                     |
| CV.min | 4.42  | 4.38                           | 4.38                         | 4.67 | 4.37 | 4.37   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.41  | 4.38                           | 4.62                         | 4.55 |      |        | 4.46   | $\rho = 0.5$                          |
| AIC    | 7.06  | 7.19                           | 7.62                         | 5.44 |      |        |        | 0 1 444                               |
| BIC    | 4.62  | 4.57                           | 4.64                         | 4.46 |      |        |        | Oracle : 4.44                         |
| CV.1se | 4.43  | 4.38                           | 4.33                         | 4.17 | 4.28 |        |        |                                       |
| CV.min | 4.18  | 4.15                           | 4.16                         | 4.40 | 4.13 | 4.15   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.18  | 4.15                           | 4.38                         | 4.31 |      |        | 4.23   | $\rho = 0.9$                          |
| AIC    | 6.65  | 6.78                           | 7.20                         | 5.08 |      |        |        | ·                                     |
| BIC    | 4.39  | 4.34                           | 4.40                         | 4.23 |      |        |        | Oracle : 4.20                         |
|        |       |                                |                              |      |      |        |        |                                       |

Table 36: Predictive MSE for n=1000, binary design, sparse covariates, and decay 50.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|--------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 2.11  | 2.06                           | 2.02                     | 2.04  | 1.97  |        |        |                                       |
| CV.min | 1.98  | 1.93                           | 1.91                     | 1.97  | 1.89  | 1.91   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 2.03  | 1.95                           | 1.93                     | 1.98  |       |        | 1.93   | $\rho = 0$                            |
| AIC    | 2.47  | 2.50                           | 2.68                     | 1.98  |       |        |        | Oracle: 1.66                          |
| BIC    | 2.59  | 2.38                           | 2.18                     | 2.29  |       |        |        | 07 acic . 1.00                        |
| CV.1se | 1.90  | 1.85                           | 1.81                     | 1.85  | 1.76  |        |        |                                       |
| CV.min | 1.78  | 1.73                           | 1.71                     | 1.78  | 1.69  | 1.71   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.83  | 1.76                           | 1.71                     | 1.79  |       |        | 1.72   | $\rho = 0.5$                          |
| AIC    | 2.20  | 2.23                           | 2.38                     | 1.79  |       |        |        | Oracle: 1.47                          |
| BIC    | 2.40  | 2.19                           | 1.95                     | 2.12  |       |        |        | Oracie: 1.47                          |
| CV.1se | 1.79  | 1.74                           | 1.70                     | 1.76  | 1.65  |        |        |                                       |
| CV.min | 1.68  | 1.64                           | 1.61                     | 1.69  | 1.59  | 1.62   |        | $sd(\mu)/\sigma = 2$                  |
| AICc   | 1.73  | 1.66                           | 1.62                     | 1.70  |       |        | 1.62   | $\rho = 0.9$                          |
| AIC    | 2.07  | 2.09                           | 2.23                     | 1.69  |       |        |        | Oracle: 1.38                          |
| BIC    | 2.28  | 2.08                           | 1.84                     | 2.02  |       |        |        | Oracie: 1.38                          |
| CV.1se | 8.24  | 8.17                           | 8.39                     | 7.62  | 7.95  |        |        |                                       |
| CV.min | 7.60  | 7.57                           | 7.86                     | 7.64  | 7.58  | 7.60   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.69  | 7.54                           | 8.30                     | 7.58  |       |        | 8.08   | $\rho = 0$                            |
| AIC    | 10.46 | 10.70                          | 11.38                    | 8.30  |       |        |        | -                                     |
| BIC    | 10.06 | 9.29                           | 10.18                    | 8.59  |       |        |        | Oracle: 6.62                          |
| CV.1se | 7.42  | 7.33                           | 7.47                     | 6.86  | 7.11  |        |        |                                       |
| CV.min | 6.82  | 6.77                           | 6.99                     | 6.87  | 6.78  | 6.79   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.92  | 6.76                           | 7.35                     | 6.82  |       |        | 7.26   | $\rho = 0.5$                          |
| AIC    | 9.31  | 9.51                           | 10.10                    | 7.46  |       |        |        | 0 1 7 00                              |
| BIC    | 9.38  | 8.53                           | 9.14                     | 7.86  |       |        |        | Oracle: 5.88                          |
| CV.1se | 6.99  | 6.92                           | 7.11                     | 6.51  | 6.71  |        |        |                                       |
| CV.min | 6.44  | 6.39                           | 6.65                     | 6.49  | 6.40  | 6.41   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.54  | 6.38                           | 6.88                     | 6.46  |       |        | 6.83   | $\rho = 0.9$                          |
| AIC    | 8.75  | 8.94                           | 9.50                     | 7.00  |       |        |        | •                                     |
| BIC    | 8.98  | 8.13                           | 8.69                     | 7.50  |       |        |        | Oracle: 5.54                          |
| CV.1se | 29.81 | 29.91                          | 30.03                    | 28.31 | 29.84 |        |        |                                       |
| CV.min | 28.31 | 28.88                          | 29.78                    | 29.60 | 28.34 | 28.39  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 28.2  | 28.41                          | 31.56                    | 28.90 |       |        | 28.40  | $\rho = 0$                            |
| AIC    | 43.35 | 44.71                          | 46.79                    | 35.84 |       |        |        | •                                     |
| BIC    | 30.01 | 29.97                          | 30.07                    | 29.69 |       |        |        | <i>Oracle</i> : 26.48                 |
| CV.1se | 26.57 | 26.62                          | 26.70                    | 25.36 | 26.60 |        |        |                                       |
| CV.min | 25.38 | 25.82                          | 26.53                    | 26.50 | 25.42 | 25.44  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 25.25 | 25.38                          | 28.50                    | 25.87 |       |        | 25.38  | $\rho = 0.5$                          |
| AIC    | 38.55 | 39.72                          | 41.54                    | 32.20 |       |        |        | ,                                     |
| BIC    | 26.68 | 26.67                          | 26.72                    | 26.49 |       |        |        | Oracle: 23.53                         |
| CV.1se | 25.05 | 25.11                          | 25.16                    | 23.99 | 25.10 |        |        |                                       |
| CV.min | 23.95 | 24.36                          | 25.01                    | 24.95 | 23.99 | 24.03  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 23.85 | 23.94                          | 26.63                    | 24.43 | 20.77 | 25     | 23.94  | $\rho = 0.9$                          |
| AIC    | 36.24 | 37.35                          | 39.09                    | 30.06 |       |        |        | •                                     |
| BIC    | 25.15 | 25.13                          | 25.18                    | 24.98 |       |        |        | Oracle: 22.16                         |
|        | 25.15 | 20.10                          | 23.10                    | 21.70 |       |        |        |                                       |

Table 37: Predictive MSE for n=1000, binary design, sparse covariates, and decay 100.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}~\gamma=10$ | AL     | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|-------------------------|--------|-------|--------|--------|---------------------------------------|
| CV.1se | 3.76  | 3.61                           | 3.36                    | 3.65   | 3.30  |        |        |                                       |
| CV.min | 3.56  | 3.43                           | 3.26                    | 3.53   | 3.26  | 3.28   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 3.67  | 3.47                           | 3.35                    | 3.55   |       |        | 3.36   | $\rho = 0$                            |
| AIC    | 4.47  | 4.55                           | 4.87                    | 3.57   |       |        |        | Oracle: 2.94                          |
| BIC    | 4.59  | 4.06                           | 3.62                    | 4.07   |       |        |        | 07 acie . 2.94                        |
| CV.1se | 3.38  | 3.23                           | 2.98                    | 3.31   | 2.91  |        |        |                                       |
| CV.min | 3.20  | 3.08                           | 2.90                    | 3.20   | 2.88  | 2.90   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 3.30  | 3.11                           | 2.98                    | 3.23   |       |        | 2.98   | $\rho = 0.5$                          |
| AIC    | 3.98  | 4.05                           | 4.32                    | 3.23   |       |        |        | Oracle: 2.61                          |
| BIC    | 4.23  | 3.69                           | 3.20                    | 3.78   |       |        |        | Oracle: 2.01                          |
| CV.1se | 3.18  | 3.04                           | 2.83                    | 3.16   | 2.76  |        |        |                                       |
| CV.min | 3.02  | 2.91                           | 2.75                    | 3.04   | 2.72  | 2.76   |        | $sd(\mu)/\sigma = 2$                  |
| AICc   | 3.12  | 2.94                           | 2.81                    | 3.07   |       |        | 2.81   | $\rho = 0.9$                          |
| AIC    | 3.74  | 3.81                           | 4.07                    | 3.06   |       |        |        | Oracle: 2.46                          |
| BIC    | 4.04  | 3.51                           | 3.04                    | 3.63   |       |        |        | Oracle : 2.40                         |
| CV.1se | 15.29 | 15.35                          | 16.83                   | 14.13  | 14.78 |        |        |                                       |
| CV.min | 13.96 | 14.04                          | 15.26                   | 14.06  | 13.95 | 13.98  |        | $sd(\mu)/\sigma = 1$                  |
| AICc   | 14.24 | 13.96                          | 15.45                   | 14.00  |       |        | 14.51  | $\rho = 0$                            |
| AIC    | 18.83 | 19.34                          | 20.48                   | 15.33  |       |        |        | 0 1 11 70                             |
| BIC    | 21.17 | 19.98                          | 21.18                   | 17.90  |       |        |        | <i>Oracle</i> : 11.78                 |
| CV.1se | 13.82 | 13.84                          | 15.21                   | 12.77  | 13.33 |        |        |                                       |
| CV.min | 12.54 | 12.58                          | 13.66                   | 12.68  | 12.53 | 12.54  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 12.85 | 12.52                          | 13.71                   | 12.65  |       |        | 13.25  | $\rho = 0.5$                          |
| AIC    | 16.74 | 17.18                          | 18.16                   | 13.77  |       |        |        | •                                     |
| BIC    | 18.86 | 18.33                          | 18.89                   | 16.72  |       |        |        | Oracle: 10.46                         |
| CV.1se | 13.02 | 13.04                          | 14.46                   | 12.13  | 12.59 |        |        |                                       |
| CV.min | 11.84 | 11.86                          | 13.02                   | 12.00  | 11.83 | 11.83  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 12.15 | 11.82                          | 12.94                   | 11.98  |       |        | 12.53  | $\rho = 0.9$                          |
| AIC    | 15.75 | 16.16                          | 17.10                   | 12.95  |       |        |        | ·                                     |
| BIC    | 17.80 | 17.37                          | 17.79                   | 16.04  |       |        |        | Oracle: 9.86                          |
| CV.1se | 53.36 | 53.48                          | 53.51                   | 51.35  | 53.41 |        |        |                                       |
| CV.min | 51.39 | 52.79                          | 53.45                   | 53.56  | 51.43 | 51.55  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 51.14 | 52.09                          | 55.86                   | 52.29  |       |        | 51.95  | $\rho = 0$                            |
| AIC    | 77.50 | 80.32                          | 83.64                   | 65.12  |       |        |        | ·                                     |
| BIC    | 53.49 | 53.50                          | 53.52                   | 53.31  |       |        |        | <i>Oracle</i> : 47.14                 |
| CV.1se | 47.42 | 47.49                          | 47.51                   | 45.88  | 47.46 |        |        |                                       |
| CV.min | 46.02 | 46.99                          | 47.48                   | 47.86  | 46.06 | 46.14  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 45.75 | 46.41                          | 50.02                   | 46.73  |       |        | 46.29  | $\rho = 0.5$                          |
| AIC    | 68.81 | 71.22                          | 74.17                   | 58.32  |       |        |        | ,                                     |
| BIC    | 47.49 | 47.49                          | 47.51                   | 47.37  |       |        |        | <i>Oracle</i> : 41.82                 |
| CV.1se | 44.74 | 44.79                          | 44.80                   | 43.44  | 44.78 |        |        |                                       |
| CV.min | 43.47 | 44.38                          | 44.80                   | 45.16  | 43.50 | 43.59  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 43.18 | 43.79                          | 46.92                   | 44.14  |       |        | 43.66  | $\rho = 0.9$                          |
| AIC    | 64.73 | 67.04                          | 69.87                   | 54.55  |       |        |        | •                                     |
| BIC    | 44.79 | 44.79                          | 44.81                   | 44.69  |       |        |        | <i>Oracle</i> : 39.43                 |
|        | /     | 1 1117                         | 11.01                   | 1 1.07 |       |        |        |                                       |

Table 38: Predictive MSE for n=1000, binary design, sparse covariates, and decay 200.

|        | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | AL    | MCP   | CVbest   | ICbest |                                       |
|--------|-------------|--------------------------------|---------------------------------|-------|-------|----------|--------|---------------------------------------|
| CV.1se | 5.50        | 5.19                           | 4.63                            | 5.29  | 4.56  |          |        |                                       |
| CV.min | 5.24        | 4.99                           | 4.60                            | 5.13  | 4.55  | 4.60     |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.39        | 5.03                           | 4.76                            | 5.16  |       |          | 4.75   | $\rho = 0$                            |
| AIC    | 6.62        | 6.76                           | 7.25                            | 5.24  |       |          |        | Oracle : 4.33                         |
| BIC    | 6.47        | 5.65                           | 4.98                            | 5.74  |       |          |        | 074666.4.55                           |
| CV.1se | 4.93        | 4.64                           | 4.09                            | 4.81  | 4.01  |          |        |                                       |
| CV.min | 4.70        | 4.46                           | 4.08                            | 4.66  | 4     | 4.08     |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.85        | 4.51                           | 4.20                            | 4.69  |       |          | 4.20   | $\rho = 0.5$                          |
| AIC    | 5.89        | 6.00                           | 6.43                            | 4.73  |       |          |        | <i>Oracle</i> : 3.84                  |
| BIC    | 5.94        | 5.10                           | 4.38                            | 5.31  |       |          |        | 074666.5.04                           |
| CV.1se | 4.65        | 4.38                           | 3.88                            | 4.59  | 3.81  |          |        |                                       |
| CV.min | 4.44        | 4.22                           | 3.88                            | 4.43  | 3.78  | 3.88     |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.59        | 4.26                           | 3.97                            | 4.46  |       |          | 3.98   | $\rho = 0.9$                          |
| AIC    | 5.54        | 5.65                           | 6.05                            | 4.49  |       |          |        | <i>Oracle</i> : 3.62                  |
| BIC    | 5.65        | 4.82                           | 4.15                            | 5.08  |       |          |        | 07466 . 3.02                          |
| CV.1se | 22.82       | 23.17                          | 26.71                           | 21.08 | 22.03 |          |        |                                       |
| CV.min | 20.74       | 21.00                          | 23.69                           | 20.92 | 20.74 | 20.79    |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 21.25       | 20.81                          | 23.26                           | 20.86 |       |          | 21.08  | $\rho = 0$                            |
| AIC    | 27.81       | 28.66                          | 30.26                           | 22.86 |       |          |        | Oracle: 17.32                         |
| BIC    | 31.33       | 30.68                          | 31.31                           | 28.86 |       |          |        | 07466 . 17.32                         |
| CV.1se | 20.66       | 20.93                          | 24.44                           | 19.07 | 19.93 |          |        |                                       |
| CV.min | 18.64       | 18.82                          | 21.57                           | 18.87 | 18.64 | 18.66    |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 19.17       | 18.65                          | 20.58                           | 18.86 |       |          | 19.17  | $\rho = 0.5$                          |
| AIC    | 24.70       | 25.42                          | 26.82                           | 20.50 |       |          |        | Oracle: 15.36                         |
| BIC    | 27.83       | 27.60                          | 27.86                           | 26.46 |       |          |        | 07 acic . 13.30                       |
| CV.1se | 19.48       | 19.76                          | 23.30                           | 18.14 | 18.83 |          |        |                                       |
| CV.min | 17.62       | 17.78                          | 20.53                           | 17.88 | 17.61 | 17.62    |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 18.13       | 17.63                          | 19.45                           | 17.89 |       |          | 18.14  | $\rho = 0.9$                          |
| AIC    | 23.26       | 23.95                          | 25.28                           | 19.30 |       |          |        | Oracle : 14.49                        |
| BIC    | 26.26       | 26.12                          | 26.29                           | 25.22 |       |          |        | 014016.14.49                          |
| CV.1se | 78.47       | 78.59                          | 78.62                           | 75.90 | 78.53 |          |        |                                       |
| CV.min | 76.00       | 78.08                          | 78.62                           | 79.15 | 76.01 | 76.19    |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | <b>75.6</b> | 77.89                          | 81.00                           | 77.21 |       |          | 77.52  | $\rho = 0$                            |
| AIC    | 114.01      | 118.59                         | 123.13                          | 96.44 |       |          |        | Oracle : 69.25                        |
| BIC    | 78.59       | 78.61                          | 78.62                           | 78.42 |       |          |        | 074666 . 07.23                        |
| CV.1se | 69.71       | 69.78                          | 69.79                           | 67.79 | 69.75 |          |        |                                       |
| CV.min | 68.02       | 69.44                          | 69.81                           | 70.68 | 68.07 | 68.17    |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 67.61       | 69.22                          | 72.36                           | 68.97 |       |          | 68.86  | $\rho = 0.5$                          |
| AIC    | 101.21      | 105.15                         | 109.20                          | 86.21 |       |          |        | Oracle : 61.43                        |
| BIC    | 69.77       | 69.78                          | 69.79                           | 69.65 |       |          |        | 07466.01.43                           |
| CV.1se | 65.81       | 65.86                          | 65.86                           | 64.21 | 65.85 | <u> </u> |        |                                       |
| CV.min | 64.32       | 65.58                          | 65.89                           | 66.75 | 64.36 | 64.49    |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 63.9        | 65.37                          | 68.08                           | 65.23 |       |          | 65.06  | $\rho = 0.9$                          |
| AIC    | 95.28       | 99.04                          | 102.94                          | 80.65 |       |          |        | Oracle : 57.96                        |
| BIC    | 65.85       | 65.85                          | 65.86                           | 65.75 |       |          |        | - Cracic . 31.70                      |

Table 39: Predictive MSE for n=1000, continuous design, sparse covariates, and decay 10.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | AL    | MCP   | CVbest | ICbest |                                       |
|--------|-------|--------------------------------|--------------------------|-------|-------|--------|--------|---------------------------------------|
| CV.1se | 1.38  | 1.35                           | 1.31                     | 1.32  | 1.28  |        |        |                                       |
| CV.min | 1.30  | 1.28                           | 1.25                     | 1.27  | 1.24  | 1.25   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.30  | 1.28                           | 1.27                     | 1.27  |       |        | 1.27   | $\rho = 0$                            |
| AIC    | 1.68  | 1.69                           | 1.79                     | 1.27  |       |        |        | Oracle: 1.25                          |
| BIC    | 1.42  | 1.37                           | 1.32                     | 1.32  |       |        |        | Oracic . 1.23                         |
| CV.1se | 0.56  | 0.55                           | 0.51                     | 0.61  | 0.49  |        |        |                                       |
| CV.min | 0.53  | 0.51                           | 0.49                     | 0.59  | 0.47  | 0.49   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.53  | 0.52                           | 0.49                     | 0.59  |       |        | 0.49   | $\rho = 0.5$                          |
| AIC    | 0.61  | 0.61                           | 0.63                     | 0.59  |       |        |        | Oracle : <b>0.47</b>                  |
| BIC    | 0.64  | 0.60                           | 0.54                     | 0.61  |       |        |        | Oracie . <b>0.4</b> 7                 |
| CV.1se | 0.16  | 0.15                           | 0.14                     | 0.17  | 0.14  |        |        |                                       |
| CV.min | 0.15  | 0.15                           | 0.14                     | 0.17  | 0.13  | 0.14   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.15  | 0.15                           | 0.14                     | 0.17  |       |        | 0.14   | $\rho = 0.9$                          |
| AIC    | 0.15  | 0.14                           | 0.14                     | 0.17  |       |        |        | Oracle : <b>0.13</b>                  |
| BIC    | 0.20  | 0.19                           | 0.17                     | 0.17  |       |        |        | Oracie : <b>0.13</b>                  |
| CV.1se | 5.39  | 5.29                           | 5.15                     | 5.00  | 5.10  |        |        |                                       |
| CV.min | 5.08  | 5.01                           | 4.95                     | 5.13  | 4.94  | 4.95   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.08  | 5.02                           | 5.06                     | 5.08  |       |        | 5.05   | $\rho = 0$                            |
| AIC    | 7.41  | 7.50                           | 8.01                     | 5.27  |       |        |        |                                       |
| BIC    | 5.42  | 5.32                           | 5.32                     | 5.09  |       |        |        | Oracle: 4.99                          |
| CV.1se | 2.19  | 2.12                           | 2.01                     | 2.08  | 1.94  |        |        |                                       |
| CV.min | 2.04  | 1.99                           | 1.92                     | 2.07  | 1.88  | 1.92   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 2.04  | 1.99                           | 1.94                     | 2.06  |       |        | 1.94   | $\rho = 0.5$                          |
| AIC    | 2.69  | 2.72                           | 2.89                     | 2.07  |       |        |        | 0 1 100                               |
| BIC    | 2.34  | 2.25                           | 2.12                     | 2.23  |       |        |        | <i>Oracle</i> : <b>1.88</b>           |
| CV.1se | 0.64  | 0.61                           | 0.56                     | 0.54  | 0.54  |        |        |                                       |
| CV.min | 0.58  | 0.57                           | 0.54                     | 0.52  | 0.53  | 0.54   |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.58  | 0.57                           | 0.55                     | 0.52  |       |        | 0.57   | $\rho = 0.9$                          |
| AIC    | 0.61  | 0.61                           | 0.65                     | 0.52  |       |        |        |                                       |
| BIC    | 0.69  | 0.68                           | 0.68                     | 0.54  |       |        |        | Oracle: 0.51                          |
| CV.1se | 20.93 | 20.70                          | 20.50                    | 19.70 | 20.35 |        |        |                                       |
| CV.min | 19.78 | 19.65                          | 19.69                    | 20.92 | 19.64 | 19.66  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 19.76 | 19.76                          | 20.60                    | 20.41 |       |        | 19.76  | $\rho = 0$                            |
| AIC    | 31.66 | 32.29                          | 34.25                    | 24.31 |       |        |        |                                       |
| BIC    | 20.61 | 20.65                          | 21.70                    | 19.91 |       |        |        | Oracle: 19.97                         |
| CV.1se | 8.31  | 8.18                           | 8.01                     | 7.93  | 7.74  |        |        |                                       |
| CV.min | 7.82  | 7.71                           | 7.66                     | 8.19  | 7.48  | 7.65   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 7.78  | 7.74                           | 7.98                     | 8.10  |       |        | 7.78   | $\rho = 0.5$                          |
| AIC    | 11.66 | 11.85                          | 12.62                    | 8.89  |       |        |        |                                       |
| BIC    | 8.22  | 8.21                           | 8.22                     | 8.12  |       |        |        | Oracle: 7.53                          |
| CV.1se | 2.18  | 2.17                           | 2.12                     | 2.05  | 2.15  |        |        |                                       |
| CV.min | 2.09  | 2.09                           | 2.08                     | 2.02  | 2.07  | 2.08   |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 2.09  | 2.09                           | 2.08                     | 2.03  |       |        | 2.08   | $\rho = 0.9$                          |
| AIC    | 2.66  | 2.74                           | 3.05                     | 2.03  |       |        |        |                                       |
| BIC    | 2.10  | 2.09                           | 2.08                     | 2.07  |       |        |        | Oracle: 2.04                          |
|        |       | ,                              |                          | ,     |       |        |        |                                       |

Table 40: Predictive MSE for n=1000, continuous design, sparse covariates, and decay 50.

|                   | lasso  | $\operatorname{GL} \gamma = 1$ | ,      | AL     | MCP         | CVbest | ICbest   |                                       |
|-------------------|--------|--------------------------------|--------|--------|-------------|--------|----------|---------------------------------------|
| CV.1se            | 8.47   | 8.27                           | 8.11   | 8.19   | 7.90        |        |          |                                       |
| CV.min            | 7.94   | 7.76                           | 7.67   | 7.92   | <b>7.61</b> | 7.69   |          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 8.15   | 7.88                           | 7.74   | 7.95   |             |        | 7.76     | $\rho = 0$                            |
| AIC               | 9.89   | 10.03                          | 10.73  | 7.94   |             |        |          | Oracle: 6.65                          |
| BIC               | 10.42  | 9.81                           | 9.31   | 9.16   |             |        |          | Oracie . 0.03                         |
| CV.1se            | 3.20   | 3.09                           | 2.93   | 3.63   | 2.81        |        |          |                                       |
| CV.min            | 2.98   | 2.89                           | 2.78   | 3.38   | 2.71        | 2.78   |          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 3.18   | 3.01                           | 2.76   | 3.44   |             |        | 2.76     | $\rho = 0.5$                          |
| AIC               | 3.35   | 3.38                           | 3.57   | 3.36   |             |        |          | Oracle: 2.28                          |
| BIC               | 6.83   | 4.77                           | 3.50   | 5.19   |             |        |          | Oracie : 2.28                         |
| CV.1se            | 0.61   | 0.59                           | 0.55   | 1.14   | 0.53        |        |          |                                       |
| CV.min            | 0.57   | 0.55                           | 0.53   | 1.08   | 0.52        | 0.53   |          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.62   | 0.58                           | 0.53   | 1.08   |             |        | 0.53     | $\rho = 0.9$                          |
| AIC               | 0.57   | 0.55                           | 0.54   | 1.08   |             |        |          | 0 1 0 10                              |
| BIC               | 1.64   | 1.64                           | 1.59   | 1.21   |             |        |          | Oracle: 0.42                          |
| CV.1se            | 33.07  | 32.79                          | 33.77  | 30.55  | 31.94       |        |          |                                       |
| CV.min            | 30.50  | 30.37                          | 31.59  | 30.66  | 30.41       | 30.47  |          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 30.93  | 30.49                          | 32.44  | 30.41  |             |        | 30.59    | $\rho = 0$                            |
| AIC               | 41.93  | 42.89                          | 45.60  | 33.25  |             |        |          | ,                                     |
| BIC               | 40.50  | 39.02                          | 47.09  | 34.53  |             |        |          | Oracle: 26.59                         |
| CV.1se            | 13.10  | 12.48                          | 12.58  | 12.37  | 11.41       |        |          |                                       |
| CV.min            | 11.51  | 11.24                          | 11.59  | 11.95  | 10.93       | 11.30  |          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 11.92  | 11.46                          | 11.22  | 12.03  | 2000        | 11.00  | 11.40    | $\rho = 0.5$                          |
| AIC               | 14.26  | 14.50                          | 15.38  | 12.16  |             |        | 11.10    | ,                                     |
| BIC               | 16.31  | 16.34                          | 16.49  | 15.92  |             |        |          | Oracle: 9.11                          |
| CV.1se            | 2.86   | 2.70                           | 2.63   | 2.46   | 2.21        |        |          |                                       |
| CV.rise<br>CV.min | 2.56   | 2.37                           | 2.38   | 2.31   | 2.09        | 2.31   |          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 2.60   | 2.59                           | 2.53   | 2.31   | 2.07        | 2.31   | 2.48     | $\rho = 0.9$                          |
| AIC               | 2.26   | 2.28                           | 2.48   | 2.30   |             |        | 2.40     | •                                     |
| BIC               | 2.80   | 2.80                           | 2.78   | 2.75   |             |        |          | Oracle: 1.68                          |
| CV.1se            | 119.93 | 120.31                         | 120.82 | 113.86 | 120.03      |        |          |                                       |
| CV.1se<br>CV.min  | 113.81 | 115.93                         | 119.70 | 118.93 | 113.89      | 114.14 |          | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 113.42 | 116.46                         | 120.93 | 116.93 | 113.09      | 114,14 | 113.39   | $sa(\mu)/\sigma = 0.3$ $\rho = 0$     |
| AICC              | 173.78 | 179.27                         | 187.58 | 144.00 |             |        | 113.39   | $\rho = 0$                            |
| BIC               |        |                                | 120.92 | 119.52 |             |        |          | Oracle: 106.35                        |
| CV.1se            | 120.69 | 120.84                         |        |        | 41.40       |        |          |                                       |
|                   | 41.42  | 41.42                          | 41.42  | 40.99  | 41.42       | 41.00  |          | 1/ )/ 0.5                             |
| CV.min            | 41.07  | 41.14                          | 41.36  | 42.25  | 41.06       | 41.08  | 40.00    | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 40.82  | 41.28                          | 41.44  | 41.71  |             |        | 40.82    | $\rho = 0.5$                          |
| AIC               | 59.16  | 60.69                          | 63.73  | 49.77  |             |        |          | Oracle: 36.43                         |
| BIC               | 41.38  | 41.40                          | 41.42  | 41.31  | 7.60        |        |          |                                       |
| CV.1se            | 7.60   | 7.59                           | 7.57   | 7.50   | 7.60        | 7.05   |          | 1/ )/ ^ ~ ~                           |
| CV.min            | 7.40   | 7.39                           | 7.37   | 7.40   | 7.36        | 7.37   | <b>-</b> | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 7.39   | 7.41                           | 7.39   | 7.42   |             |        | 7.38     | $\rho = 0.9$                          |
| AIC               | 9.64   | 9.97                           | 11.00  | 7.50   |             |        |          | Oracle: 6.70                          |
| BIC               | 7.43   | 7.44                           | 7.43   | 7.38   |             |        |          |                                       |

Table 41: Predictive MSE for n=1000, continuous design, sparse covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | ,      | AL     | MCP    | CVbest | ICbest |                                       |
|--------|--------|--------------------------------|--------|--------|--------|--------|--------|---------------------------------------|
| CV.1se | 15.10  | 14.47                          | 13.52  | 14.64  | 13.24  |        |        |                                       |
| CV.min | 14.30  | 13.80                          | 13.11  | 14.18  | 13.12  | 13.17  |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 14.72  | 14.01                          | 13.45  | 14.25  |        |        | 13.53  | $\rho = 0$                            |
| AIC    | 17.93  | 18.24                          | 19.55  | 14.33  |        |        |        | Oracle: 11.82                         |
| BIC    | 18.30  | 16.69                          | 14.97  | 16.28  |        |        |        | 07466.11.02                           |
| CV.1se | 5.57   | 5.26                           | 4.71   | 6.67   | 4.41   |        |        |                                       |
| CV.min | 5.32   | 5.06                           | 4.65   | 6.10   | 4.39   | 4.65   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.67   | 5.23                           | 4.64   | 6.35   |        |        | 4.64   | $\rho = 0.5$                          |
| AIC    | 6.07   | 6.12                           | 6.49   | 5.98   |        |        |        | Oracle: 4.01                          |
| BIC    | 17.96  | 17.51                          | 5.13   | 16.69  |        |        |        | 07466.4.01                            |
| CV.1se | 1.01   | 0.96                           | 0.86   | 2.24   | 0.82   |        |        |                                       |
| CV.min | 0.97   | 0.92                           | 0.85   | 2.01   | 0.81   | 0.85   |        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.06   | 0.97                           | 0.85   | 2.02   |        |        | 0.85   | $\rho = 0.9$                          |
| AIC    | 0.96   | 0.93                           | 0.94   | 2.01   |        |        |        | Oracle: 0.70                          |
| BIC    | 2.91   | 2.92                           | 2.88   | 2.82   |        |        |        | 014616.0.70                           |
| CV.1se | 61.30  | 61.63                          | 67.80  | 56.69  | 59.40  |        |        |                                       |
| CV.min | 56.03  | 56.36                          | 61.20  | 56.45  | 56.05  | 56.08  |        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 57.25  | 56.51                          | 61.22  | 56.21  |        |        | 56.57  | $\rho = 0$                            |
| AIC    | 75.47  | 77.53                          | 82.05  | 61.51  |        |        |        | Oracle: 47.30                         |
| BIC    | 85.09  | 84.04                          | 85.85  | 71.78  |        |        |        | Oracle: 47.30                         |
| CV.1se | 26.22  | 25.20                          | 28.27  | 23.25  | 23.48  |        |        |                                       |
| CV.min | 21.83  | 21.47                          | 26.06  | 22.17  | 21.11  | 21.36  |        | $sd(\mu)/\sigma = 1$                  |
| AICc   | 22.98  | 21.55                          | 21.26  | 22.50  |        |        | 21.78  | $\rho = 0.5$                          |
| AIC    | 25.54  | 26.06                          | 27.54  | 22.37  |        |        |        | 0116.04                               |
| BIC    | 29.05  | 29.08                          | 29.14  | 28.80  |        |        |        | Oracle: 16.04                         |
| CV.1se | 5.02   | 4.99                           | 4.96   | 4.61   | 4.79   |        |        |                                       |
| CV.min | 4.76   | 4.68                           | 4.79   | 4.25   | 4.36   | 4.69   |        | $sd(\mu)/\sigma = 1$                  |
| AICc   | 4.74   | 4.81                           | 4.76   | 4.23   |        |        | 4.70   | $\rho = 0.9$                          |
| AIC    | 3.92   | 3.98                           | 4.36   | 4.11   |        |        |        | 0 1 200                               |
| BIC    | 4.86   | 4.86                           | 4.83   | 4.81   |        |        |        | Oracle: 2.80                          |
| CV.1se | 214.42 | 214.86                         | 215.02 | 206.23 | 214.59 |        |        |                                       |
| CV.min | 206.43 | 212.06                         | 214.78 | 214.96 | 206.33 | 207.05 |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 205.31 | 212.39                         | 215.21 | 209.69 |        |        | 205.37 | $\rho = 0$                            |
| AIC    | 310.41 | 321.76                         | 335.07 | 261.14 |        |        |        | •                                     |
| BIC    | 214.89 | 215.00                         | 217.26 | 214.16 |        |        |        | <i>Oracle</i> : 189.14                |
| CV.1se | 72.92  | 72.92                          | 72.92  | 72.56  | 72.92  |        |        |                                       |
| CV.min | 72.61  | 72.80                          | 72.95  | 74.88  | 72.64  | 72.66  |        | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 72.32  | 72.89                          | 72.96  | 73.92  |        |        | 72.31  | $\rho = 0.5$                          |
| AIC    | 104.61 | 107.80                         | 112.84 | 89.35  |        |        |        | •                                     |
| BIC    | 72.91  | 72.92                          | 72.92  | 72.88  |        |        |        | <i>Oracle</i> : 64.15                 |
| CV.1se | 12.72  | 12.72                          | 12.71  | 12.66  | 12.72  |        |        |                                       |
| CV.min | 12.53  | 12.53                          | 12.53  | 12.57  | 12.51  | 12.51  |        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 12.5   | 12.58                          | 12.60  | 12.60  |        |        | 12.50  | $\rho = 0.9$                          |
| AIC    | 16.60  | 17.27                          | 18.84  | 12.81  |        |        |        | •                                     |
| BIC    | 12.61  | 12.62                          | 12.69  | 12.54  |        |        |        | Oracle: 11.20                         |
| סוכ    | 12.01  | 12.02                          | 12.03  | 14.54  |        |        |        |                                       |

Table 42: Predictive MSE for n=1000, continuous design, sparse covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ |        | AL     | MCP    | CVbest | ICbest |                                     |
|--------|--------|--------------------------------|--------|--------|--------|--------|--------|-------------------------------------|
| CV.1se | 22.06  | 20.83                          | 18.60  | 21.21  | 18.31  |        |        |                                     |
| CV.min | 21.02  | 20.04                          | 18.49  | 20.59  | 18.26  | 18.51  |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 21.63  | 20.28                          | 19.18  | 20.69  |        |        | 19.29  | $\rho = 0$                          |
| AIC    | 26.52  | 27.07                          | 29.04  | 21.02  |        |        |        | Oracle: 17.37                       |
| BIC    | 26.07  | 23.17                          | 20.23  | 23.08  |        |        |        | 01acic . 11.31                      |
| CV.1se | 8.07   | 7.45                           | 6.44   | 9.77   | 6.03   |        |        |                                     |
| CV.min | 7.79   | 7.30                           | 6.54   | 8.91   | 6.04   | 6.54   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 8.27   | 7.47                           | 6.47   | 9.35   |        |        | 6.48   | $\rho = 0.5$                        |
| AIC    | 8.98   | 9.08                           | 9.65   | 8.69   |        |        |        | Oracle: 5.87                        |
| BIC    | 26.50  | 25.09                          | 6.71   | 25.92  |        |        |        | Oracie . 5.67                       |
| CV.1se | 1.44   | 1.33                           | 1.17   | 3.34   | 1.09   |        |        |                                     |
| CV.min | 1.39   | 1.31                           | 1.18   | 2.88   | 1.10   | 1.19   |        | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 1.51   | 1.35                           | 1.16   | 2.90   |        |        | 1.16   | $\rho = 0.9$                        |
| AIC    | 1.39   | 1.34                           | 1.41   | 2.84   |        |        |        | Oracle: 1.01                        |
| BIC    | 4.27   | 4.28                           | 3.44   | 4.21   |        |        |        | Oracie : 1.01                       |
| CV.1se | 91.40  | 92.90                          | 107.18 | 84.53  | 88.38  |        |        |                                     |
| CV.min | 83.20  | 84.26                          | 95.00  | 83.92  | 83.19  | 83.31  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 85.14  | 84.21                          | 93.73  | 83.70  |        |        | 84.23  | $\rho = 0$                          |
| AIC    | 111.39 | 114.82                         | 121.21 | 91.72  |        |        |        | •                                   |
| BIC    | 125.83 | 125.78                         | 126.15 | 116.17 |        |        |        | Oracle: 69.47                       |
| CV.1se | 40.67  | 40.08                          | 42.55  | 34.99  | 39.34  |        |        |                                     |
| CV.min | 34.02  | 34.26                          | 41.87  | 33.17  | 33.76  | 33.38  |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 35.81  | 32.73                          | 32.27  | 33.80  |        |        | 33.55  | $\rho = 0.5$                        |
| AIC    | 37.63  | 38.50                          | 40.63  | 33.23  |        |        |        |                                     |
| BIC    | 42.62  | 42.64                          | 42.67  | 42.42  |        |        |        | Oracle: 23.49                       |
| CV.1se | 7.28   | 7.27                           | 7.23   | 6.96   | 7.25   |        |        |                                     |
| CV.min | 6.96   | 6.94                           | 6.98   | 6.41   | 6.89   | 6.93   |        | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 6.90   | 7.03                           | 7.00   | 6.35   |        |        | 6.89   | $\rho = 0.9$                        |
| AIC    | 5.77   | 5.89                           | 6.45   | 5.97   |        |        |        | •                                   |
| BIC    | 7.09   | 7.11                           | 7.11   | 7.01   |        |        |        | Oracle: 4.03                        |
| CV.1se | 315.28 | 315.72                         | 315.85 | 304.89 | 315.47 |        |        |                                     |
| CV.min | 305.33 | 313.63                         | 315.86 | 317.57 | 305.18 | 306.22 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 303.58 | 314.44                         | 315.81 | 309.81 |        |        | 303.59 | $\rho = 0$                          |
| AIC    | 456.70 | 475.12                         | 493.35 | 386.66 |        |        |        | •                                   |
| BIC    | 315.72 | 315.81                         | 351.65 | 314.97 |        |        |        | Oracle: 277.88                      |
| CV.1se | 106.78 | 106.79                         | 106.78 | 106.40 | 106.79 |        |        |                                     |
| CV.min | 106.43 | 106.70                         | 106.84 | 109.83 | 106.46 | 106.57 |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 106.08 | 106.77                         | 106.79 | 108.39 | 100.10 | 100.57 | 106.12 | $\rho = 0.5$                        |
| AIC    | 153.36 | 158.62                         | 165.71 | 131.58 |        |        | 100.12 | •                                   |
| BIC    | 106.77 | 106.78                         | 106.79 | 106.75 |        |        |        | Oracle:93.96                        |
| CV.1se | 18.33  | 18.33                          | 18.32  | 18.28  | 18.33  |        |        |                                     |
| CV.13c | 18.14  | 18.15                          | 18.20  | 18.18  | 18.14  | 18.14  |        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 18.1   | 18.22                          | 18.29  | 18.23  | 10.17  | 10,17  | 18.10  | $\rho = 0.9$                        |
| AIC    | 24.24  | 25.34                          | 27.45  | 18.64  |        |        | 10.10  | ·                                   |
| BIC    | 18.25  | 18.28                          | 18.32  | 18.18  |        |        |        | Oracle: 16.13                       |
| DIC    | 10.23  | 10.20                          | 10.32  | 10.10  |        |        |        |                                     |

Table 43: Estimation MSE for n=100, binary design, dense covariates, and decay 10.

|        | lasso       | $\operatorname{GL} \gamma = 1$ |      | marginal AL | sparsenet MCP |                                       |
|--------|-------------|--------------------------------|------|-------------|---------------|---------------------------------------|
| CV.1se | 0.99        | 0.94                           | 1.06 | 0.53        | 0.87          |                                       |
| CV.min | 0.59        | 0.63                           | 0.84 | 0.51        | 0.62          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.72        | 0.67                           | 0.54 | 0.56        |               | $\rho = 0$                            |
| AIC    | 0.55        | 0.55                           | 0.56 | 0.52        |               | Oracle : 0.37                         |
| BIC    | 0.55        | 0.55                           | 0.56 | 0.53        |               | 07466 . 0.57                          |
| CV.1se | 0.97        | 0.92                           | 0.99 | 0.49        | 0.83          |                                       |
| CV.min | 0.58        | 0.60                           | 0.79 | 0.46        | 0.59          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.69        | 0.64                           | 0.48 | 0.52        |               | $\rho = 0.5$                          |
| AIC    | 0.49        | 0.49                           | 0.50 | 0.47        |               | Oracle : 0.33                         |
| BIC    | 0.49        | 0.49                           | 0.50 | 0.48        |               | 07466.0.55                            |
| CV.1se | 0.93        | 0.89                           | 0.96 | 0.47        | 0.80          |                                       |
| CV.min | 0.56        | 0.59                           | 0.78 | 0.44        | 0.58          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.67        | 0.63                           | 0.46 | 0.50        |               | $\rho = 0.9$                          |
| AIC    | 0.46        | 0.47                           | 0.47 | 0.45        |               | Oma ala . 0.21                        |
| BIC    | 0.46        | 0.47                           | 0.47 | 0.46        |               | Oracle: 0.31                          |
| CV.1se | 2.18        | 2.18                           | 2.20 | 1.79        | 2.17          |                                       |
| CV.min | 1.91        | 2.00                           | 2.13 | 2.03        | 1.93          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.91        | 1.92                           | 2.21 | 1.73        |               | $\rho = 0$                            |
| AIC    | 2.21        | 2.22                           | 2.24 | 2.15        |               | ·                                     |
| BIC    | 2.20        | 2.21                           | 2.24 | 2.15        |               | Oracle: 1.40                          |
| CV.1se | 1.98        | 1.98                           | 1.99 | 1.64        | 1.97          |                                       |
| CV.min | 1.75        | 1.82                           | 1.93 | 1.83        | 1.77          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.74        | 1.76                           | 1.97 | 1.57        |               | $\rho = 0.5$                          |
| AIC    | 1.98        | 1.99                           | 2.01 | 1.93        |               |                                       |
| BIC    | 1.98        | 1.98                           | 2.01 | 1.93        |               | Oracle: 1.26                          |
| CV.1se | 1.88        | 1.87                           | 1.88 | 1.54        | 1.86          |                                       |
| CV.min | 1.66        | 1.72                           | 1.82 | 1.72        | 1.67          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.66        | 1.67                           | 1.86 | 1.5         |               | $\rho = 0.9$                          |
| AIC    | 1.87        | 1.88                           | 1.90 | 1.83        |               |                                       |
| BIC    | 1.87        | 1.88                           | 1.90 | 1.82        |               | Oracle: 1.19                          |
| CV.1se | 5.67        | 5.67                           | 5.68 | 6.91        | 5.67          |                                       |
| CV.min | 5.68        | 5.70                           | 5.71 | 8.23        | 5.72          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 5.61        | 7.11                           | 8.94 | 6.01        |               | $\rho = 0$                            |
| AIC    | 8.88        | 8.93                           | 9.00 | 8.74        |               | ,                                     |
| BIC    | 8.87        | 8.92                           | 9.00 | 8.73        |               | Oracle: 5.30                          |
| CV.1se | 5.08        | 5.08                           | 5.08 | 6.21        | 5.08          |                                       |
| CV.min | 5.09        | 5.11                           | 5.11 | 7.39        | 5.13          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 5.03        | 6.20                           | 7.98 | 5.41        | 0.10          | $\rho = 0.5$                          |
| AIC    | 7.93        | 7.98                           | 8.04 | 7.81        |               |                                       |
| BIC    | 7.93        | 7.97                           | 8.04 | 7.81        |               | Oracle: 4.74                          |
| CV.1se | 4.82        | 4.83                           | 4.83 | 5.84        | 4.83          |                                       |
| CV.13C | 4.84        | 4.85                           | 4.86 | 6.96        | 4.86          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | <b>4.77</b> | 5.83                           | 7.57 | 5.14        | 1.00          | $\rho = 0.9$                          |
| AIC    | 7.53        | 7.57                           | 7.63 | 7.41        |               |                                       |
| BIC    | 7.52        | 7.56                           | 7.63 | 7.40        |               | Oracle: 4.52                          |
| DIC    | 1.54        | 7.50                           | 7.03 | 7.40        |               |                                       |

Table 44: Estimation MSE for n=100, binary design, dense covariates, and decay 50.

|        | lasso        | $\operatorname{GL} \gamma = 1$ |       | marginal AL |       |                                       |
|--------|--------------|--------------------------------|-------|-------------|-------|---------------------------------------|
| CV.1se | 7.33         | 7.44                           | 7.46  | 3.26        | 7.34  |                                       |
| CV.min | 5.91         | 6.93                           | 7.27  | 2.95        | 5.82  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 6.28         | 3.35                           | 3.02  | 4.31        |       | $\rho = 0$                            |
| AIC    | 2.98         | 3.00                           | 3.03  | 2.94        |       | Oracle : 2.73                         |
| BIC    | 2.98         | 3.00                           | 3.03  | 2.94        |       | Oracic . 2.73                         |
| CV.1se | 6.67         | 6.68                           | 6.71  | 2.96        | 6.66  |                                       |
| CV.min | 5.46         | 6.27                           | 6.57  | 2.64        | 5.45  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.70         | 3.11                           | 2.70  | 3.86        |       | $\rho = 0.5$                          |
| AIC    | 2.67         | 2.68                           | 2.71  | 2.63        |       | Oracle : 2.45                         |
| BIC    | 2.67         | 2.68                           | 2.71  | 2.63        |       | Oracie . 2.43                         |
| CV.1se | 6.28         | 6.30                           | 6.35  | 2.89        | 6.29  |                                       |
| CV.min | 5.24         | 5.94                           | 6.21  | 2.51        | 5.27  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.46         | 3.15                           | 2.55  | 3.77        |       | $\rho = 0.9$                          |
| AIC    | 2.52         | 2.54                           | 2.56  | 2.49        |       | Oracle : 2.31                         |
| BIC    | 2.52         | 2.54                           | 2.56  | 2.49        |       | Oracie : 2.51                         |
| CV.1se | 12.07        | 12.11                          | 12.12 | 10.25       | 12.07 |                                       |
| CV.min | 11.33        | 11.94                          | 12.07 | 11.32       | 11.41 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 11.31        | 11.06                          | 12.10 | 10.12       |       | $\rho = 0$                            |
| AIC    | 11.96        | 12.05                          | 12.14 | 11.78       |       |                                       |
| BIC    | 11.96        | 12.04                          | 12.14 | 11.77       |       | <i>Oracle</i> : 9.58                  |
| CV.1se | 10.82        | 10.84                          | 10.85 | 9.17        | 10.82 |                                       |
| CV.min | 10.25        | 10.69                          | 10.82 | 10.09       | 10.33 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 10.15        | 9.82                           | 10.78 | 9.06        |       | $\rho = 0.5$                          |
| AIC    | 10.66        | 10.73                          | 10.82 | 10.49       |       |                                       |
| BIC    | 10.65        | 10.72                          | 10.82 | 10.49       |       | <i>Oracle</i> : 8.54                  |
| CV.1se | 10.25        | 10.27                          | 10.27 | 8.73        | 10.26 |                                       |
| CV.min | 9.73         | 10.12                          | 10.23 | 9.51        | 9.75  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 9.66         | 9.31                           | 10.20 | 8.66        |       | $\rho = 0.9$                          |
| AIC    | 10.09        | 10.16                          | 10.24 | 9.93        |       |                                       |
| BIC    | 10.08        | 10.15                          | 10.24 | 9.93        |       | Oracle: 8.05                          |
| CV.1se | 30.53        | 30.55                          | 30.60 | 37.75       | 30.56 |                                       |
| CV.min | 30.69        | 30.74                          | 30.82 | 44.89       | 30.81 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 30.41        | 45.69                          | 48.52 | 32.65       |       | $\rho = 0$                            |
| AIC    | 47.87        | 48.29                          | 48.60 | 47.19       |       |                                       |
| BIC    | 47.84        | 48.27                          | 48.60 | 47.17       |       | <i>Oracle</i> : 31.48                 |
| CV.1se | 27.31        | 27.33                          | 27.33 | 33.73       | 27.33 |                                       |
| CV.min | 27.44        | 27.49                          | 27.51 | 39.84       | 27.55 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 27.22        | 40.56                          | 43.22 | 29.07       |       | $\rho = 0.5$                          |
| AIC    | 42.66        | 43.03                          | 43.30 | 42.06       |       | ,                                     |
| BIC    | 42.64        | 43.01                          | 43.30 | 42.04       |       | Oracle: 28.08                         |
| CV.1se | 25.85        | 25.87                          | 25.88 | 31.38       | 25.87 |                                       |
| CV.min | 26.00        | 25.97                          | 26.03 | 37.38       | 26.07 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | <b>25.67</b> | 38.25                          | 40.92 | 27.59       |       | $\rho = 0.9$                          |
| AIC    | 40.38        | 40.73                          | 40.99 | 39.78       |       |                                       |
| BIC    | 40.36        | 40.71                          | 40.99 | 39.76       |       | Oracle: 26.61                         |
|        | 10.50        | 10.71                          | 10.77 | 57.10       |       |                                       |

Table 45: Estimation MSE for n=100, binary design, dense covariates, and decay 100.

|                  | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL |       |                                       |
|------------------|-------|--------------------------------|--------------------------|-------------|-------|---------------------------------------|
| CV.1se           | 14.97 | 15.13                          | 15.17                    | 6.70        | 15.02 |                                       |
| CV.min           | 12.62 | 14.61                          | 14.91                    | 5.99        | 12.53 | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 13.31 | 6.05                           | 6.12                     | 9.01        |       | $\rho = 0$                            |
| AIC              | 6.04  | 6.08                           | 6.13                     | 5.96        |       | Oracle : 6.12                         |
| BIC              | 6.04  | 6.08                           | 6.13                     | 5.96        |       | 07466.0.12                            |
| CV.1se           | 13.48 | 13.54                          | 13.55                    | 6.03        | 13.50 |                                       |
| CV.min           | 11.56 | 13.10                          | 13.37                    | 5.35        | 11.65 | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 11.88 | 5.49                           | 5.44                     | 8.14        |       | $\rho = 0.5$                          |
| AIC              | 5.37  | 5.41                           | 5.45                     | 5.31        |       | Oracle : 5.45                         |
| BIC              | 5.37  | 5.41                           | 5.45                     | 5.3         |       | Oracie : 5.45                         |
| CV.1se           | 12.74 | 12.81                          | 12.84                    | 5.92        | 12.80 |                                       |
| CV.min           | 10.99 | 12.38                          | 12.67                    | 5.11        | 10.93 | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 11.29 | 5.27                           | 5.17                     | 7.86        |       | $\rho = 0.9$                          |
| AIC              | 5.10  | 5.14                           | 5.18                     | 5.04        |       | 0                                     |
| BIC              | 5.10  | 5.13                           | 5.18                     | 5.04        |       | <i>Oracle</i> : 5.16                  |
| CV.1se           | 24.48 | 24.56                          | 24.57                    | 20.88       | 24.50 |                                       |
| CV.min           | 23.19 | 24.40                          | 24.52                    | 22.96       | 23.24 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 23.11 | 23.13                          | 24.53                    | 20.63       |       | $\rho = 0$                            |
| AIC              | 24.21 | 24.42                          | 24.58                    | 23.85       |       |                                       |
| BIC              | 24.20 | 24.41                          | 24.58                    | 23.84       |       | <i>Oracle</i> : 21.34                 |
| CV.1se           | 21.91 | 21.95                          | 21.95                    | 18.66       | 21.94 |                                       |
| CV.min           | 20.91 | 21.80                          | 21.92                    | 20.46       | 21.03 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 20.78 | 20.54                          | 21.87                    | 18.48       |       | $\rho = 0.5$                          |
| AIC              | 21.58 | 21.76                          | 21.91                    | 21.26       |       |                                       |
| BIC              | 21.57 | 21.76                          | 21.91                    | 21.25       |       | <i>Oracle</i> : 19.00                 |
| CV.1se           | 20.67 | 20.71                          | 20.72                    | 17.65       | 20.70 |                                       |
| CV.min           | 19.66 | 20.53                          | 20.67                    | 19.21       | 19.67 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 19.53 | 19.34                          | 20.61                    | 17.53       |       | $\rho = 0.9$                          |
| AIC              | 20.35 | 20.51                          | 20.66                    | 20.05       |       |                                       |
| BIC              | 20.34 | 20.50                          | 20.66                    | 20.04       |       | <i>Oracle</i> : 17.97                 |
| CV.1se           | 61.84 | 61.86                          | 61.92                    | 76.46       | 61.85 |                                       |
| CV.min           | 62.12 | 62.25                          | 62.34                    | 90.65       | 62.44 | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 61.54 | 94.48                          | 98.16                    | 66.07       | •     | $\rho = 0$                            |
| AIC              | 96.74 | 97.74                          | 98.25                    | 95.38       |       |                                       |
| BIC              | 96.70 | 97.70                          | 98.25                    | 95.35       |       | Oracle : 64.46                        |
| CV.1se           | 55.33 | 55.40                          | 55.36                    | 68.27       | 55.34 |                                       |
| CV.min           | 55.59 | 55.77                          | 55.74                    | 80.79       | 55.83 | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 55.07 | 83.89                          | 87.52                    | 59.02       |       | $\rho = 0.5$                          |
| AIC              | 86.29 | 87.15                          | 87.62                    | 85.08       |       |                                       |
| BIC              | 86.25 | 87.11                          | 87.62                    | 85.05       |       | <i>Oracle</i> : 57.58                 |
| CV.1se           | 52.31 | 52.35                          | 52.39                    | 63.43       | 52.34 |                                       |
| CV.13c<br>CV.min | 52.51 | 52.62                          | 52.66                    | 75.65       | 52.69 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 51.93 | 79.08                          | 82.74                    | 55.84       | 02.00 | $\rho = 0.9$                          |
| AIC              | 81.57 | 82.38                          | 82.83                    | 80.38       |       |                                       |
| BIC              | 81.52 | 82.35                          | 82.83                    | 80.28       |       | <i>Oracle</i> : 54.48                 |
|                  | 01.32 | 02.33                          | 02.03                    | 00.20       |       |                                       |

Table 46: Estimation MSE for n=100, binary design, dense covariates, and decay 200.

|                   | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|-------------------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se            | 30.33  | 30.56                          | 30.60                           | 13.61       | 30.38         |                                       |
| CV.min            | 26.07  | 29.77                          | 30.17                           | 12.06       | 25.72         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 27.01  | 12.04                          | 12.33                           | 18.27       |               | $\rho = 0$                            |
| AIC               | 12.15  | 12.26                          | 12.34                           | 12          |               | <i>Oracle</i> : 12.55                 |
| BIC               | 12.15  | 12.26                          | 12.34                           | 12          |               | 07 actc . 12.55                       |
| CV.1se            | 27.21  | 27.33                          | 27.35                           | 12.36       | 27.28         |                                       |
| CV.min            | 23.89  | 26.73                          | 27.01                           | 10.79       | 23.88         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 24.26  | 10.74                          | 10.99                           | 16.73       |               | $\rho = 0.5$                          |
| AIC               | 10.83  | 10.93                          | 11.00                           | 10.7        |               | Oracle : 11.21                        |
| BIC               | 10.83  | 10.92                          | 11.00                           | 10.7        |               | 07acie . 11.21                        |
| CV.1se            | 25.68  | 25.79                          | 25.82                           | 11.97       | 25.74         |                                       |
| CV.min            | 22.64  | 25.13                          | 25.46                           | 10.24       | 22.44         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 22.74  | 10.23                          | 10.38                           | 15.86       |               | $\rho = 0.9$                          |
| AIC               | 10.24  | 10.33                          | 10.39                           | 10.12       |               | Oracle: 10.60                         |
| BIC               | 10.23  | 10.32                          | 10.39                           | 10.12       |               | Oracie: 10.00                         |
| CV.1se            | 49.21  | 49.37                          | 49.37                           | 42.14       | 49.29         |                                       |
| CV.min            | 46.77  | 49.09                          | 49.30                           | 46.25       | 46.84         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 46.69  | 47.26                          | 49.34                           | 41.64       |               | $\rho = 0$                            |
| AIC               | 48.63  | 49.11                          | 49.40                           | 47.93       |               | ·                                     |
| BIC               | 48.61  | 49.09                          | 49.40                           | 47.91       |               | Oracle : 46.19                        |
| CV.1se            | 44.03  | 44.14                          | 44.15                           | 37.50       | 44.11         |                                       |
| CV.min            | 42.08  | 43.93                          | 44.11                           | 41.17       | 42.30         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 41.73  | 42.04                          | 43.94                           | 37.24       |               | $\rho = 0.5$                          |
| AIC               | 43.31  | 43.73                          | 43.99                           | 42.68       |               | ,                                     |
| BIC               | 43.29  | 43.72                          | 43.99                           | 42.67       |               | Oracle: 41.04                         |
| CV.1se            | 41.58  | 41.69                          | 41.70                           | 35.58       | 41.60         |                                       |
| CV.min            | 39.52  | 41.37                          | 41.58                           | 38.66       | 39.66         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 39.23  | 39.74                          | 41.49                           | 35.18       |               | $\rho = 0.9$                          |
| AIC               | 40.90  | 41.29                          | 41.54                           | 40.32       |               | ,                                     |
| BIC               | 40.88  | 41.27                          | 41.54                           | 40.30       |               | <i>Oracle</i> : 38.90                 |
| CV.1se            | 124.66 | 124.81                         | 124.79                          | 154.61      | 124.68        |                                       |
| CV.min            | 125.32 | 125.62                         | 125.84                          | 182.91      | 125.93        | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 124.15 | 193.36                         | 198.18                          | 133.05      |               | $\rho = 0$                            |
| AIC               | 195.19 | 197.42                         | 198.29                          | 192.44      |               | ·                                     |
| BIC               | 195.11 | 197.36                         | 198.28                          | 192.34      |               | Oracle: 130.14                        |
| CV.1se            | 111.25 | 111.38                         | 111.34                          | 136.84      | 111.28        |                                       |
| CV.min            | 111.79 | 112.04                         | 112.02                          | 162.37      | 112.21        | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 110.75 | 171.44                         | 176.10                          | 118.55      |               | $\rho = 0.5$                          |
| AIC               | 173.46 | 175.42                         | 176.20                          | 171.07      |               | ,                                     |
| BIC               | 173.39 | 175.35                         | 176.19                          | 171.01      |               | <i>Oracle</i> : 116.03                |
| CV.1se            | 105.14 | 105.23                         | 105.25                          | 127.70      | 105.21        |                                       |
| CV.rise<br>CV.min | 105.41 | 105.68                         | 105.77                          | 152.09      | 105.93        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 104.31 | 161.77                         | 166.42                          | 112.41      | 100.70        | $\rho = 0.9$                          |
| AIC               | 163.88 | 165.73                         | 166.50                          | 161.47      |               | ,                                     |
| BIC               | 163.80 | 165.66                         | 166.50                          | 161.41      |               | Oracle: 109.94                        |
|                   | 103.00 | 103.00                         | 100.50                          | 101.71      |               |                                       |

Table 47: Estimation MSE for n=100, continuous design, dense covariates, and decay 10.

| $ \begin{array}{c} \mathrm{CV.lse} & 4.07 & 3.93 & 4.31 & 2.11 & 3.58 \\ \mathrm{CV.min} & 2.44 & 2.60 & 3.40 & 2.03 & 2.52 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlCc} & 2.89 & 3.36 & 2.23 & 2.24 & 2.10 & 0 \\ \mathrm{BIC} & 2.20 & 2.21 & 2.24 & 2.10 & 0 \\ \mathrm{CV.lse} & 2.01 & 1.97 & 1.89 & 1.04 & 1.82 \\ \mathrm{CV.min} & 1.54 & 1.55 & 1.68 & 0.84 & 1.44 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlCc} & 1.57 & 1.81 & 1.01 & 1.16 & \rho = 0.5 \\ \mathrm{AlC} & 0.83 & 0.84 & 0.84 & 0.82 & 0 \\ \mathrm{BIC} & 0.83 & 0.84 & 0.84 & 0.91 & 0 \\ \mathrm{CV.lse} & 0.40 & 0.39 & 0.34 & 0.29 & 0.37 \\ \mathrm{CV.lse} & 0.40 & 0.32 & 0.32 & 0.22 & 0.31 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlCc} & 0.32 & 0.32 & 0.32 & 0.22 & 0.31 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlC} & 0.32 & 0.32 & 0.32 & 0.22 & 0.31 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlC} & 0.22 & 0.22 & 0.22 & 0.2 & 0.2 & 0.22 \\ \mathrm{BIC} & 0.24 & 0.23 & 0.22 & 0.32 & 0.22 & 0.31 \\ \mathrm{CV.lse} & 8.82 & 8.80 & 8.92 & 7.23 & 8.80 \\ \mathrm{CV.min} & 7.73 & 8.04 & 8.56 & 8.16 & 7.76 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlCc} & 7.66 & 8.50 & 8.88 & \textbf{6.93} & \rho = 0 \\ \mathrm{AlC} & 8.87 & 8.91 & 9.00 & 8.63 & 0 \\ \mathrm{CV.min} & 3.11 & 3.16 & 3.26 & 3.07 & 3.11 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlCc} & 3.08 & 3.29 & 3.31 & \textbf{2.79} & \rho = 0.5 \\ \mathrm{AlC} & 3.35 & 3.36 & 3.39 & 3.28 & 0 \\ \mathrm{CV.min} & 3.11 & 3.16 & 3.26 & 3.07 & 3.11 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlCc} & 3.08 & 3.29 & 3.31 & \textbf{2.79} & \rho = 0.5 \\ \mathrm{AlC} & 3.35 & 3.36 & 3.39 & 3.28 & 0 \\ \mathrm{CV.min} & 0.71 & 0.71 & 0.69 & 0.70 & 0.69 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlCc} & 0.70 & 0.74 & 0.71 & \textbf{0.68} & \rho = 0.5 \\ \mathrm{AlC} & 0.89 & 0.89 & 0.91 & 0.70 & 0.69 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.11 & 35.06 & 0 \\ \mathrm{BlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \mathrm{AlC} & 3.5.9 & 35.80 & 36.10 & 35.04 & 22.94 & \mathrm$ |        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--|--------|-------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| AICc 2.89 3.36 2.23 2.24 $\rho = 0$ AIC 2.20 2.21 2.24 2.10 $\rho = 0$ BIC 2.20 2.20 2.23 2.15 $\rho = 0$ CV.lse 2.01 1.97 1.89 1.04 1.82 $\rho = 0$ CV.lse 2.01 1.97 1.89 1.04 1.82 $\rho = 0$ AIC 1.57 1.81 1.01 1.16 $\rho = 0$ AIC 0.83 0.84 0.84 0.84 0.82 $\rho = 0$ BIC 0.83 0.84 0.84 0.91 $\rho = 0$ CV.lise 0.40 0.39 0.34 0.29 0.37 $\rho = 0$ CV.lise 0.40 0.39 0.32 0.32 0.22 0.31 $\rho = 0$ AIC 0.32 0.35 0.33 0.25 $\rho = 0$ AIC 0.22 0.22 0.22 0.22 0.2 $\rho = 0$ BIC 0.24 0.23 0.22 0.35 0.32 0.22 0.31 $\rho = 0$ CV.lise 8.82 8.80 8.92 7.23 8.80 $\rho = 0$ CV.lise 8.87 8.91 9.00 8.63 $\rho = 0$ BIC 8.87 8.91 9.00 8.63 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.36 2.83 3.36 $\rho = 0$ CV.lise 3.39 3.38 3.30 2.89 3.31 2.79 $\rho = 0$ AIC 3.56 3.39 3.39 3.27 $\rho = 0$ CV.lise 3.50 3.50 3.50 3.39 3.27 $\rho = 0$ CV.lise 3.50 3.50 3.50 3.39 3.27 $\rho = 0$ CV.lise 0.84 0.82 0.74 0.72 0.79 $\rho = 0$ CV.lise 0.89 0.89 0.91 0.80 $\rho = 0$ BIC 0.89 0.89 0.91 0.80 $\rho = 0$ AIC 0.89 0.89 0.91 0.80 $\rho = 0$ AIC 3.56 3.581 3.511 35.06 $\rho = 0$ AIC 3.561 35.81 36.11 35.06 $\rho = 0$ AIC 3.57 3.581 36.11 35.06 $\rho = 0$ AIC 3.581 3.581 36.11 35.06 $\rho = 0$ AIC 3.582 8.59 8.59 8.60 10.06 8.59 $\rho = 0$ AIC 3.59 3.580 3.580 3.510 35.04 $\rho = 0$ CV.lise 2.33 2.32 2.32 2.32 2.29 2.32 $\rho = 0$ CV.lise 2.33 2.33 2.32 2.32 2.32 2.29 2.32 $\rho = 0$ AIC 3.61 3.62 3.67 3.44 $\rho = 0$ AIC 3.61 3.62 3.67 3.44 $\rho = 0$   | CV.1se |       |                                |                          |             |               |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.min |       |                                |                          |             | 2.52          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         2.20         2.20         2.23         2.15         Oracle: 1.48           CV.Ise         2.01         1.97         1.89         1.04         1.82         CV.min         1.54         1.55         1.68         0.84         1.44 $sd(\mu)/\sigma = 2$ AIC         1.57         1.81         1.01         1.16 $\rho = 0.5$ AIC         0.83         0.84         0.84         0.82         Oracle: 0.56           CV.Ise         0.40         0.39         0.34         0.29         0.37         cV.min           CV.min         0.32         0.32         0.32         0.22         0.32         o.25 $\rho = 0.9$ AIC         0.32         0.35         0.33         0.25 $\rho = 0.9$ $\rho = 0.9$ AIC         0.22         0.22         0.22         0.22 $\rho = 0.9$ V.Ise         8.82         8.80         8.92         7.23         8.80 $\rho = 0.9$ V.Ise         8.82         8.80         8.92         7.23         8.80 $\rho = 0.9$ AIC         7.66         8.50         8.88         6.93 $\rho = 0.0$ $\rho = 0.0$  |        |       |                                |                          |             |               | $\rho = 0$                            |
| BIC         2.20         2.20         2.23         2.15           CV.Ise         2.01         1.97         1.89         1.04         1.82           CV.min         1.54         1.55         1.68         0.84         1.44 $sd(\mu)/\sigma = 2$ AIC         0.83         0.84         0.84         0.82         Oracle : 0.56           CV.Ise         0.40         0.39         0.34         0.29         0.37           CV.min         0.32         0.32         0.32         0.22         0.31 $sd(\mu)/\sigma = 2$ AIC         0.32         0.35         0.33         0.25 $\rho = 0.9$ AIC         0.22         0.22         0.22         0.22         Oracle : 0.15           CV.Ise         8.82         8.80         8.92         7.23         8.80 $ccolor (\mu)/\sigma = 1$ AIC         7.66         8.50         8.88         6.93 $ccolor (\mu)/\sigma = 1$ $ccolor (\mu)/\sigma = 1$ AIC         8.87         8.91         9.00         8.65 $ccolor (\mu)/\sigma = 1$ AIC         8.87         8.91         9.00         8.63 $ccolor (\mu)/\sigma = 1$ AIC         3.03 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Oracle · 1.48</td>   |        |       |                                |                          |             |               | Oracle · 1.48                         |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        | 2.20  |                                |                          |             |               | 074666.1.40                           |
| AICc 1.57 1.81 1.01 1.16 $\rho = 0.5$ AIC 0.83 0.84 0.84 0.82 $\rho = 0.5$ BIC 0.83 0.84 0.84 0.91 $\rho = 0.5$ Oracle : 0.56 $\rho = 0.5$ CV. Ise 0.40 0.39 0.34 0.29 0.37 $\rho = 0.9$ AIC 0.22 0.32 0.32 0.32 0.22 0.31 $\rho = 0.9$ AIC 0.24 0.23 0.22 0.32 0.32 $\rho = 0.9$ Oracle : 0.15 $\rho = 0.9$ AIC 0.24 0.23 0.22 0.32 $\rho = 0.9$ AIC 0.25 $\rho = 0.9$ AIC 0.26 8.50 8.88 6.93 $\rho = 0.9$ AIC 8.87 8.91 9.00 8.65 $\rho = 0.9$ AIC 3.35 3.36 3.39 3.36 0.37 3.11 $\rho = 0.9$ AIC 3.35 3.36 3.39 3.27 $\rho = 0.9$ AIC 0.84 0.82 0.74 0.72 0.79 $\rho = 0.9$ AIC 0.89 0.89 0.91 0.70 0.69 $\rho = 0.9$ AIC 0.89 0.89 0.91 0.70 0.80 BIC 0.89 0.89 0.91 0.70 0.70 0.70 0.70 0.70 0.70 0.70 0.7  |        | 2.01  | 1.97                           | 1.89                     | 1.04        | 1.82          |                                       |
| AIC 0.83 0.84 0.84 0.84 0.91    CV.1se 0.40 0.39 0.34 0.29 0.37    CV.min 0.32 0.32 0.32 0.32 0.22 0.21    AIC 0.22 0.22 0.22 0.22 0.2    BIC 0.24 0.23 0.22 0.32    CV.min 7.73 8.04 8.56 8.16 7.76 $sd(\mu)/\sigma = 1$ AIC 8.87 8.91 9.00 8.65    BIC 8.87 8.91 9.00 8.65    CV.lse 3.39 3.38 3.36 2.83 3.36    CV.min 3.11 3.16 3.26 3.07 3.11 $sd(\mu)/\sigma = 1$ AIC 3.35 3.36 3.39 3.28    CV.min 3.5 3.36 3.39 3.27    CV.lse 0.84 0.82 0.74 0.72 0.79    CV.lse 0.84 0.82 0.74 0.71 0.68    AIC 0.70 0.74 0.71 0.69 0.70 0.69 $sd(\mu)/\sigma = 1$ AIC 0.70 0.74 0.71 0.69 0.70 0.69 $sd(\mu)/\sigma = 1$ AIC 0.89 0.89 0.91 0.80    BIC 0.89 0.89 0.91 0.80    CV.lse 2.283 22.84 22.85 27.74 22.85    CV.lse 2.253 24.53 35.87 24.03    AIC 3.55 3.58 8.59 8.60 10.06 8.59    CV.lse 8.59 8.59 8.60 10.06 8.59    CV.lse 8.39 13.44 13.56 13.17    BIC 13.38 13.44 13.56 13.17    BIC 2.24 2.28 3 2.29 2.53 2.26    AIC 2.24 2.28 3.11 2.34    CV.min 2.26 2.26 2.29 2.53 2.26    AIC 2.24 2.28 3.11 2.34    AIC 3.61 3.62 3.67 3.44    Oracle : 2.11  | CV.min |       |                                |                          |             | 1.44          |                                       |
| BIC 0.83 0.84 0.84 0.91  |        |       |                                |                          |             |               | $\rho = 0.5$                          |
| BIC         0.83         0.84         0.84         0.91           CV.1se         0.40         0.39         0.34         0.29         0.37           CV.min         0.32         0.32         0.32         0.22         0.21           AICc         0.32         0.35         0.33         0.25 $\rho = 0.9$ AIC         0.22         0.22         0.22         0.22         0.72           CV.Ise         8.82         8.80         8.92         7.23         8.80           CV.min         7.73         8.04         8.56         8.16         7.76         sd( $\mu$ )/ $\sigma$ = 1           AIC         8.87         8.91         9.00         8.65         0.00         <   | AIC    | 0.83  | 0.84                           | 0.84                     | 0.82        |               | $O_{raclo} \cdot 0.56$                |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    |       |                                |                          |             |               | 07466 . 0.30                          |
| AICc 0.32 0.35 0.33 0.25 $\rho = 0.9$ AIC 0.22 0.22 0.22 0.22 0.32 $\rho_{\rm c} = 0.9$ BIC 0.24 0.23 0.22 0.32 $\rho_{\rm c} = 0.9$ Oracle : 0.15 $\rho = 0.9$ AIC 8.87 8.91 9.00 8.65 $\rho = 0.9$ Oracle : 5.62 $\rho = 0.9$ Oracle : 0.24 $\rho = 0.9$ Oracle : 0.26 $\rho = 0.9$ Oracle : 0.27 $\rho = 0.9$ Oracle : 0.28 $\rho = 0.9$ Oracle : 0.28 $\rho = 0.9$ Oracle : 0.29 $\rho = 0.9$ Oracle : 0.29 $\rho = 0.9$ Oracle : 0.29 $\rho = 0.9$ Oracle : 0.21 $\rho = 0.9$ Oracle : 0.29 $\rho = 0.9$ Oracle : 0.25 $\rho = 0.9$ Oracle : 0.26 $\rho = 0.9$ Oracle : 0.29 $\rho = 0.9$ Oracle : 0.29 $\rho = 0.9$ Oracle : 0.20 $\rho =$   | CV.1se | 0.40  | 0.39                           | 0.34                     | 0.29        | 0.37          |                                       |
| AIC 0.22 0.22 0.22 0.32  | CV.min | 0.32  |                                | 0.32                     | 0.22        | 0.31          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC 0.24 0.23 0.22 0.32  | AICc   | 0.32  | 0.35                           | 0.33                     |             |               | $\rho = 0.9$                          |
| BIC         0.24         0.23         0.22         0.32           CV.1se         8.82         8.80         8.92         7.23         8.80           CV.min         7.73         8.04         8.56         8.16         7.76         sd(μ)/σ = 1           AIC         8.87         8.91         9.00         8.65         Oracle : 5.62           CV.lse         3.39         3.38         3.36         2.83         3.36           CV.min         3.11         3.16         3.26         3.07         3.11         sd(μ)/σ = 1           AIC         3.08         3.29         3.31         2.79         ρ = 0.5           AIC         3.35         3.36         3.39         3.28         Oracle : 2.11           CV.nin         3.35         3.36         3.39         3.27         Oracle : 2.11           CV.1se         0.84         0.82         0.74         0.72         0.79         cv.min           CV.min         0.71         0.71         0.69         0.70         0.69         sd(μ)/σ = 1           AIC         0.89         0.89         0.91         0.80         Oracle : 0.56           CV.lse         22.83         22.84         22  | AIC    | 0.22  | 0.22                           | 0.22                     |             |               | $O_{racle} \cdot 0.15$                |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 0.24  | 0.23                           | 0.22                     |             |               | 07acte . 0.13                         |
| AICc 7.66 8.50 8.88 6.93 $\rho = 0$ AIC 8.87 8.91 9.00 8.65 BIC 8.87 8.91 9.00 8.63  CV.1se 3.39 3.38 3.36 2.83 3.36 CV.min 3.11 3.16 3.26 3.07 3.11 $sd(\mu)/\sigma = 1$ AICc 3.08 3.29 3.31 2.79 $\rho = 0.5$ AIC 3.35 3.36 3.39 3.28 BIC 3.35 3.36 3.39 3.27  CV.1se 0.84 0.82 0.74 0.72 0.79 CV.min 0.71 0.71 0.69 0.70 0.69 $sd(\mu)/\sigma = 1$ AICc 0.70 0.74 0.71 0.68 $\rho = 0.9$ AIC 0.89 0.89 0.91 0.80 BIC 0.89 0.89 0.91 0.70  CV.1se 22.83 22.84 22.85 27.74 22.85 CV.min 22.87 22.91 23.01 33.04 22.94 $sd(\mu)/\sigma = 0.5$ AIC 35.61 35.81 36.11 35.06 BIC 35.59 35.80 36.10 35.04  CV.1se 8.59 8.59 8.60 10.06 8.59 CV.min 8.58 8.59 8.64 12.07 8.62 $sd(\mu)/\sigma = 0.5$ AIC 8.52 8.61 13.38 9.09  AIC 13.39 13.44 13.56 13.17 BIC 13.38 13.44 13.56 13.15  CV.1se 2.33 2.32 2.32 2.29 2.32 CV.min 2.26 2.26 2.29 2.53 2.26 $sd(\mu)/\sigma = 0.5$ AIC 2.24 2.28 3.11 2.34 $\rho = 0.9$ AIC 3.61 3.62 3.67 3.44   | CV.1se | 8.82  | 8.80                           | 8.92                     | 7.23        | 8.80          |                                       |
| AIC 8.87 8.91 9.00 8.65 $Oracle: 5.62$ $Oracle: 7.97$ $Oracle: 7.97$ $Oracle: 7.97$ $Oracle: 7.97$ $Oracle: 7.97$ $Oracle: 7$  | CV.min | 7.73  | 8.04                           | 8.56                     | 8.16        | 7.76          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 8.87 8.91 9.00 8.63 $Oracle : 5.62$ CV.1se 3.39 3.38 3.36 2.83 3.36 $CV.min$ 3.11 3.16 3.26 3.07 3.11 $sd(\mu)/\sigma = 1$ AICc 3.08 3.29 3.31 2.79 $\rho = 0.5$ AIC 3.35 3.36 3.39 3.28 $Oracle : 2.11$ CV.1se 0.84 0.82 0.74 0.72 0.79 $CV.min$ 0.71 0.71 0.69 0.70 0.69 $sd(\mu)/\sigma = 1$ AICc 0.70 0.74 0.71 0.68 $\rho = 0.9$ AIC 0.89 0.89 0.91 0.80 $Oracle : 0.56$ BIC 0.89 0.89 0.91 0.70 $Oracle : 0.56$ CV.1se 22.83 22.84 22.85 27.74 22.85 $CV.min$ 22.87 22.91 23.01 33.04 22.94 $sd(\mu)/\sigma = 0.5$ AIC 35.61 35.81 36.11 35.06 $Oracle : 0.56$ BIC 35.59 35.80 36.10 35.04 $Oracle : 0.56$ CV.1se 8.59 8.59 8.60 10.06 8.59 $Oracle : 0.56$ CV.1se 8.52 8.61 13.38 9.09 $Oracle : 0.56$ AICc 8.52 8.61 13.38 9.09 $Oracle : 0.56$ CV.1se 2.33 2.32 2.32 2.29 2.32 $CV.min$ 2.26 2.26 2.29 2.53 2.26 $sd(\mu)/\sigma = 0.5$ AICC 13.39 13.44 13.56 13.17 $Oracle : 7.97$ CV.1se 2.33 2.32 2.32 2.29 2.32 $CV.min$ 2.26 2.26 2.29 2.53 2.26 $sd(\mu)/\sigma = 0.5$ AICC 2.24 2.28 3.11 2.34 $Oracle : 2.11$  | AICc   | 7.66  | 8.50                           | 8.88                     | 6.93        |               | $\rho = 0$                            |
| BIC         8.87         8.91         9.00         8.63           CV.Ise         3.39         3.38         3.36         2.83         3.36           CV.min         3.11         3.16         3.26         3.07         3.11 $sd(\mu)/\sigma = 1$ AIC         3.08         3.29         3.31         2.79 $\rho = 0.5$ AIC         3.35         3.36         3.39         3.27           CV.Ise         0.84         0.82         0.74         0.72         0.79           CV.min         0.71         0.71         0.69         0.70         0.69 $sd(\mu)/\sigma = 1$ AIC         0.89         0.89         0.91         0.80         0.69 $sd(\mu)/\sigma = 0.5$ AIC         0.89         0.89         0.91         0.70         0.69 $sd(\mu)/\sigma = 0.5$ CV.1se         22.83         22.84         22.85         27.74         22.85 $cv$ CV.min         22.87         22.91         23.01         33.04         22.94 $sd(\mu)/\sigma = 0.5$ AIC         35.61         35.81         36.11         35.06         0racle : 21.25           CV.1se         8.59  | AIC    | 8.87  | 8.91                           | 9.00                     | 8.65        |               | Omasla . 5.62                         |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 8.87  | 8.91                           | 9.00                     | 8.63        |               | Oracie : 5.02                         |
| AICc 3.08 3.29 3.31 2.79 $\rho = 0.5$ AIC 3.35 3.36 3.39 3.28 $\rho = 0.5$ BIC 3.35 3.36 3.39 3.27 $\rho = 0.5$ CV.1se 0.84 0.82 0.74 0.72 0.79 CV.min 0.71 0.71 0.69 0.70 0.69 $\rho = 0.9$ AIC 0.89 0.89 0.91 0.80 $\rho = 0.9$ AIC 0.89 0.89 0.91 0.70 $\rho = 0.9$ CV.min 22.87 22.91 23.01 33.04 22.94 $\rho = 0.9$ AIC 35.61 35.81 36.11 35.06 BIC 35.59 35.80 36.10 35.04 $\rho = 0.5$ AIC 8.59 8.59 8.60 10.06 8.59 $\rho = 0.5$ AIC 8.52 8.61 13.38 9.09 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.17 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.17 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.17 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.15 $\rho = 0.5$ AIC 2.24 2.28 3.11 2.34 $\rho = 0.9$ AIC 3.61 3.62 3.67 3.44 $\rho = 0.9$ AIC 3.61 3.62 3.67 3.44   | CV.1se | 3.39  | 3.38                           | 3.36                     | 2.83        | 3.36          |                                       |
| AIC 3.35 3.36 3.39 3.28 $Oracle: 2.11$ CV.1se 0.84 0.82 0.74 0.72 0.79 $Oracle: 2.11$ CV.min 0.71 0.71 0.69 0.70 0.69 $Oracle: 2.11$ AIC 0.89 0.89 0.91 0.80 $Oracle: 2.11$ CV.1se 22.83 22.84 22.85 27.74 22.85 $Oracle: 2.11$ CV.min 22.87 22.91 23.01 33.04 22.94 $Oracle: 2.11$ AIC 35.61 35.81 36.11 35.06 $Oracle: 2.12$ BIC 35.59 35.80 36.10 35.04  CV.1se 8.59 8.59 8.60 10.06 8.59 $Oracle: 2.12$ CV.min 8.58 8.59 8.64 12.07 8.62 $Oracle: 2.12$ AIC 13.39 13.44 13.56 13.17 $Oracle: 7.97$ BIC 13.38 13.44 13.56 13.15 $Oracle: 7.97$ CV.1se 2.33 2.32 2.32 2.29 2.32 $Oracle: 7.97$ AIC 2.24 2.28 3.11 2.34 $Oracle: 2.11$  | CV.min | 3.11  | 3.16                           | 3.26                     |             | 3.11          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 3.35 3.36 3.39 3.27   CV.1se 0.84 0.82 0.74 0.72 0.79   CV.min 0.71 0.71 0.69 0.70 0.69   AICc 0.70 0.74 0.71 0.68   | AICc   | 3.08  | 3.29                           | 3.31                     | 2.79        |               | $\rho = 0.5$                          |
| BIC         3.35         3.36         3.39         3.27           CV.1se         0.84         0.82         0.74         0.72         0.79           CV.min         0.71         0.69         0.70         0.69 $sd(\mu)/\sigma = 1$ AICc         0.70         0.74         0.71 <b>0.68</b> $\rho = 0.9$ AIC         0.89         0.89         0.91         0.80         Oracle : 0.56           CV.1se         22.83         22.84         22.85         27.74         22.85           CV.min         22.87         22.91         23.01         33.04         22.94 $sd(\mu)/\sigma = 0.5$ AIC         35.61         35.81         36.11         35.06         Oracle : 21.25           BIC         35.59         35.80         36.10         35.04         Oracle : 21.25           CV.1se         8.59         8.60         10.06         8.59 $sd(\mu)/\sigma = 0.5$ AIC         8.52         8.61         13.38         9.09 $\rho = 0.5$ AIC         13.38         13.44         13.56         13.17         Oracle : 7.97           BIC         13.38         13.44         13.56         13.15   | AIC    | 3.35  | 3.36                           | 3.39                     | 3.28        |               | Omagle : 2.11                         |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 3.35  | 3.36                           | 3.39                     | 3.27        |               | 07466.2.11                            |
| AICc 0.70 0.74 0.71 0.68 $\rho = 0.9$ AIC 0.89 0.89 0.91 0.70 $\rho = 0.9$ Oracle : 0.56 BIC 0.89 0.89 0.91 0.70 $\rho = 0.5$ CV.1se 22.83 22.84 22.85 27.74 22.85 CV.min 22.87 22.91 23.01 33.04 22.94 $\rho = 0.5$ AICc 22.53 24.53 35.87 24.03 $\rho = 0.5$ AIC 35.61 35.81 36.11 35.06 BIC 35.59 35.80 36.10 35.04 $\rho = 0.5$ CV.1se 8.59 8.59 8.60 10.06 8.59 CV.min 8.58 8.59 8.64 12.07 8.62 $\rho = 0.5$ AICc 8.52 8.61 13.38 9.09 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.17 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.17 $\rho = 0.5$ AIC 13.38 13.44 13.56 13.15 $\rho = 0.5$ AIC 13.38 13.44 13.56 13.15 $\rho = 0.5$ AIC 13.39 2.32 2.32 2.29 2.32 CV.min 2.26 2.26 2.29 2.53 2.26 $\rho = 0.5$ AICc 2.24 2.28 3.11 2.34 $\rho = 0.9$ AIC 3.61 3.62 3.67 3.44   | CV.1se | 0.84  | 0.82                           | 0.74                     | 0.72        | 0.79          |                                       |
| AIC 0.89 0.89 0.91 0.70 $Oracle : 0.56$ $Oracle : 0.57$ $Ora$  | CV.min | 0.71  | 0.71                           | 0.69                     | 0.70        | 0.69          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         0.89         0.89         0.91         0.70         Oracle: 0.36           CV.1se         22.83         22.84         22.85         27.74         22.85 $cc{3.36}$  | AICc   | 0.70  | 0.74                           | 0.71                     | 0.68        |               | $\rho = 0.9$                          |
| BIC         0.89         0.89         0.91         0.70           CV.1se         22.83         22.84         22.85         27.74         22.85           CV.min         22.87         22.91         23.01         33.04         22.94 $sd(\mu)/\sigma = 0.5$ AICc         22.53         24.53         35.87         24.03 $\rho = 0$ AIC         35.61         35.81         36.11         35.06         Oracle: 21.25           CV.1se         8.59         8.59         8.60         10.06         8.59           CV.min         8.58         8.59         8.64         12.07         8.62 $sd(\mu)/\sigma = 0.5$ AICc         8.52         8.61         13.38         9.09 $\rho = 0.5$ AIC         13.39         13.44         13.56         13.17         Oracle: 7.97           BIC         13.38         13.44         13.56         13.15         Oracle: 7.97           CV.1se         2.33         2.32         2.29         2.32 $sd(\mu)/\sigma = 0.5$ AIC         3.61         3.62         3.67         3.44 $sd(\mu)/\sigma = 0.5$ AIC         3.61         3.62         3.67   | AIC    | 0.89  | 0.89                           | 0.91                     | 0.80        |               | Omasla : 0.56                         |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 0.89  | 0.89                           | 0.91                     | 0.70        |               | Oracie : 0.30                         |
| AICc 22.53 24.53 35.87 24.03 $\rho = 0$ AIC 35.61 35.81 36.11 35.06 BIC 35.59 35.80 36.10 35.04  CV.1se 8.59 8.59 8.60 10.06 8.59 CV.min 8.58 8.59 8.64 12.07 8.62 $sd(\mu)/\sigma = 0.5$ AICc 8.52 8.61 13.38 9.09 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.17 BIC 13.38 13.44 13.56 13.15  CV.1se 2.33 2.32 2.32 2.29 CV.min 2.26 2.26 2.29 2.53 2.26 $sd(\mu)/\sigma = 0.5$ AICc 3.61 3.62 3.67 3.44   | CV.1se | 22.83 | 22.84                          | 22.85                    | 27.74       | 22.85         |                                       |
| AIC 35.61 35.81 36.11 35.06 BIC 35.59 35.80 36.10 35.04 $Oracle: 21.25$ CV.1se 8.59 8.59 8.60 10.06 8.59 CV.min 8.58 8.59 8.64 12.07 8.62 $oldsymbol{sd}(\mu)/\sigma = 0.5$ AICc 8.52 8.61 13.38 9.09 $oldsymbol{sd}(\mu)/\sigma = 0.5$ AIC 13.39 13.44 13.56 13.17 $oldsymbol{oracle}(\pi)$ BIC 13.38 13.44 13.56 13.15 $oldsymbol{oracle}(\pi)$ CV.1se 2.33 2.32 2.32 2.29 2.32 CV.min 2.26 2.26 2.29 2.53 2.26 $oldsymbol{sd}(\mu)/\sigma = 0.5$ AICc 2.24 2.28 3.11 2.34 $oldsymbol{oracle}(\pi)$ AIC 3.61 3.62 3.67 3.44  | CV.min | 22.87 | 22.91                          | 23.01                    | 33.04       | 22.94         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| BIC         35.59         35.80         36.10         35.04         Oracle: 21.25           CV.1se         8.59         8.59         8.60         10.06         8.59           CV.min         8.58         8.59         8.64         12.07         8.62 $sd(\mu)/\sigma = 0.5$ AICc         8.52         8.61         13.38         9.09 $\rho = 0.5$ AIC         13.39         13.44         13.56         13.17         Oracle: 7.97           BIC         13.38         13.44         13.56         13.15         Oracle: 7.97           CV.1se         2.33         2.32         2.32         2.29         2.32           CV.min         2.26         2.26         2.29         2.53         2.26 $sd(\mu)/\sigma = 0.5$ AICc         2.24         2.28         3.11         2.34 $\rho = 0.9$ AIC         3.61         3.62         3.67         3.44         Oracle: 2.11  | AICc   | 22.53 | 24.53                          | 35.87                    | 24.03       |               | $\rho = 0$                            |
| BIC         35.59         35.80         36.10         35.04           CV.1se         8.59         8.60         10.06         8.59           CV.min         8.58         8.59         8.64         12.07         8.62 $sd(\mu)/\sigma = 0.5$ AICc         8.52         8.61         13.38         9.09 $\rho = 0.5$ AIC         13.39         13.44         13.56         13.17         Oracle: 7.97           BIC         13.38         13.44         13.56         13.15         Oracle: 7.97           CV.1se         2.33         2.32         2.32         2.29         2.32           CV.min         2.26         2.26         2.29         2.53         2.26 $sd(\mu)/\sigma = 0.5$ AICc         2.24         2.28         3.11         2.34 $\rho = 0.9$ AIC         3.61         3.62         3.67         3.44         Oracle: 2.11   | AIC    | 35.61 | 35.81                          | 36.11                    | 35.06       |               | Orgalo : 21.25                        |
| CV.min         8.58         8.59         8.64         12.07         8.62 $sd(\mu)/\sigma = 0.5$ AIC         8.52         8.61         13.38         9.09 $\rho = 0.5$ AIC         13.39         13.44         13.56         13.17         Oracle: 7.97           BIC         13.38         13.44         13.56         13.15         Oracle: 7.97           CV.1se         2.33         2.32         2.32         2.29         2.32           CV.min         2.26         2.26         2.29         2.53         2.26 $sd(\mu)/\sigma = 0.5$ AIC         3.61         3.62         3.67         3.44         Oracle: 2.11  | BIC    | 35.59 | 35.80                          | 36.10                    | 35.04       |               | 07 acte . 21.23                       |
| AICc 8.52 8.61 13.38 9.09 $\rho = 0.5$ AIC 13.39 13.44 13.56 13.17 $\rho = 0.5$ Oracle : 7.97 BIC 13.38 13.44 13.56 13.15 $\rho = 0.5$ CV.1se 2.33 2.32 2.32 2.29 2.32 CV.min 2.26 2.26 2.29 2.53 2.26 $\rho = 0.5$ AICc 2.24 2.28 3.11 2.34 $\rho = 0.9$ AIC 3.61 3.62 3.67 3.44 $\rho = 0.9$ $\rho = 0.9$ $\rho = 0.9$ AIC 3.61 3.62 3.67 3.44   | CV.1se | 8.59  | 8.59                           | 8.60                     | 10.06       | 8.59          |                                       |
| AIC       13.39       13.44       13.56       13.17       Oracle: 7.97         BIC       13.38       13.44       13.56       13.15       Oracle: 7.97         CV.1se       2.33       2.32       2.32       2.29       2.32         CV.min       2.26       2.26       2.29       2.53       2.26 $sd(μ)/σ = 0.5$ AICc       2.24       2.28       3.11       2.34 $ρ = 0.9$ AIC       3.61       3.62       3.67       3.44       Oracle: 2.11  | CV.min | 8.58  | 8.59                           | 8.64                     | 12.07       | 8.62          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| BIC         13.38         13.44         13.56         13.15         Oracle: 7.97           CV.1se         2.33         2.32         2.32         2.29         2.32           CV.min         2.26         2.26         2.29         2.53         2.26 $sd(\mu)/\sigma = 0.5$ AICc         2.24         2.28         3.11         2.34 $\rho = 0.9$ AIC         3.61         3.62         3.67         3.44         Oracle: 2.11   | AICc   | 8.52  | 8.61                           | 13.38                    | 9.09        |               | $\rho = 0.5$                          |
| BIC       13.38       13.44       13.56       13.15         CV.1se       2.33       2.32       2.32       2.29       2.32         CV.min       2.26       2.26       2.29       2.53       2.26 $sd(\mu)/\sigma = 0.5$ AIC       2.24       2.28       3.11       2.34 $\rho = 0.9$ AIC       3.61       3.62       3.67       3.44       Oracle : 2.11  | AIC    | 13.39 | 13.44                          | 13.56                    | 13.17       |               | Oracle : 7.07                         |
| CV.min 2.26 2.26 2.29 2.53 2.26 $sd(\mu)/\sigma = 0.5$<br>AIC 2.24 2.28 3.11 2.34 $\rho = 0.9$<br>AIC 3.61 3.62 3.67 3.44  | BIC    | 13.38 | 13.44                          | 13.56                    | 13.15       |               | Oracle : 1.91                         |
| AICc <b>2.24</b> 2.28 3.11 2.34 $\rho = 0.9$ AIC 3.61 3.62 3.67 3.44   | CV.1se | 2.33  | 2.32                           | 2.32                     | 2.29        | 2.32          |                                       |
| AIC 3.61 3.62 3.67 3.44 Oracle : 2.11  | CV.min | 2.26  | 2.26                           | 2.29                     | 2.53        | 2.26          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| + $I$  | AICc   | 2.24  | 2.28                           | 3.11                     | 2.34        |               | $\rho = 0.9$                          |
| BIC 3.60 3.62 3.67 2.66  | AIC    | 3.61  | 3.62                           | 3.67                     | 3.44        |               | Oracle · 2 11                         |
|  | BIC    | 3.60  | 3.62                           | 3.67                     | 2.66        |               |                                       |

Table 48: Estimation MSE for n=100, continuous design, dense covariates, and decay 50.

|                  | lasso               | $\operatorname{GL} \gamma = 1$ |        | marginal AL | sparsenet MCP |                                       |
|------------------|---------------------|--------------------------------|--------|-------------|---------------|---------------------------------------|
| CV.1se           | 29.84               | 30.21                          | 30.39  | 13.26       | 29.97         |                                       |
| CV.min           | 24.06               | 28.29                          | 29.64  | 11.90       | 24.04         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 25.41               | 22.67                          | 12.22  | 17.14       |               | $\rho = 0$                            |
| AIC              | 12.07               | 12.15                          | 12.26  | 11.89       |               | Oracle: 11.08                         |
| BIC              | 12.07               | 12.14                          | 12.26  | 11.88       |               | 074666.11.00                          |
| CV.1se           | 10.41               | 10.41                          | 10.42  | 5.40        | 10.39         |                                       |
| CV.min           | 9.40                | 9.94                           | 10.30  | 4.26        | 9.42          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 9.31                | 10.16                          | 4.16   | 6.64        |               | $\rho = 0.5$                          |
| AIC              | 4.13                | 4.15                           | 4.18   | 4.09        |               | Oracle: 3.78                          |
| BIC              | 4.13                | 4.14                           | 4.18   | 4.08        |               | Oracie . 5.76                         |
| CV.1se           | 1.88                | 1.86                           | 1.83   | 1.54        | 1.85          |                                       |
| CV.min           | 1.60                | 1.61                           | 1.69   | 1.12        | 1.59          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 1.55                | 1.78                           | 1.31   | 1.26        |               | $\rho = 0.9$                          |
| AIC              | 0.75                | 0.75                           | 0.76   | 0.74        |               | 01069                                 |
| BIC              | 0.75                | 0.75                           | 0.76   | 1.38        |               | Oracle: 0.68                          |
| CV.1se           | 48.97               | 49.08                          | 49.11  | 41.41       | 49.03         |                                       |
| CV.min           | 46.03               | 48.36                          | 48.95  | 45.64       | 46.16         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 45.69               | 46.15                          | 48.71  | 40.67       |               | $\rho = 0$                            |
| AIC              | 48.15               | 48.51                          | 48.87  | 47.37       |               | ,                                     |
| BIC              | 48.13               | 48.49                          | 48.86  | 47.35       |               | <i>Oracle</i> : 38.53                 |
| CV.1se           | 16.82               | 16.83                          | 16.85  | 14.38       | 16.81         |                                       |
| CV.min           | 16.23               | 16.58                          | 16.82  | 15.44       | 16.19         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 16.03               | 16.57                          | 16.64  | 14.36       |               | $\rho = 0.5$                          |
| AIC              | 16.54               | 16.62                          | 16.77  | 16.30       |               |                                       |
| BIC              | 16.53               | 16.61                          | 16.76  | 16.29       |               | <i>Oracle</i> : 13.23                 |
| CV.1se           | 3.06                | 3.06                           | 3.06   | 2.82        | 3.06          |                                       |
| CV.min           | 2.89                | 2.90                           | 2.99   | 2.61        | 2.88          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 2.83                | 3.01                           | 2.98   | 2.64        |               | $\rho = 0.9$                          |
| AIC              | 2.99                | 3.00                           | 3.04   | 2.88        |               |                                       |
| BIC              | 2.99                | 3.00                           | 3.04   | 2.87        |               | Oracle: 2.37                          |
| CV.1se           | 123.67              | 123.68                         | 123.80 | 151.41      | 123.69        |                                       |
| CV.min           | 124.09              | 124.31                         | 124.59 | 180.32      | 125.12        | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 122.78              | 181.19                         | 195.40 | 131.22      |               | $\rho = 0$                            |
| AIC              | 192.75              | 194.48                         | 195.68 | 189.98      |               | -                                     |
| BIC              | 192.67              | 194.40                         | 195.66 | 189.91      |               | Oracle: 126.96                        |
| CV.1se           | 42.38               | 42.39                          | 42.42  | 49.61       | 42.42         |                                       |
| CV.min           | 42.56               | 42.60                          | 42.70  | 59.52       | 42.68         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 42.17               | 50.84                          | 66.80  | 45.06       | 12.00         | $\rho = 0.5$                          |
| AIC              | 66.10               | 66.57                          | 67.06  | 65.12       |               | ·                                     |
| BIC              | 66.07               | 66.53                          | 67.05  | 65.09       |               | Oracle: 43.47                         |
| CV.1se           | 7.73                | 7.73                           | 7.74   | 7.84        | 7.73          |                                       |
| CV.13C<br>CV.min | 7.73                | 7.73                           | 7.78   | 8.64        | 7.74          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 7.71<br><b>7.66</b> | 7.73                           | 12.06  | 8.10        | 7.74          | $\rho = 0.9$                          |
| AIC              | 11.97               | 12.05                          | 12.00  | 11.58       |               | ·                                     |
| BIC              | 11.96               | 12.05                          | 12.19  | 10.18       |               | Oracle: 7.75                          |
| ВіС              | 11.90               | 12.03                          | 12.10  | 10.10       |               |                                       |

Table 49: Estimation MSE for n=100, continuous design, dense covariates, and decay 100.

| $ \begin{array}{c} \mathrm{CV.lse} & 61.16 & 61.57 & 61.63 & 27.47 & 61.23 \\ \mathrm{CV.min} & 51.50 & 59.56 & 60.70 & 24.23 & 51.80 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlCc} & 53.49 & 32.73 & 24.78 & 36.31 & \rho = 0 \\ \mathrm{AlC} & 24.45 & 24.64 & 24.82 & 24.13 & Oracle : 24.83 \\ \mathrm{CV.lse} & 20.83 & 20.84 & 20.86 & 10.87 & 20.84 \\ \mathrm{CV.min} & 19.15 & 20.19 & 20.68 & 8.57 & 19.09 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlCc} & 18.93 & 18.83 & 8.35 & 13.38 & \rho = 0.5 \\ \mathrm{AlC} & 8.26 & 8.30 & 8.37 & 8.21 & Oracle : 8.37 \\ \mathrm{CV.lse} & 3.54 & 3.54 & 3.53 & 3.00 & 3.54 \\ \mathrm{CV.min} & 3.20 & 3.27 & 3.41 & 2.17 & 3.21 & \mathrm{sd}(\mu)/\sigma = 2 \\ \mathrm{AlCc} & 3.11 & 3.48 & 1.60 & 2.48 & \rho = 0.9 \\ \mathrm{AlC} & 1.40 & 1.40 & 1.42 & 1.38 & Oracle : 1.42 \\ \mathrm{CV.lse} & 99.62 & 99.74 & 99.82 & 84.51 & 99.66 \\ \mathrm{CV.min} & 94.55 & 98.98 & 99.72 & 92.58 & 94.75 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlC} & 93.78 & 93.69 & 99.07 & 83.67 & \rho = 0 \\ \mathrm{BIC} & 97.71 & 98.58 & 99.27 & 96.27 & Oracle : 86.46 \\ \mathrm{CV.lie} & 33.64 & 33.24 & 33.31 & 33.69 & 30.80 & 32.52 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlCc} & 33.02 & 33.24 & 33.34 & 32.53 & Oracle : 29.19 \\ \mathrm{CV.min} & 32.47 & 33.31 & 33.69 & 30.80 & 32.52 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlCc} & 33.02 & 33.24 & 33.34 & 32.53 & Oracle : 29.19 \\ \mathrm{CV.min} & 5.53 & 5.59 & 5.70 & 4.97 & 5.53 & \mathrm{sd}(\mu)/\sigma = 1 \\ \mathrm{AlCc} & 5.58 & 5.61 & 5.68 & 5.44 & Oracle : 4.90 \\ \mathrm{CV.min} & 25.98 & 250.88 & 251.03 & 30.99 & 251.08 \\ \mathrm{CV.min} & 25.98 & 250.88 & 251.03 & 30.99 & 251.08 \\ \mathrm{CV.lie} & 390.99 & 395.04 & 397.25 & 385.61 & Oracle : 4.90 \\ \mathrm{CV.lie} & 390.99 & 395.04 & 397.25 & 385.61 & Oracle : 260.93 \\ \mathrm{BIC} & 31.18 & 313.294 & 133.82 & 129.89 & Oracle : 260.93 \\ \mathrm{CV.lie} & 34.44 & 14.44 & 14.45 & 14.67 & 14.45 \\ \mathrm{CV.lie} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45 \\ \mathrm{CV.lie} & 14.49 & 14.44 & 14.45 & 14.67 & 14.45 \\ \mathrm{CV.min} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45 \\ \mathrm{CV.lie} & 14.49 & 14.44 & 14.45 & 14.67 & 14.45 \\ \mathrm{CV.lie} & 131.76 & 132.88 & 133.81 & 129.82 & Oracle : 87.87 \\ \mathrm{CV.lie} & 14.49 & 14.44 & 14.45 & 14.67 & 14.45 \\ \mathrm{CV.min} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45 \\ \mathrm{CV.min} & 14.44 & 14.44$  |        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|---|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| AICc 53.49 32.73 24.78 36.31 $\rho = 0$ AIC 24.45 24.64 24.82 24.13 $\rho = 0$ BIC 24.44 24.63 24.82 24.14 $\rho = 0$ CV.lse 20.83 20.84 20.86 10.87 20.84 $\rho = 0$ CV.lse 20.83 18.83 8.35 13.38 $\rho = 0$ AICc 18.93 18.83 8.35 13.38 $\rho = 0$ AIC 8.26 8.30 8.37 8.18 $\rho = 0$ BIC 8.25 8.30 8.37 8.21 $\rho = 0$ CV.lse 3.54 3.54 3.53 3.00 3.54 $\rho = 0$ CV.min 3.20 3.27 3.41 2.17 3.21 $\rho = 0$ AIC 1.40 1.40 1.42 1.38 $\rho = 0$ BIC 1.40 1.40 1.42 1.38 $\rho = 0$ BIC 1.40 1.40 1.42 1.38 $\rho = 0$ BIC 97.71 98.58 99.72 92.58 94.75 $\rho = 0$ AIC 93.78 93.69 99.07 83.67 $\rho = 0$ AIC 93.78 93.69 99.07 83.67 $\rho = 0$ AIC 97.75 98.62 99.27 96.27 $\rho = 0$ BIC 97.71 98.58 99.26 96.23 $\rho = 0$ CV.min 32.47 33.31 33.69 30.80 32.52 $\rho = 0$ AIC 33.02 33.24 33.49 32.55 $\rho = 0$ BIC 33.00 33.24 33.49 32.55 $\rho = 0$ AIC 33.02 33.24 33.49 32.55 $\rho = 0$ AIC 5.58 5.61 5.68 5.42 $\rho = 0$ AIC 5.58 5.61 5.68 5.42 $\rho = 0$ AIC 249.33 381.45 396.79 26.84 $\rho = 0$ AIC 39.99 395.04 397.25 385.41 $\rho = 0$ AIC 39.99 395.04 397.25 385.41 $\rho = 0$ AIC 39.99 395.04 397.28 385.61 $\rho = 0$ AIC 39.99 395.04 397.25 385.45 $\rho = 0$ AIC 39.99 395.04 397.28 385.61 $\rho = 0$ AIC 39.99 395.04 397.25 385.45 $\rho = 0$ AIC 39.99 395.04 397.25 385.61 $\rho = 0$ AIC 39.144 14.44 14.45 14.67 14.45 $\rho = 0$ AIC 131.83 132.94 133.82 129.89 $\rho = 0$ AIC 131.84 14.44 14.44 14.45 14.67 14.45 $\rho = 0$ AIC 131.84 14.44 14.44  |        |        |                                |                                 |             |               |                                       |
| AIC 24.45 24.64 24.82 24.13 $P$ Coracle : 24.83 $P$ Coracle : 24.84 $P$ Coracle : 24.83 $P$ Coracle : 24.84 $P$ Coracle : 24.85 $P$ Coracle : 24  |        |        |                                |                                 |             | 51.80         |                                       |
| BIC         24.44         24.63         24.82         24.14         Oracle : 24.83           CV. Ise         20.83         20.84         20.86         10.87         20.84 $20.84$ $20.96$ $20.56$ $30.83$ $30.83$ $30.83$ $30.83$ $30.84$ $30.84$ $30.84$ $30.84$ $30.84$ $30.94$ $30.84$ $30.94$ $30.84$ $30.94$ $30.94$ $30.94$ $30.94$ $30.94$  |        |        |                                | 24.78                           |             |               | $\rho = 0$                            |
| BIC         24.44         24.03         24.82         24.14           CV.Isin         20.83         20.84         20.86         10.87         20.84           CV.min         19.15         20.19         20.68         8.57         19.09 $sd(\mu)/\sigma = 2$ AIC         18.93         18.83         8.35         13.38 $\rho = 0.5$ AIC         8.26         8.30         8.37         8.18         Oracle: 8.37           CV.Ise         3.54         3.54         3.53         3.00         3.54 $sd(\mu)/\sigma = 2$ AIC         3.11         3.48         1.60         2.48 $\rho = 0.9$ AIC         3.11         3.48         1.60         2.48 $\rho = 0.9$ AIC         3.11         3.48         1.60         2.48 $\rho = 0.9$ AIC         1.40         1.40         1.42         2.30         Oracle: 1.42           CV.1se         99.62         99.74         99.82         84.51         99.66           CV.min         94.55         98.98         99.72         96.27 $\rho$ $\rho$ Oracle: 8.46           CV.1se         93.64         33.67 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Oracle : 24.83</td>   |        |        |                                |                                 |             |               | Oracle : 24.83                        |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 24.44  | 24.63                          | 24.82                           | 24.14       |               | 07466.24.03                           |
| AICc 18.93 18.83 8.35 13.38 $\rho = 0.5$ AIC 8.26 8.30 8.37 8.18 $\rho = 0.5$ AIC 8.26 8.30 8.37 8.18 $\rho = 0.5$ Oracle : 8.37 CV.1se 3.54 3.54 3.53 3.00 3.54 $\rho = 0.5$ AIC 3.11 3.48 1.60 2.48 $\rho = 0.9$ AIC 99.74 99.82 84.51 99.66 $\rho = 0.9$ AIC 97.75 98.62 99.77 96.27 $\rho = 0.9$ AIC 97.75 98.62 99.27 96.27 $\rho = 0.2$ AIC 97.71 98.58 99.26 96.23 $\rho = 0.5$ AIC 33.04 33.36 33.36 33.36 $\rho = 0.5$ AIC 33.00 33.24 33.36 28.83 $\rho = 0.5$ AIC 33.00 33.22 33.49 32.55 $\rho = 0.5$ AIC 33.00 33.22 33.49 32.55 $\rho = 0.5$ AIC 5.44 5.70 5.62 5.05 $\rho = 0.9$ AIC 5.44 5.70 5.62 5.05 $\rho = 0.9$ AIC 5.44 5.70 5.62 5.05 $\rho = 0.9$ AIC 5.88 5.61 5.68 5.42 $\rho = 0.9$ AIC 39.16 5.88 25.10 30.79 25.10 $\rho = 0.9$ AIC 39.16 39.51 39.52 $\rho = 0.9$ AIC 5.88 3.17 28.79 38.48 $\rho = 0.9$ AIC 39.16 39.93 39.50 30.79 25.10 $\rho = 0.9$ AIC 5.88 5.61 5.68 5.44 $\rho = 0.9$ AIC 5.84 5.70 5.62 5.05 $\rho = 0.9$ AIC 39.93 38.145 396.97 28.85 38.54 $\rho = 0.5$ AIC 39.99 395.04 397.25 385.45 $\rho = 0.9$ AIC 39.16 395.18 397.28 385.61 $\rho = 0.5$ AIC 39.16 395.18 397.28 385.61 $\rho = 0.5$ AIC 39.16 395.18 397.28 385.61 $\rho = 0.5$ AIC 31.70  | CV.1se | 20.83  | 20.84                          | 20.86                           | 10.87       | 20.84         |                                       |
| AIC 8.26 8.30 8.37 8.18 $Oracle: 8.37$ CV.1se 3.54 3.54 3.53 3.00 3.54 $(\mu)/\sigma = 2$ AIC 3.11 3.48 1.60 2.48 $\rho = 0.9$ AIC 1.40 1.40 1.42 1.38 $\rho = 0.9$ AIC 1.40 1.40 1.42 2.30 $\rho = 0.9$ AIC 2.16 3.78 99.62 99.74 99.82 84.51 99.66 $\rho = 0.9$ AIC 93.78 93.69 99.07 83.67 $\rho = 0.9$ AIC 97.75 98.62 99.27 96.27 $\rho = 0.9$ AIC 97.75 98.62 99.27 96.23 $\rho = 0.9$ AIC 2.30 $\rho = 0.9$ AIC 3.36 3.36 33.69 30.80 32.52 $\rho = 0.9$ AIC 3.36 3.37 3.37 3.38 33.69 30.80 32.52 $\rho = 0.5$ AIC 3.30 33.24 33.36 28.83 $\rho = 0.5$ AIC 3.30 3.32 33.49 32.55 $\rho = 0.5$ AIC 3.30 3.32 33.49 32.53 $\rho = 0.5$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ AIC 3.91.16 395.18 397.28 385.61 $\rho = 0.5$ AIC 3.91.16 395.18 397.25 385.45 $\rho = 0.5$ AIC 3.91.16 395.18 397.28 385.61 $\rho = 0.5$ AIC 4.44 4.44 4.44 4.44 5.44 6.67 14.45 $\rho = 0.5$ AIC 131.83 132.94 133.82 129.89 $\rho = 0.5$ AIC 131.76 132.88 133.81 129.82 $\rho = 0.5$ AIC 131.76 132.88 133.81 129.82 $\rho = 0.5$ AIC 14.39 14.47 22.61 151.40 $\rho = 0.5$ AIC 14.39 14.47 22.61 151.40  | CV.min | 19.15  | 20.19                          | 20.68                           | 8.57        | 19.09         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         8.25         8.30         8.37         8.21         Oracle : 8.37           CV. Ise         3.54         3.54         3.53         3.00         3.54 $sd(\mu)/\sigma = 2$ AIC         3.11         3.48         1.60         2.48 $\rho = 0.9$ AIC         1.40         1.40         1.42         1.38         Oracle : 1.42           CV. Ise         99.62         99.74         99.82         84.51         99.66           CV.min         94.55         98.98         99.72         92.58         94.75 $sd(\mu)/\sigma = 1$ AIC         93.78         93.69         99.27         96.27         Oracle : 86.46           CV. Ise         93.64         33.67         33.71         28.79         33.68           CV. Ise         33.64         33.67         33.71         28.79         33.68           CV. Ise         33.64         33.67         33.71         28.79         33.68           CV. Ise         33.64         33.67         33.71         28.79         33.68           CV. Ise         33.02         33.24         33.349         32.53         Oracle : 29.19           CV. Ise         5.73 <td< td=""><td>AICc</td><td>18.93</td><td>18.83</td><td>8.35</td><td>13.38</td><td></td><td><math display="block">\rho = 0.5</math></td></td<>   | AICc   | 18.93  | 18.83                          | 8.35                            | 13.38       |               | $\rho = 0.5$                          |
| BIC         8.25         8.30         8.31         8.21           CV.Isia         3.54         3.53         3.00         3.54           CV.min         3.20         3.27         3.41         2.17         3.21         sd(μ)/σ = 2           AICc         3.11         3.48         1.60         2.48 $\rho = 0.9$ AIC         1.40         1.40         1.42         1.38         Oracle : 1.42           CV.Ise         99.62         99.74         99.82         84.51         99.66           CV.min         94.55         98.98         99.72         92.58         94.75         sd(μ)/σ = 1           AICc         93.78         93.69         99.07         83.67 $\rho = 0$ AIC         97.75         98.62         99.27         96.27         Oracle : 86.46           CV.Ise         33.64         33.67         33.71         28.79         33.68         sd(μ)/σ = 1           AICc         32.08         32.43         33.36         28.83 $\rho = 0.5$ CV.Ise         33.00         33.22         33.49         32.53         Oracle : 29.19           CV.Ise         5.73         5.73         5.73   | AIC    | 8.26   | 8.30                           | 8.37                            | 8.18        |               | Orgalo · § 37                         |
| $\begin{array}{c} \text{CV.min} & 3.20 & 3.27 & 3.41 & 2.17 & 3.21 & \mathrm{sd}(\mu)/\sigma = 2\\ \text{AICc} & 3.11 & 3.48 & 1.60 & 2.48 & \rho = 0.9\\ \text{AIC} & 1.40 & 1.40 & 1.42 & 1.38\\ \text{BIC} & 1.40 & 1.40 & 1.42 & 2.30 & Oracle: 1.42\\ \hline \text{CV.Ise} & 99.62 & 99.74 & 99.82 & 84.51 & 99.66\\ \text{CV.min} & 94.55 & 98.98 & 99.72 & 92.58 & 94.75 & \mathrm{sd}(\mu)/\sigma = 1\\ \text{AICc} & 93.78 & 93.69 & 99.07 & 83.67 & \rho = 0\\ \text{AIC} & 97.75 & 98.62 & 99.27 & 96.27\\ \hline \text{BIC} & 97.71 & 98.58 & 99.26 & 96.23 & Oracle: 86.46\\ \hline \text{CV.Ise} & 33.64 & 33.67 & 33.71 & 28.79 & 33.68\\ \hline \text{CV.min} & 32.47 & 33.31 & 33.69 & 30.80 & 32.52 & \mathrm{sd}(\mu)/\sigma = 1\\ \text{AICc} & 32.08 & 32.43 & 33.36 & 28.83 & \rho = 0.5\\ \hline \text{AIC} & 33.02 & 33.24 & 33.49 & 32.55 & Oracle: 29.19\\ \hline \text{CV.Ise} & 5.73 & 5.73 & 5.73 & 5.38 & 5.74\\ \hline \text{CV.min} & 5.53 & 5.59 & 5.70 & 4.97 & 5.53 & \mathrm{sd}(\mu)/\sigma = 1\\ \hline \text{AICc} & 5.44 & 5.70 & 5.62 & 5.05 & \rho = 0.9\\ \hline \text{AIC} & 5.58 & 5.61 & 5.68 & 5.42 & Oracle: 4.90\\ \hline \text{CV.Ise} & 250.85 & 250.88 & 251.03 & 307.99 & 251.08\\ \hline \text{CV.Ise} & 250.85 & 250.88 & 251.03 & 307.99 & 251.08\\ \hline \text{CV.Ise} & 390.99 & 395.04 & 397.25 & 385.45\\ \hline \text{CV.Ise} & 84.73 & 11.72 & 133.55 & 90.21 & \rho = 0.5\\ \hline \text{AIC} & 84.43 & 117.72 & 133.55 & 90.21 & \rho = 0.5\\ \hline \text{AIC} & 84.43 & 117.72 & 133.55 & 90.21 & \rho = 0.5\\ \hline \text{AIC} & 84.43 & 117.72 & 133.55 & 90.21 & \rho = 0.5\\ \hline \text{AIC} & 84.43 & 117.72 & 133.55 & 90.21 & \rho = 0.5\\ \hline \text{AIC} & 131.83 & 132.94 & 133.82 & 129.89\\ \hline \text{CV.Ise} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Ise} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Ise} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Ise} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ \hline \text{CV.Isin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45\\ $ | BIC    | 8.25   | 8.30                           | 8.37                            | 8.21        |               | Oracie . 8.37                         |
| AICc 3.11 3.48 1.60 2.48 $\rho = 0.9$ AIC 1.40 1.40 1.42 1.38 $\rho = 0.9$ AIC 1.40 1.40 1.42 2.30 $\rho = 0.9$ AIC 1.40 1.40 1.42 2.30 $\rho = 0.9$ AIC 1.40 1.40 1.42 2.30 $\rho = 0.9$ AIC 2.30 $\rho = 0.9$ AIC 2.30 $\rho = 0.9$ AIC 2.378 93.69 99.72 92.58 94.75 $\rho = 0.9$ AIC 2.378 93.69 99.07 83.67 $\rho = 0.9$ AIC 2.379 98.58 99.26 96.23 $\rho = 0.9$ AIC 2.33.1 33.1 33.69 30.80 32.52 $\rho = 0.5$ AIC 33.02 33.24 33.49 32.55 $\rho = 0.5$ AIC 33.02 33.24 33.49 32.53 $\rho = 0.5$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.44 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.44 $\rho = 0.9$ AIC 2.49.3 381.45 396.97 266.84 $\rho = 0.9$ AIC 390.99 395.04 397.25 385.45 $\rho = 0.5$ AIC 31.83 132.94 133.82 129.89 BIC 131.76 132.84 118.99 85.26 $\rho = 0.5$ AIC 31.83 132.94 133.82 129.89 BIC 131.76 132.84 133.81 129.82 $\rho = 0.5$ AIC 14.39 14.44 14.49 14.54 16.22 14.49 $\rho = 0.9$ AIC 14.39 14.47 22.61 151.4 $\rho = 0.9$ AIC 14.39 14.47 22.61 151.4 $\rho = 0.9$ AIC 14.39 14.47 22.61 151.4   | CV.1se | 3.54   | 3.54                           | 3.53                            | 3.00        | 3.54          |                                       |
| AIC 1.40 1.40 1.42 1.38   BIC 1.40 1.40 1.42 2.30    CV.1se 99.62 99.74 99.82 84.51 99.66   CV.min 94.55 98.98 99.72 92.58 94.75 $sd(\mu)/\sigma=1$ AICc 93.78 93.69 99.07 83.67 $\rho=0$ AIC 97.75 98.62 99.27 96.27   BIC 97.71 98.58 99.26 96.23    CV.lse 33.64 33.67 33.71 28.79 33.68   CV.min 32.47 33.31 33.69 30.80 32.52 $sd(\mu)/\sigma=1$ AICc 33.02 33.24 33.49 32.55   BIC 33.00 33.22 33.49 32.53    CV.lse 5.73 5.73 5.73 5.73 5.38 5.74   CV.min 5.53 5.59 5.70 4.97 5.53 $sd(\mu)/\sigma=1$ AICc 5.44 5.70 5.62 5.05 $\rho=0.9$ AIC 5.58 5.61 5.68 5.42   BIC 5.58 5.61 5.68 5.42   CV.lse 250.85 250.88 251.03 307.99 251.08   CV.lse 84.75 84.79 84.80 98.73 84.80   CV.lse 84.75 84.79 84.80 98.73 84.80   CV.lse 84.75 84.79 84.80 98.73 84.80   CV.lse 131.83 132.94 133.81 129.82   CV.lse 14.44 14.44 14.45 14.67 14.45   CV.min 14.44 14.49 14.54 16.22 14.49 $sd(\mu)/\sigma=0.5$ AICc 14.39 14.47 22.61 151.4  | CV.min | 3.20   | 3.27                           | 3.41                            | 2.17        | 3.21          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC 1.40 1.40 1.42 2.30 $Oracte: 1.42$ CV.1se 99.62 99.74 99.82 84.51 99.66 CV.min 94.55 98.98 99.72 92.58 94.75 $\rho=0$ AIC 93.78 93.69 99.07 83.67 $\rho=0$ AIC 97.75 98.62 99.27 96.27 $\rho=0$ AIC 97.75 98.62 99.26 96.23 $Oracle: 86.46$ CV.1se 33.64 33.67 33.71 28.79 33.68 CV.min 32.47 33.31 33.69 30.80 32.52 $\rho=0.5$ AIC 33.02 33.24 33.36 28.83 $\rho=0.5$ AIC 33.00 33.22 33.49 32.55 $Oracle: 9.99$ $Oracle: 9.99$ AIC 5.58 5.61 5.68 5.42 $Oracle: 9.99$ AIC 5.58 5.61 5.68 5.44 $Oracle: 9.99$ AIC 5.58 5.61 5.68 5.44 $Oracle: 9.99$ AIC 250.85 250.88 251.03 307.99 251.08 $Oracle: 4.90$ AIC 391.16 395.18 397.28 385.45 $Oracle: 260.93$ AIC 31.76 392.83 385.41 $Oracle: 260.93$ AIC 31.76 393.94 397.25 385.45 $Oracle: 260.93$ AIC 31.76 132.88 133.81 129.82 $Oracle: 87.87$ $Oracle: 87.87$ $Oracle: 87.87$ $Oracle: 260.93$ AIC 131.83 132.94 133.82 129.89 $Oracle: 87.87$  | AICc   | 3.11   | 3.48                           | 1.60                            | 2.48        |               | $\rho = 0.9$                          |
| BIC         1.40         1.40         1.42         2.30           CV.1se         99.62         99.74         99.82         84.51         99.66           CV.min         94.55         98.98         99.72         92.58         94.75         sd(μ)/σ = 1           AIC         93.78         93.69         99.07         83.67         ρ = 0           AIC         97.75         98.62         99.27         96.27           BIC         97.71         98.58         99.26         96.23           CV.Ise         33.64         33.67         33.71         28.79         33.68           CV.min         32.47         33.31         33.69         30.80         32.52         sd(μ)/σ = 1           AIC         33.02         33.24         33.36         28.83         ρ = 0.5           AIC         33.00         33.22         33.49         32.53         Oracle : 29.19           CV.lse         5.73         5.73         5.73         5.38         5.74           CVmin         5.53         5.59         5.70         4.97         5.53         sd(μ)/σ = 0           AIC         5.44         5.70         5.62         5.05         ρ         ρ   | AIC    | 1.40   | 1.40                           | 1.42                            | 1.38        |               | Omagle : 1.42                         |
| CV.min 94.55 98.98 99.72 92.58 94.75 $\operatorname{sd}(\mu)/\sigma = 1$ AICc 93.78 93.69 99.07 83.67 $\rho = 0$ AIC 97.75 98.62 99.27 96.27 $\rho = 0$ Oracle : 86.46 CV.1se 33.64 33.67 33.71 28.79 33.68 $\rho = 0.5$ AIC 33.02 33.24 33.36 28.83 $\rho = 0.5$ AIC 33.00 33.22 33.49 32.55 $\rho = 0.5$ AIC 5.53 5.59 5.70 4.97 5.53 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ AIC 391.16 395.18 397.28 385.61 BIC 390.99 395.04 397.25 385.45 $\rho = 0.5$ AIC 31.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82 $\rho = 0.5$ AIC 14.49 $\rho = 0.5$ AIC 15.16 13.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82 $\rho = 0.5$ AIC 14.49 $\rho = 0.5$ AIC 14.49 $\rho = 0.5$ AIC 14.44 14.44 14.45 14.67 14.45 $\rho = 0.5$ AIC 14.49 $\rho = 0.5$ AIC 14.44 14.44 14.45 14.67 14.45 $\rho = 0.5$ AIC 14.49 $\rho = 0.5$ AIC 14.40 $\rho = 0.5$   | BIC    | 1.40   | 1.40                           | 1.42                            | 2.30        |               | Oracie : 1.42                         |
| AICc 93.78 93.69 99.07 83.67 $\rho = 0$ AIC 97.75 98.62 99.27 96.27 BIC 97.71 98.58 99.26 96.23  CV.1se 33.64 33.67 33.71 28.79 33.68  CV.min 32.47 33.31 33.69 30.80 32.52 $sd(\mu)/\sigma = 1$ AICc 32.08 32.43 33.36 28.83 $\rho = 0.5$ AIC 33.02 33.24 33.49 32.55 BIC 33.00 33.22 33.49 32.53  CV.min 5.53 5.73 5.73 5.73 5.38 5.74  CV.min 5.53 5.59 5.70 4.97 5.53 $sd(\mu)/\sigma = 1$ AICc 5.44 5.70 5.62 5.05 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 BIC 5.58 5.61 5.68 5.42  CV.1se 250.85 250.88 251.03 307.99 251.08  CV.min 251.92 252.45 253.02 365.30 253.21 $sd(\mu)/\sigma = 0.5$ AIC 391.16 395.18 397.28 385.61 BIC 390.99 395.04 397.25 385.45  CV.nin 85.25 85.31 85.31 118.99 85.26 $sd(\mu)/\sigma = 0.5$ AIC 131.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82  CV.nin 14.44 14.44 14.45 14.67 14.45  CV.nin 14.44 14.44 14.45 14.67 14.45  CV.nin 14.44 14.44 14.45 14.67 14.45  CV.nin 14.44 14.44 14.49 14.54 16.22 14.49 $sd(\mu)/\sigma = 0.5$ AIC 14.39 14.47 22.61 15.14  AIC 243.3 22.50 22.55 21.62   | CV.1se | 99.62  | 99.74                          | 99.82                           | 84.51       | 99.66         |                                       |
| AICc 93.78 93.69 99.07 83.67 $\rho = 0$ AIC 97.75 98.62 99.27 96.27 BIC 97.71 98.58 99.26 96.23  CV.1se 33.64 33.67 33.71 28.79 33.68  CV.min 32.47 33.31 33.69 30.80 32.52 $sd(\mu)/\sigma = 1$ AICc 32.08 32.43 33.36 28.83 $\rho = 0.5$ AIC 33.02 33.24 33.49 32.55 BIC 33.00 33.22 33.49 32.53  CV.min 5.53 5.73 5.73 5.73 5.38 5.74  CV.min 5.53 5.59 5.70 4.97 5.53 $sd(\mu)/\sigma = 1$ AICc 5.44 5.70 5.62 5.05 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 BIC 5.58 5.61 5.68 5.42  CV.1se 250.85 250.88 251.03 307.99 251.08  CV.min 251.92 252.45 253.02 365.30 253.21 $sd(\mu)/\sigma = 0.5$ AIC 391.16 395.18 397.28 385.61 BIC 390.99 395.04 397.25 385.45  CV.nin 85.25 85.31 85.31 118.99 85.26 $sd(\mu)/\sigma = 0.5$ AIC 131.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82  CV.nin 14.44 14.44 14.45 14.67 14.45  CV.nin 14.44 14.44 14.45 14.67 14.45  CV.nin 14.44 14.44 14.45 14.67 14.45  CV.nin 14.44 14.44 14.49 14.54 16.22 14.49 $sd(\mu)/\sigma = 0.5$ AIC 14.39 14.47 22.61 15.14  AIC 243.3 22.50 22.55 21.62   | CV.min | 94.55  | 98.98                          | 99.72                           | 92.58       | 94.75         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 97.71 98.58 99.26 96.23 $CV.1se$ 33.64 33.67 33.71 28.79 33.68 $CV.min$ 32.47 33.31 33.69 30.80 32.52 $cV.min$ 32.47 33.31 33.69 30.80 32.52 $cV.min$ 32.48 32.43 33.36 28.83 $cV.min$ 32.08 32.43 33.49 32.55 $cV.min$ 33.00 33.22 33.49 32.53 $cV.min$ 5.53 5.73 5.73 5.38 5.74 $cV.min$ 5.53 5.59 5.70 4.97 5.53 $cV.min$ 5.53 5.59 5.70 4.97 5.53 $cV.min$ 5.58 5.61 5.68 5.42 $cV.min$ 5.58 5.61 5.68 5.42 $cV.min$ 5.58 5.61 5.68 5.44 $cV.min$ 5.59 5.61 5.68 5.44 $cV.min$ 6.51 5.58 5.61 5.68 5.44 $cV.min$ 6.51.80 250.88 251.03 307.99 251.08 $cV.min$ 251.92 252.45 253.02 365.30 253.21 $cV.min$ 251.92 252.45 253.02 365.30 253.21 $cV.min$ 251.92 395.18 397.28 385.61 $cV.min$ 85.25 85.31 85.31 118.99 85.26 $cV.min$ 87.27 84.80 98.73 84.80 $cV.min$ 85.25 85.31 85.31 118.99 85.26 $cV.min$ 85.25 85.31 85.31 118.99 85.26 $cV.min$ 87.27 84.80 98.73 84.80 $cV.min$ 87.28 84.79 84.80 98.73 84.80 $cV.min$ 85.25 85.31 85.31 118.99 85.26 $cV.min$ 86.28 84.43 117.72 133.55 90.21 $cV.min$ 85.25 85.31 85.31 118.99 85.26 $cV.min$ 86.28 84.43 117.74 133.85 129.89 $cV.min$ 87.44 14.44 14.45 14.45 14.67 14.45 $cV.min$ 14.44 14.44 14.45 14.45 14.67 14.45 $cV.min$ 14.44 14.44 14.45 14.54 16.22 14.49 $cV.min$ 14.44 14.44 14.45 14.67 14.67 14.45 $cV.min$ 14.44 14.44 14.45 14.54 16.22 14.49 $cV.min$ 14.44 14.44 14.45 14.67 14.67 14.45 $cV.min$ 14.44 14.44 14.45 14.67 14.67 14.49 $cV.min$ 14.44 14.44 14.45 14.67 14.67 14.49 $cV.min$ 14.44 14.44 14.45 14.67 14.67 14.49 $cV.m$   | AICc   | 93.78  | 93.69                          | 99.07                           | 83.67       |               |                                       |
| BIC         97.71         98.58         99.26         96.23           CV.1se         33.64         33.67         33.71         28.79         33.68           CV.min         32.47         33.31         33.69         30.80         32.52 $sd(\mu)/\sigma = 1$ AIC         32.08         32.43         33.36         28.83 $\rho = 0.5$ AIC         33.00         33.22         33.49         32.55         Oracle : 29.19           CV.1se         5.73         5.73         5.73         5.38         5.74           CV.min         5.53         5.59         5.70         4.97         5.53 $sd(\mu)/\sigma = 1$ AIC         5.58         5.61         5.68         5.42         Oracle : 4.90           CV.1se         250.85         250.88         251.03         307.99         251.08           CV.min         251.92         252.45         253.02         365.30         253.21 $sd(\mu)/\sigma = 0.5$ AIC         391.16         395.18         397.28         385.61         Oracle : 260.93           CV.se         84.75         84.79         84.80         98.73         84.80           CV.min         85.25   | AIC    | 97.75  | 98.62                          | 99.27                           | 96.27       |               | 0 1 06 46                             |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 97.71  | 98.58                          | 99.26                           | 96.23       |               | <i>Oracle</i> : 86.46                 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se | 33.64  | 33.67                          | 33.71                           | 28.79       | 33.68         |                                       |
| AICc 32.08 32.43 33.36 28.83 $ρ = 0.5$ AIC 33.02 33.24 33.49 32.55 $Oracle : 29.19$ $Orac$   |        |        |                                | 33.69                           |             | 32.52         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 33.00 33.22 33.49 32.53 $Oracle : 29.19$ CV.1se 5.73 5.73 5.73 5.38 5.74 $Ovalling (V) = 0.9$ AIC 5.44 5.70 5.62 5.05 $ovalling (V) = 0.9$ AIC 5.58 5.61 5.68 5.42 $ovalling (V) = 0.9$ BIC 5.58 5.61 5.68 5.44 $ovalling (V) = 0.9$ CV.1se 250.85 250.88 251.03 307.99 251.08 $ovalling (V) = 0.9$ AIC 249.33 381.45 396.97 266.84 $ovalling (V) = 0.9$ AIC 391.16 395.18 397.28 385.61 $ovalling (V) = 0.9$ BIC 390.99 395.04 397.25 385.45 $ovalling (V) = 0.9$ CV.1se 84.75 84.79 84.80 98.73 84.80 $ovalling (V) = 0.9$ AIC 131.83 132.94 133.82 129.89 $ovalling (V) = 0.9$ BIC 131.76 132.88 133.81 129.82 $ovalling (V) = 0.9$ AIC 14.44 14.44 14.45 14.67 14.45 $ovalling (V) = 0.9$ AIC 14.39 14.47 22.61 15.14 $ovalling (V) = 0.9$ AIC 14.39 14.47 22.61 15.14 $ovalling (V) = 0.9$ AIC 23.33 23.55 23.50 23.75 21.62   | AICc   | 32.08  | 32.43                          | 33.36                           | 28.83       |               |                                       |
| BIC         33.00         33.22         33.49         32.53           CV.1se         5.73         5.73         5.38         5.74           CV.min         5.53         5.59         5.70 <b>4.97</b> 5.53 $sd(\mu)/\sigma = 1$ AIC         5.44         5.70         5.62         5.05 $\rho = 0.9$ AIC         5.58         5.61         5.68         5.42         Oracle : 4.90           CV.1se         250.85         250.88         251.03         307.99         251.08           CV.min         251.92         252.45         253.02         365.30         253.21 $sd(\mu)/\sigma = 0.5$ AIC         391.16         395.18         397.28         385.61         Oracle : 260.93           BIC         390.99         395.04         397.25         385.45         Oracle : 260.93           CV.1se         84.75         84.79         84.80         98.73         84.80 $sd(\mu)/\sigma = 0.5$ AIC         131.83         132.94         133.82         129.89 $oracle : 87.87$ BIC         131.76         132.88         133.81         129.82 $oracle : 87.87$ CV.1se         14.44 </td <td>AIC</td> <td>33.02</td> <td>33.24</td> <td>33.49</td> <td>32.55</td> <td></td> <td>20.10</td>  | AIC    | 33.02  | 33.24                          | 33.49                           | 32.55       |               | 20.10                                 |
| $\begin{array}{ c c c c c c c c }\hline CV.1se & 5.73 & 5.73 & 5.73 & 5.38 & 5.74 \\ CV.min & 5.53 & 5.59 & 5.70 & \textbf{4.97} & 5.53 & \operatorname{sd}(\mu)/\sigma = 1 \\ AICc & 5.44 & 5.70 & 5.62 & 5.05 & \rho = 0.9 \\ AIC & 5.58 & 5.61 & 5.68 & 5.42 & Oracle : 4.90 \\ \hline BIC & 5.58 & 5.61 & 5.68 & 5.42 & Oracle : 4.90 \\ \hline CV.1se & 250.85 & 250.88 & 251.03 & 307.99 & 251.08 & \\ CV.min & 251.92 & 252.45 & 253.02 & 365.30 & 253.21 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ AICc & \textbf{249.33} & 381.45 & 396.97 & 266.84 & \rho = 0 \\ AIC & 391.16 & 395.18 & 397.28 & 385.61 & Oracle : 260.93 \\ \hline CV.1se & 84.75 & 84.79 & 84.80 & 98.73 & 84.80 & \\ CV.min & 85.25 & 85.31 & 85.31 & 118.99 & 85.26 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ AICc & \textbf{84.43} & 117.72 & 133.55 & 90.21 & \rho = 0.5 \\ AIC & 131.83 & 132.94 & 133.82 & 129.89 & Oracle : 87.87 \\ \hline CV.1se & 14.44 & 14.44 & 14.45 & 14.67 & 14.45 & \\ CV.min & 14.44 & 14.44 & 14.45 & 14.67 & 14.45 & \\ CV.min & 14.44 & 14.44 & 14.45 & 14.67 & 14.45 & \\ CV.min & 14.44 & 14.49 & 14.54 & 16.22 & 14.49 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ AICc & \textbf{14.39} & 14.47 & 22.61 & 15.14 & \rho = 0.9 \\ AIC & 22.32 & 22.50 & 22.75 & 21.62 & \\ \hline \end{array}$  | BIC    | 33.00  | 33.22                          | 33.49                           | 32.53       |               | <i>Oracie</i> : 29.19                 |
| AICc 5.44 5.70 5.62 5.05 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ BIC 5.58 5.61 5.68 5.44 $\rho = 0.9$ CV.1se 250.85 250.88 251.03 307.99 251.08 CV.min 251.92 252.45 253.02 365.30 253.21 $\rho = 0.5$ AICc 249.33 381.45 396.97 266.84 $\rho = 0.5$ AIC 391.16 395.18 397.28 385.61 BIC 390.99 395.04 397.25 385.45 $\rho = 0.5$ CV.1se 84.75 84.79 84.80 98.73 84.80 CV.min 85.25 85.31 85.31 118.99 85.26 $\rho = 0.5$ AIC 131.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82 $\rho = 0.5$ CV.1se 14.44 14.44 14.45 14.67 14.45 $\rho = 0.5$ AIC 14.39 14.47 22.61 15.14 $\rho = 0.5$ AIC 14.39 14.47 22.61 15.14 $\rho = 0.5$ AIC 23.33 14.47 22.61 15.14 $\rho = 0.5$ AIC 23.33 22.50 23.75 21.63   | CV.1se | 5.73   | 5.73                           | 5.73                            |             | 5.74          |                                       |
| AICc 5.44 5.70 5.62 5.05 $\rho = 0.9$ AIC 5.58 5.61 5.68 5.42 $\rho = 0.9$ BIC 5.58 5.61 5.68 5.44 $\rho = 0.9$ CV.1se 250.85 250.88 251.03 307.99 251.08 CV.min 251.92 252.45 253.02 365.30 253.21 $\rho = 0.5$ AICc 249.33 381.45 396.97 266.84 $\rho = 0.5$ AIC 391.16 395.18 397.28 385.61 BIC 390.99 395.04 397.25 385.45 $\rho = 0.5$ CV.1se 84.75 84.79 84.80 98.73 84.80 CV.min 85.25 85.31 85.31 118.99 85.26 $\rho = 0.5$ AIC 131.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82 $\rho = 0.5$ CV.1se 14.44 14.44 14.45 14.67 14.45 $\rho = 0.5$ AIC 14.39 14.47 22.61 15.14 $\rho = 0.5$ AIC 14.39 14.47 22.61 15.14 $\rho = 0.5$ AIC 23.33 14.47 22.61 15.14 $\rho = 0.5$ AIC 23.33 22.50 23.75 21.63   | CV.min | 5.53   | 5.59                           | 5.70                            | 4.97        | 5.53          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AIC 5.58 5.61 5.68 5.42 $Oracle: 4.90$ BIC 5.58 5.61 5.68 5.44 $Oracle: 4.90$ CV.1se 250.85 250.88 251.03 307.99 251.08 CV.min 251.92 252.45 253.02 365.30 253.21 $sd(\mu)/\sigma = 0.5$ AIC 391.16 395.18 397.28 385.61 BIC 390.99 395.04 397.25 385.45 $Oracle: 260.93$ CV.min 85.25 85.31 85.31 118.99 85.26 $sd(\mu)/\sigma = 0.5$ AIC 84.43 117.72 133.55 90.21 $\rho = 0.5$ AIC 131.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82 $Oracle: 87.87$ CV.1se 14.44 14.44 14.45 14.67 14.45 $Oracle: 87.87$ CV.min 14.44 14.49 14.54 16.22 14.49 $oracle: 81.90$ AIC 22.32 22.50 22.75 21.62   |        |        |                                |                                 |             |               |                                       |
| BIC         5.58         5.61         5.68         5.44         Oracle: 4.90           CV.1se         250.85         250.88         251.03         307.99         251.08           CV.min         251.92         252.45         253.02         365.30         253.21 $sd(\mu)/\sigma = 0.5$ AICc         249.33         381.45         396.97         266.84 $\rho = 0$ AIC         391.16         395.18         397.28         385.61         Oracle: 260.93           BIC         390.99         395.04         397.25         385.45         Oracle: 260.93           CV.1se         84.75         84.79         84.80         98.73         84.80           CV.min         85.25         85.31         85.31         118.99         85.26 $sd(\mu)/\sigma = 0.5$ AIC         131.83         132.94         133.82         129.89         Oracle: 87.87           BIC         131.76         132.88         133.81         129.82         Oracle: 87.87           CV.nin         14.44         14.44         14.45         14.67         14.45           CV.min         14.44         14.49         14.54         16.22         14.49 $sd(\mu)/\sigma = 0.5$ <  | AIC    | 5.58   | 5.61                           | 5.68                            | 5.42        |               | ,                                     |
| $\begin{array}{ c c c c c c c c }\hline \text{CV.1se} & 250.85 & 250.88 & 251.03 & 307.99 & 251.08 \\ \hline \text{CV.min} & 251.92 & 252.45 & 253.02 & 365.30 & 253.21 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ \hline \text{AICc} & \textbf{249.33} & 381.45 & 396.97 & 266.84 & & & & & & & \\ \hline \text{AIC} & 391.16 & 395.18 & 397.28 & 385.61 & & & & & \\ \hline \text{BIC} & 390.99 & 395.04 & 397.25 & 385.45 & & & & & \\ \hline \text{CV.1se} & 84.75 & 84.79 & 84.80 & 98.73 & 84.80 & \\ \hline \text{CV.min} & 85.25 & 85.31 & 85.31 & 118.99 & 85.26 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ \hline \text{AICc} & \textbf{84.43} & 117.72 & 133.55 & 90.21 & & & & \\ \hline \text{AIC} & 131.83 & 132.94 & 133.82 & 129.89 & & & & \\ \hline \text{BIC} & 131.76 & 132.88 & 133.81 & 129.82 & & & & \\ \hline \text{CV.nin} & 14.44 & 14.44 & 14.45 & 14.67 & 14.45 & \\ \hline \text{CV.min} & 14.44 & 14.49 & 14.54 & 16.22 & 14.49 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ \hline \text{AICc} & \textbf{14.39} & 14.47 & 22.61 & 15.14 & & & \\ \hline \text{AIC} & 22.32 & 22.50 & 22.75 & 21.62 & & & \\ \hline \end{array}$   |        |        |                                |                                 |             |               | <i>Oracle</i> : 4.90                  |
| CV.min         251.92         252.45         253.02         365.30         253.21 $sd(\mu)/\sigma = 0.5$ AICc         249.33         381.45         396.97         266.84 $\rho = 0$ AIC         391.16         395.18         397.28         385.61 $\rho = 0$ BIC         390.99         395.04         397.25         385.45 $\rho = 0.5$ CV.1se         84.75         84.79         84.80         98.73         84.80           CV.min         85.25         85.31         85.31         118.99         85.26 $sd(\mu)/\sigma = 0.5$ AIC         84.43         117.72         133.55         90.21 $\rho = 0.5$ AIC         131.83         132.94         133.82         129.89 $\rho = 0.5$ BIC         131.76         132.88         133.81         129.82 $\rho = 0.5$ CV.1se         14.44         14.44         14.45         14.67         14.45           CV.min         14.44         14.49         14.54         16.22         14.49 $sd(\mu)/\sigma = 0.5$ AIC         14.39         14.47         22.61         15.14 $\rho = 0.9$   |        |        |                                |                                 |             | 251.08        |                                       |
| AICc 249.33 381.45 396.97 266.84 $\rho = 0$ AIC 391.16 395.18 397.28 385.61 BIC 390.99 395.04 397.25 385.45  CV.1se 84.75 84.79 84.80 98.73 84.80 CV.min 85.25 85.31 85.31 118.99 85.26 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 84.43 117.72 133.55 90.21 $\rho = 0.5$ AIC 131.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82  CV.1se 14.44 14.44 14.45 14.67 14.45 CV.min 14.44 14.49 14.54 16.22 14.49 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 14.39 14.47 22.61 15.14 $\rho = 0.9$  |        |        |                                |                                 |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC 391.16 395.18 397.28 385.61 $Oracle: 260.93$ $Oracl$   | AICc   | 249.33 | 381.45                         | 396.97                          | 266.84      |               |                                       |
| BIC       390.99       395.04       397.25       385.45         CV.1se       84.75       84.79       84.80       98.73       84.80         CV.min       85.25       85.31       85.31       118.99       85.26 $sd(\mu)/\sigma = 0.5$ AICc       84.43       117.72       133.55       90.21 $\rho = 0.5$ AIC       131.83       132.94       133.82       129.89         BIC       131.76       132.88       133.81       129.82         CV.1se       14.44       14.45       14.67       14.45         CV.min       14.44       14.49       14.54       16.22       14.49 $sd(\mu)/\sigma = 0.5$ AICc       14.39       14.47       22.61       15.14 $\rho = 0.9$  | AIC    | 391.16 | 395.18                         | 397.28                          | 385.61      |               |                                       |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   | BIC    | 390.99 | 395.04                         | 397.25                          | 385.45      |               | Oracle: 260.93                        |
| CV.min       85.25       85.31       85.31       118.99       85.26 $sd(\mu)/\sigma = 0.5$ AICc       84.43       117.72       133.55       90.21 $\rho = 0.5$ AIC       131.83       132.94       133.82       129.89         BIC       131.76       132.88       133.81       129.82         CV.1se       14.44       14.45       14.67       14.45         CV.min       14.44       14.49       14.54       16.22       14.49 $sd(\mu)/\sigma = 0.5$ AICc       14.39       14.47       22.61       15.14 $\rho = 0.9$   | CV.1se | 84.75  |                                | 84.80                           |             | 84.80         |                                       |
| AICc 84.43 117.72 133.55 90.21 $\rho = 0.5$ AIC 131.83 132.94 133.82 129.89 BIC 131.76 132.88 133.81 129.82  CV.1se 14.44 14.44 14.45 14.67 14.45 CV.min 14.44 14.49 14.54 16.22 14.49 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 14.39 14.47 22.61 15.14 $\rho = 0.9$  |        | 85.25  | 85.31                          | 85.31                           | 118.99      | 85.26         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC       131.83       132.94       133.82       129.89         BIC       131.76       132.88       133.81       129.82         CV.1se       14.44       14.45       14.67       14.45         CV.min       14.44       14.49       14.54       16.22       14.49 $sd(\mu)/\sigma = 0.5$ AICc       14.39       14.47       22.61       15.14 $\rho = 0.9$  |        |        |                                |                                 |             |               |                                       |
| BIC       131.76       132.88       133.81       129.82       Oracle: 87.87         CV.1se       14.44       14.44       14.45       14.67       14.45         CV.min       14.44       14.49       14.54       16.22       14.49 $sd(\mu)/\sigma = 0.5$ AICc       14.39       14.47       22.61       15.14 $\rho = 0.9$ AIC       22.32       22.50       22.75       21.62  |        |        |                                |                                 |             |               | ,                                     |
| CV.1se       14.44       14.44       14.45       14.67       14.45         CV.min       14.44       14.49       14.54       16.22       14.49 $sd(\mu)/\sigma = 0.5$ AICc       14.39       14.47       22.61       15.14 $\rho = 0.9$ AIC       22.32       22.50       22.75       21.62  |        |        |                                |                                 |             |               | <i>Oracle</i> : 87.87                 |
| CV.min 14.44 14.49 14.54 16.22 14.49 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 14.39 14.47 22.61 15.14 $\rho = 0.9$  |        |        |                                |                                 |             | 14.45         |                                       |
| AICc 14.39 14.47 22.61 15.14 $\rho = 0.9$   |        |        |                                |                                 |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC 22.32 22.50 22.75 21.62   |        |        |                                |                                 |             |               | \' //                                 |
| 1110 22,32 22,30 22,13 21,02  | AIC    | 22.32  | 22.50                          | 22.75                           | 21.62       |               | ,                                     |
| BIC 22.31 22.50 22.74 18.94 Oracle: 14.79   |        |        |                                |                                 |             |               | <i>Oracle</i> : 14.79                 |

Table 50: Estimation MSE for n=100, continuous design, dense covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 123.78 | 124.17                         | 124.38                          | 55.67       | 123.87        |                                       |
| CV.min | 105.81 | 121.52                         | 122.75                          | 48.79       | 106.45        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 109.36 | 52.25                          | 49.94                           | 74.35       |               | $\rho = 0$                            |
| AIC    | 49.18  | 49.63                          | 49.96                           | 48.59       |               | Oracle : 50.89                        |
| BIC    | 49.16  | 49.61                          | 49.96                           | 48.58       |               | Oracie : 50.89                        |
| CV.1se | 41.62  | 41.63                          | 41.66                           | 21.97       | 41.60         |                                       |
| CV.min | 38.52  | 40.66                          | 41.36                           | 17.13       | 38.32         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 37.84  | 29.69                          | 16.67                           | 26.77       |               | $\rho = 0.5$                          |
| AIC    | 16.46  | 16.57                          | 16.70                           | 16.31       |               | Omasla , 17 02                        |
| BIC    | 16.45  | 16.57                          | 16.69                           | 16.3        |               | <i>Oracle</i> : 17.03                 |
| CV.1se | 6.86   | 6.85                           | 6.85                            | 5.93        | 6.86          |                                       |
| CV.min | 6.37   | 6.53                           | 6.75                            | 4.25        | 6.36          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 6.19   | 6.79                           | 2.75                            | 4.94        |               | $\rho = 0.9$                          |
| AIC    | 2.70   | 2.71                           | 2.74                            | 2.67        |               | 012.90                                |
| BIC    | 2.69   | 2.71                           | 2.74                            | 4.17        |               | Oracle: 2.80                          |
| CV.1se | 200.18 | 200.56                         | 200.62                          | 170.55      | 200.38        |                                       |
| CV.min | 190.91 | 199.28                         | 200.41                          | 186.30      | 190.80        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 189.24 | 191.81                         | 199.68                          | 168.56      |               | $\rho = 0$                            |
| AIC    | 196.78 | 198.74                         | 199.88                          | 193.84      |               | ·                                     |
| BIC    | 196.71 | 198.66                         | 199.87                          | 193.77      |               | Oracle: 186.60                        |
| CV.1se | 67.24  | 67.30                          | 67.34                           | 57.55       | 67.30         |                                       |
| CV.min | 64.84  | 66.87                          | 67.31                           | 61.27       | 64.94         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 64.19  | 63.51                          | 66.78                           | 57.55       |               | $\rho = 0.5$                          |
| AIC    | 65.93  | 66.46                          | 66.92                           | 65.00       |               |                                       |
| BIC    | 65.88  | 66.43                          | 66.91                           | 64.97       |               | Oracle: 62.50                         |
| CV.1se | 11.08  | 11.07                          | 11.08                           | 10.48       | 11.08         |                                       |
| CV.min | 10.75  | 10.89                          | 11.04                           | 9.69        | 10.77         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 10.58  | 11.04                          | 10.92                           | 9.86        |               | $\rho = 0.9$                          |
| AIC    | 10.79  | 10.87                          | 10.99                           | 10.50       |               |                                       |
| BIC    | 10.79  | 10.87                          | 10.99                           | 10.60       |               | Oracle: 10.21                         |
| CV.1se | 505.57 | 505.68                         | 505.88                          | 621.63      | 505.30        |                                       |
| CV.min | 507.03 | 508.25                         | 509.82                          | 736.30      | 509.71        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 502.04 | 779.80                         | 797.64                          | 536.72      |               | $\rho = 0$                            |
| AIC    | 787.28 | 796.26                         | 799.84                          | 776.11      |               | ,                                     |
| BIC    | 786.99 | 795.99                         | 799.78                          | 775.79      |               | Oracle: 527.53                        |
| CV.1se | 169.34 | 169.55                         | 169.49                          | 197.63      | 169.47        |                                       |
| CV.min | 170.16 | 170.31                         | 170.41                          | 237.39      | 170.31        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 168.77 | 252.44                         | 267.51                          | 180.60      |               | $\rho = 0.5$                          |
| AIC    | 263.70 | 266.29                         | 267.81                          | 259.78      |               |                                       |
| BIC    | 263.52 | 266.19                         | 267.78                          | 259.63      |               | Oracle: 176.63                        |
| CV.1se | 27.83  | 27.83                          | 27.85                           | 28.27       | 27.84         |                                       |
| CV.min | 27.80  | 27.97                          | 28.03                           | 31.23       | 27.92         | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 27.75  | 28.33                          | 43.63                           | 29.27       |               | $\rho = 0.9$                          |
| AIC    | 43.01  | 43.43                          | 43.86                           | 41.67       |               | ·                                     |
| BIC    | 42.99  | 43.41                          | 43.84                           | 36.55       |               | <i>Oracle</i> : 28.81                 |
|        |        |                                |                                 |             |               | L                                     |

Table 51: Estimation MSE for n=100, binary design, sparse covariates, and decay 10.

|        | lasso | $\operatorname{GL} \gamma = 1$ |      | marginal AL | sparsenet MCP |                                     |
|--------|-------|--------------------------------|------|-------------|---------------|-------------------------------------|
| CV.1se | 0.64  | 0.57                           | 0.63 | 0.4         | 0.47          |                                     |
| CV.min | 0.42  | 0.4                            | 0.46 | 0.41        | 0.4           | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 0.48  | 0.43                           | 0.46 | 0.4         |               | $\rho = 0$                          |
| AIC    | 0.47  | 0.47                           | 0.48 | 0.44        |               | Oracle: 0.27                        |
| BIC    | 0.47  | 0.47                           | 0.48 | 0.44        |               | 07 dete : 0.27                      |
| CV.1se | 0.65  | 0.57                           | 0.63 | 0.38        | 0.46          |                                     |
| CV.min | 0.40  | 0.38                           | 0.45 | 0.38        | 0.37          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 0.47  | 0.41                           | 0.41 | 0.39        |               | $\rho = 0.5$                        |
| AIC    | 0.42  | 0.42                           | 0.43 | 0.40        |               | Oracle: 0.24                        |
| BIC    | 0.42  | 0.42                           | 0.43 | 0.40        |               | 07 dete : 0.21                      |
| CV.1se | 0.64  | 0.56                           | 0.63 | 0.36        | 0.45          |                                     |
| CV.min | 0.39  | 0.38                           | 0.45 | 0.36        | 0.36          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 0.46  | 0.40                           | 0.38 | 0.38        |               | $\rho = 0.9$                        |
| AIC    | 0.40  | 0.40                           | 0.41 | 0.38        |               | Oracle: 0.23                        |
| BIC    | 0.40  | 0.40                           | 0.41 | 0.38        |               | 07466 . 0.25                        |
| CV.1se | 1.86  | 1.86                           | 1.89 | 1.52        | 1.84          |                                     |
| CV.min | 1.58  | 1.65                           | 1.78 | 1.74        | 1.60          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 1.58  | 1.60                           | 1.91 | 1.45        |               | $\rho = 0$                          |
| AIC    | 1.91  | 1.92                           | 1.94 | 1.86        |               | Oracle : 1.09                       |
| BIC    | 1.91  | 1.92                           | 1.94 | 1.85        |               | 07 acic : 1.07                      |
| CV.1se | 1.69  | 1.68                           | 1.70 | 1.39        | 1.67          |                                     |
| CV.min | 1.46  | 1.50                           | 1.62 | 1.57        | 1.47          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 1.45  | 1.46                           | 1.70 | 1.32        |               | $\rho = 0.5$                        |
| AIC    | 1.71  | 1.72                           | 1.74 | 1.66        |               | Oracle: 0.97                        |
| BIC    | 1.71  | 1.72                           | 1.73 | 1.66        |               | 07 dete : 0.57                      |
| CV.1se | 1.60  | 1.60                           | 1.62 | 1.31        | 1.58          |                                     |
| CV.min | 1.39  | 1.43                           | 1.54 | 1.48        | 1.40          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 1.39  | 1.40                           | 1.61 | 1.26        |               | $\rho = 0.9$                        |
| AIC    | 1.62  | 1.63                           | 1.64 | 1.58        |               | Oracle: 0.92                        |
| BIC    | 1.62  | 1.63                           | 1.64 | 1.57        |               | 07466 . 0.72                        |
| CV.1se | 4.92  | 4.92                           | 4.93 | 5.99        | 4.92          |                                     |
| CV.min | 4.92  | 4.94                           | 4.97 | 7.11        | 4.96          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 4.87  | 5.98                           | 7.74 | 5.20        |               | $\rho = 0$                          |
| AIC    | 7.69  | 7.74                           | 7.80 | 7.57        |               | Oracle : 4.35                       |
| BIC    | 7.69  | 7.73                           | 7.80 | 7.57        |               | 07466 . 4.33                        |
| CV.1se | 4.40  | 4.40                           | 4.41 | 5.38        | 4.40          |                                     |
| CV.min | 4.41  | 4.42                           | 4.43 | 6.39        | 4.44          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 4.36  | 5.23                           | 6.91 | 4.66        |               | $\rho = 0.5$                        |
| AIC    | 6.87  | 6.91                           | 6.97 | 6.77        |               | Oracle : 3.90                       |
| BIC    | 6.87  | 6.91                           | 6.97 | 6.76        |               | 07466 . 3.70                        |
| CV.1se | 4.18  | 4.18                           | 4.18 | 5.02        | 4.18          |                                     |
| CV.min | 4.18  | 4.19                           | 4.21 | 6.00        | 4.20          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 4.13  | 4.86                           | 6.53 | 4.42        |               | $\rho = 0.9$                        |
| AIC    | 6.50  | 6.54                           | 6.59 | 6.40        |               | Oracle : 3.69                       |
| BIC    | 6.50  | 6.53                           | 6.59 | 6.39        |               | 57 act . 5.09                       |

Table 52: Estimation MSE for n=100, binary design, sparse covariates, and decay 50.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}~\gamma=10$ | marginal AL | sparsenet MCP |                                     |
|--------|-------|--------------------------------|-------------------------|-------------|---------------|-------------------------------------|
| CV.1se | 1.47  | 1.35                           | 1.90                    | 0.84        | 1.13          |                                     |
| CV.min | 0.91  | 0.88                           | 1.34                    | 0.86        | 0.87          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 1.06  | 0.83                           | 0.97                    | 0.86        |               | $\rho = 0$                          |
| AIC    | 0.98  | 0.98                           | 1.00                    | 0.93        |               | Oracle: 0.56                        |
| BIC    | 0.98  | 0.98                           | 1.00                    | 0.92        |               | 07466.0.50                          |
| CV.1se | 1.54  | 1.43                           | 1.82                    | 0.79        | 1.17          |                                     |
| CV.min | 0.89  | 0.89                           | 1.39                    | 0.79        | 0.85          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 1.07  | 0.79                           | 0.86                    | 0.83        |               | $\rho = 0.5$                        |
| AIC    | 0.88  | 0.88                           | 0.89                    | 0.84        |               | Oracle: 0.50                        |
| BIC    | 0.88  | 0.88                           | 0.89                    | 0.84        |               | 01466.0.50                          |
| CV.1se | 1.50  | 1.40                           | 1.78                    | 0.76        | 1.18          |                                     |
| CV.min | 0.87  | 0.90                           | 1.37                    | 0.76        | 0.84          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 1.05  | 0.79                           | 0.81                    | 0.82        |               | $\rho = 0.9$                        |
| AIC    | 0.83  | 0.83                           | 0.84                    | 0.79        |               | Oracle: 0.48                        |
| BIC    | 0.83  | 0.83                           | 0.84                    | 0.79        |               | 07 acte . 0.46                      |
| CV.1se | 3.93  | 3.96                           | 4.00                    | 3.22        | 3.93          |                                     |
| CV.min | 3.41  | 3.65                           | 3.89                    | 3.67        | 3.44          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 3.43  | 3.42                           | 3.99                    | 3.09        |               | $\rho = 0$                          |
| AIC    | 3.97  | 3.99                           | 4.03                    | 3.87        |               | Oracle: 2.25                        |
| BIC    | 3.96  | 3.99                           | 4.03                    | 3.86        |               | Oracie : 2.23                       |
| CV.1se | 3.54  | 3.54                           | 3.58                    | 2.93        | 3.54          |                                     |
| CV.min | 3.14  | 3.32                           | 3.49                    | 3.29        | 3.17          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 3.13  | 3.09                           | 3.55                    | 2.82        |               | $\rho = 0.5$                        |
| AIC    | 3.54  | 3.56                           | 3.59                    | 3.46        |               | Oracle: 2.01                        |
| BIC    | 3.54  | 3.55                           | 3.59                    | 3.45        |               | Oracle : 2.01                       |
| CV.1se | 3.34  | 3.36                           | 3.38                    | 2.77        | 3.33          |                                     |
| CV.min | 2.98  | 3.15                           | 3.30                    | 3.08        | 3.00          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 2.98  | 2.94                           | 3.35                    | 2.68        |               | $\rho = 0.9$                        |
| AIC    | 3.34  | 3.35                           | 3.39                    | 3.26        |               | Oracle: 1.90                        |
| BIC    | 3.33  | 3.35                           | 3.39                    | 3.26        |               | Oracie : 1.90                       |
| CV.1se | 10.17 | 10.17                          | 10.19                   | 12.43       | 10.17         |                                     |
| CV.min | 10.17 | 10.22                          | 10.26                   | 14.81       | 10.28         | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 10.09 | 14.04                          | 16.09                   | 10.77       |               | $\rho = 0$                          |
| AIC    | 15.93 | 16.04                          | 16.16                   | 15.68       |               | Oracle: 9.00                        |
| BIC    | 15.92 | 16.03                          | 16.16                   | 15.66       |               | 07 acte . 9.00                      |
| CV.1se | 9.09  | 9.10                           | 9.11                    | 11.13       | 9.10          |                                     |
| CV.min | 9.13  | 9.13                           | 9.16                    | 13.22       | 9.18          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 9.02  | 12.34                          | 14.33                   | 9.64        |               | $\rho = 0.5$                        |
| AIC    | 14.20 | 14.29                          | 14.40                   | 13.98       |               | Oracle : 8.05                       |
| BIC    | 14.19 | 14.29                          | 14.40                   | 13.97       |               | 07 acte . 8.03                      |
| CV.1se | 8.59  | 8.60                           | 8.60                    | 10.43       | 8.59          |                                     |
| CV.min | 8.62  | 8.64                           | 8.65                    | 12.40       | 8.66          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 8.52  | 11.58                          | 13.53                   | 9.14        |               | $\rho = 0.9$                        |
| AIC    | 13.40 | 13.49                          | 13.60                   | 13.19       |               | <i>Oracle</i> : 7.61                |
| BIC    | 13.39 | 13.48                          | 13.59                   | 13.18       |               | 07 acie: 7.01                       |
|        |       |                                |                         |             |               |                                     |

Table 53: Estimation MSE for n=100, binary design, sparse covariates, and decay 100.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}~\gamma=10$ | marginal AL | sparsenet MCP |                                     |
|--------|-------|--------------------------------|-------------------------|-------------|---------------|-------------------------------------|
| CV.1se | 1.64  | 1.52                           | 2.13                    | 0.93        | 1.27          |                                     |
| CV.min | 1.01  | 0.98                           | 1.54                    | 0.96        | 0.97          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 1.18  | 0.92                           | 1.08                    | 0.96        |               | $\rho = 0$                          |
| AIC    | 1.09  | 1.09                           | 1.11                    | 1.03        |               | Oracle: 0.62                        |
| BIC    | 1.09  | 1.09                           | 1.11                    | 1.02        |               | 07466.0.02                          |
| CV.1se | 1.73  | 1.61                           | 2.07                    | 0.88        | 1.31          |                                     |
| CV.min | 1.00  | 1.00                           | 1.58                    | 0.88        | 0.95          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 1.19  | 0.86                           | 0.96                    | 0.92        |               | $\rho = 0.5$                        |
| AIC    | 0.97  | 0.97                           | 0.99                    | 0.93        |               | Oracle: 0.56                        |
| BIC    | 0.97  | 0.97                           | 0.99                    | 0.93        |               | 01466.0.30                          |
| CV.1se | 1.68  | 1.57                           | 2.00                    | 0.85        | 1.33          |                                     |
| CV.min | 0.97  | 1.02                           | 1.56                    | 0.84        | 0.93          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 1.17  | 0.86                           | 0.91                    | 0.90        |               | $\rho = 0.9$                        |
| AIC    | 0.92  | 0.92                           | 0.93                    | 0.88        |               | Oracle: 0.53                        |
| BIC    | 0.92  | 0.92                           | 0.93                    | 0.88        |               | 01 acte . 0.55                      |
| CV.1se | 4.37  | 4.39                           | 4.44                    | 3.57        | 4.36          |                                     |
| CV.min | 3.79  | 4.08                           | 4.32                    | 4.07        | 3.83          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 3.81  | 3.81                           | 4.44                    | 3.44        |               | $\rho = 0$                          |
| AIC    | 4.41  | 4.43                           | 4.48                    | 4.30        |               | Oracle : 2.50                       |
| BIC    | 4.40  | 4.43                           | 4.48                    | 4.29        |               | Oracie : 2.30                       |
| CV.1se | 3.93  | 3.94                           | 3.97                    | 3.25        | 3.93          |                                     |
| CV.min | 3.50  | 3.70                           | 3.89                    | 3.66        | 3.54          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 3.48  | 3.43                           | 3.95                    | 3.13        |               | $\rho = 0.5$                        |
| AIC    | 3.93  | 3.95                           | 3.99                    | 3.84        |               | Oracle: 2.23                        |
| BIC    | 3.93  | 3.95                           | 3.99                    | 3.84        |               | 07 acte . 2.23                      |
| CV.1se | 3.72  | 3.74                           | 3.76                    | 3.08        | 3.71          |                                     |
| CV.min | 3.31  | 3.52                           | 3.68                    | 3.43        | 3.34          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 3.32  | 3.26                           | 3.73                    | 2.98        |               | $\rho = 0.9$                        |
| AIC    | 3.71  | 3.73                           | 3.77                    | 3.63        |               | Oracle: 2.11                        |
| BIC    | 3.71  | 3.73                           | 3.77                    | 3.63        |               | Oracle: 2.11                        |
| CV.1se | 11.29 | 11.30                          | 11.32                   | 13.82       | 11.30         |                                     |
| CV.min | 11.31 | 11.36                          | 11.41                   | 16.47       | 11.43         | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 11.21 | 15.81                          | 17.90                   | 11.99       |               | $\rho = 0$                          |
| AIC    | 17.71 | 17.84                          | 17.97                   | 17.43       |               | Oracle: 9.99                        |
| BIC    | 17.70 | 17.83                          | 17.97                   | 17.42       |               | 01466. 9.99                         |
| CV.1se | 10.09 | 10.09                          | 10.10                   | 12.37       | 10.09         |                                     |
| CV.min | 10.15 | 10.14                          | 10.17                   | 14.68       | 10.19         | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 10    | 13.91                          | 15.92                   | 10.71       |               | $\rho = 0.5$                        |
| AIC    | 15.76 | 15.87                          | 15.99                   | 15.52       |               | <i>Oracle</i> : 8.94                |
| BIC    | 15.76 | 15.86                          | 15.99                   | 15.51       |               | 01 ude : 0.94                       |
| CV.1se | 9.54  | 9.55                           | 9.56                    | 11.59       | 9.54          |                                     |
| CV.min | 9.59  | 9.59                           | 9.61                    | 13.78       | 9.62          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 9.46  | 13.05                          | 15.04                   | 10.15       |               | $\rho = 0.9$                        |
| AIC    | 14.89 | 14.99                          | 15.10                   | 14.65       |               | Oracle : 8.45                       |
| BIC    | 14.88 | 14.98                          | 15.10                   | 14.65       |               | Oracie : 8.43                       |
| _      |       |                                |                         |             |               |                                     |

Table 54: Estimation MSE for n=100, binary design, sparse covariates, and decay 200.

|                  | lasso | $\operatorname{GL} \gamma = 1$ |       | _     |       |                                       |
|------------------|-------|--------------------------------|-------|-------|-------|---------------------------------------|
| CV.1se           | 1.73  | 1.60                           | 2.24  | 0.98  | 1.33  |                                       |
| CV.min           | 1.07  | 1.04                           | 1.63  | 1.01  | 1.03  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 1.24  | 0.96                           | 1.14  | 1.01  |       | $\rho = 0$                            |
| AIC              | 1.15  | 1.15                           | 1.17  | 1.09  |       | Oracle : 0.66                         |
| BIC              | 1.15  | 1.15                           | 1.17  | 1.08  |       | 07 acic : 0.00                        |
| CV.1se           | 1.83  | 1.71                           | 2.19  | 0.92  | 1.39  |                                       |
| CV.min           | 1.05  | 1.06                           | 1.68  | 0.93  | 1.00  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 1.25  | 0.9                            | 1.02  | 0.97  |       | $\rho = 0.5$                          |
| AIC              | 1.03  | 1.03                           | 1.04  | 0.98  |       | Oracle : 0.59                         |
| BIC              | 1.03  | 1.03                           | 1.04  | 0.98  |       | Oracie : 0.39                         |
| CV.1se           | 1.77  | 1.66                           | 2.11  | 0.89  | 1.41  |                                       |
| CV.min           | 1.02  | 1.08                           | 1.65  | 0.89  | 0.99  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 1.24  | 0.90                           | 0.96  | 0.95  |       | $\rho = 0.9$                          |
| AIC              | 0.97  | 0.97                           | 0.99  | 0.93  |       | Oracle : 0.56                         |
| BIC              | 0.97  | 0.97                           | 0.99  | 0.93  |       | Oracie: 0.30                          |
| CV.1se           | 4.60  | 4.63                           | 4.68  | 3.77  | 4.60  |                                       |
| CV.min           | 4.00  | 4.31                           | 4.56  | 4.29  | 4.04  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 4.02  | 4.02                           | 4.68  | 3.62  |       | $\rho = 0$                            |
| AIC              | 4.64  | 4.67                           | 4.72  | 4.53  |       |                                       |
| BIC              | 4.64  | 4.67                           | 4.72  | 4.52  |       | <i>Oracle</i> : 2.63                  |
| CV.1se           | 4.15  | 4.16                           | 4.20  | 3.44  | 4.15  |                                       |
| CV.min           | 3.69  | 3.92                           | 4.11  | 3.86  | 3.73  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 3.68  | 3.62                           | 4.18  | 3.31  |       | $\rho = 0.5$                          |
| AIC              | 4.15  | 4.18                           | 4.22  | 4.06  |       |                                       |
| BIC              | 4.15  | 4.17                           | 4.22  | 4.06  |       | <i>Oracle</i> : 2.36                  |
| CV.1se           | 3.92  | 3.95                           | 3.97  | 3.25  | 3.91  |                                       |
| CV.min           | 3.50  | 3.71                           | 3.88  | 3.62  | 3.53  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 3.51  | 3.44                           | 3.94  | 3.14  |       | $\rho = 0.9$                          |
| AIC              | 3.91  | 3.94                           | 3.97  | 3.83  |       |                                       |
| BIC              | 3.91  | 3.93                           | 3.97  | 3.82  |       | Oracle: 2.23                          |
| CV.1se           | 11.92 | 11.93                          | 11.95 | 14.58 | 11.93 |                                       |
| CV.min           | 11.93 | 11.99                          | 12.04 | 17.34 | 12.05 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 11.84 | 16.71                          | 18.88 | 12.64 |       | $\rho = 0$                            |
| AIC              | 18.67 | 18.80                          | 18.95 | 18.38 |       |                                       |
| BIC              | 18.66 | 18.80                          | 18.95 | 18.37 |       | Oracle: 10.54                         |
| CV.1se           | 10.65 | 10.66                          | 10.67 | 13.06 | 10.65 |                                       |
| CV.min           | 10.72 | 10.71                          | 10.73 | 15.50 | 10.77 | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 10.57 | 14.75                          | 16.82 | 11.29 |       | $\rho = 0.5$                          |
| AIC              | 16.65 | 16.76                          | 16.89 | 16.39 |       |                                       |
| BIC              | 16.64 | 16.75                          | 16.89 | 16.38 |       | Oracle: 9.44                          |
| CV.1se           | 10.06 | 10.07                          | 10.07 | 12.21 | 10.06 |                                       |
| CV.nsc<br>CV.min | 10.12 | 10.13                          | 10.12 | 14.51 | 10.13 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 9.97  | 13.86                          | 15.85 | 10.70 | 10.10 | $\rho = 0.9$                          |
| AIC              | 15.69 | 15.79                          | 15.92 | 15.44 |       |                                       |
| BIC              | 15.68 | 15.79                          | 15.91 | 15.43 |       | Oracle: 8.92                          |
|                  | 15.00 | 13.13                          | 13.71 | 15.75 |       |                                       |

Table 55: Estimation MSE for n=100, continuous design, sparse covariates, and decay 10.

| $ \begin{array}{c} \text{CV.lse} & 2.65 & 2.33 & 2.63 & 1.63 & 1.93 \\ \text{CV.min} & 1.71 & 1.64 & 1.90 & 1.64 & 1.61 & \text{sd}(\mu)/\sigma = 2 \\ \text{AICc} & 1.96 & 1.96 & 1.87 & 1.63 & \\ \text{AIC} & 1.89 & 1.89 & 1.92 & 1.77 & \\ \text{BIC} & 1.89 & 1.89 & 1.92 & 1.77 & \\ \text{CV.lse} & 1.76 & 1.68 & 1.59 & 0.92 & 1.46 \\ \text{CV.min} & 1.27 & 1.26 & 1.37 & 0.75 & 1.13 & \text{sd}(\mu)/\sigma = 2 \\ \text{AICc} & 1.32 & 1.51 & 0.95 & 1.00 & \rho = 0.5 \\ \text{AIC} & 0.75 & 0.75 & 0.76 & 0.85 & Oracle : 0.43 \\ \text{CV.lse} & 0.38 & 0.36 & 0.32 & 0.26 & 0.33 & \\ \text{CV.lse} & 0.38 & 0.36 & 0.32 & 0.26 & 0.33 & \\ \text{CV.lmin} & 0.29 & 0.29 & 0.29 & 0.20 & 0.28 & \text{sd}(\mu)/\sigma = 2 \\ \text{AICc} & 0.29 & 0.33 & 0.32 & 0.22 & \rho = 0.9 \\ \text{AIC} & 0.19 & 0.19 & 0.20 & 0.18 & Oracle : 0.11 \\ \text{CV.lse} & 7.53 & 7.48 & 7.59 & 6.10 & 7.45 & \\ \text{CV.lmin} & 6.40 & 6.61 & 7.19 & 6.97 & 6.46 & \text{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 6.35 & 7.08 & 7.66 & 5.83 & \rho = 0 \\ \text{AIC} & 7.68 & 7.71 & 7.80 & 7.45 & Oracle : 4.37 \\ \text{CV.lse} & 3.04 & 3.03 & 3.00 & 2.54 & 3.00 & Oracle : 4.37 \\ \text{CV.lse} & 3.04 & 3.03 & 3.00 & 2.54 & 3.00 & Oracle : 4.37 \\ \text{CV.lse} & 3.04 & 3.03 & 3.00 & 2.54 & 3.00 & Oracle : 1.71 \\ \text{CV.lse} & 3.04 & 3.03 & 3.00 & 2.54 & 3.00 & Oracle : 1.71 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.71 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.min} & 0.65 & 0.64 & 0.63 & 0.62 & 0.63 & \text{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 0.78 & 0.78 & 0.80 & 0.64 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & Oracle : 0.45 \\ \text{CV.lse} & 0.76 & 0.77 & 0.81 & 0.85 & 0.79 & \text{sd}(\mu)/\sigma = 0.5 \\ \text{AIC} & 0.78 & 0.78 & 0.80 & 0.64 & 0.63 & \text{sd}(\mu)/\sigma = 0.5 \\ \text{AIC} & 0.84 & 0.98 & 0.98 & 0.80 & 0.64 & Oracle : 0$   |        | lasso | $\operatorname{GL} \gamma = 1$ |       | marginal AL |       |                                       |
|---|--------|-------|--------------------------------|-------|-------------|-------|---------------------------------------|
| AICc 1.96 1.96 1.87 1.63 $\rho = 0$ AIC 1.89 1.89 1.92 1.77 $\rho = 0$ BIC 1.89 1.89 1.92 1.77 $\rho = 0$ CV.Ise 1.76 1.68 1.59 0.92 1.46 $\rho = 0$ CV.Imin 1.27 1.26 1.37 0.75 1.13 $\rho = 0$ AIC 0.75 0.75 0.75 0.76 0.85 $\rho = 0.5$ AIC 0.75 0.75 0.76 0.85 $\rho = 0.5$ CV.Ise 0.38 0.36 0.32 0.26 0.33 $\rho = 0.5$ AIC 0.19 0.19 0.19 0.20 0.18 $\rho = 0.5$ AIC 0.20 0.20 0.20 0.20 0.30 $\rho = 0.5$ CV.Ise 7.53 7.48 7.59 6.10 7.45 $\rho = 0.5$ AIC 6.35 7.08 7.66 5.83 $\rho = 0.5$ AIC 0.37 7.71 7.80 7.45 $\rho = 0.5$ AIC 0.37 7.71 7.80 7.42 $\rho = 0.5$ AIC 0.30 3.03 3.00 2.54 3.00 $\rho = 0.5$ AIC 0.57 7.71 7.80 7.42 $\rho = 0.5$ AIC 0.76 7.71 7.80 7.42 $\rho = 0.5$ AIC 0.77 7.71 7.80 7.42 $\rho = 0.5$ AIC 0.78 0.74 0.68 0.65 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.80 0.61 $\rho = 0.5$ AIC 0.79 0.74 0.68 0.65 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.78 0.80 0.61 $\rho = 0.5$ AIC 0.78 0.78 0.80 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 BIC 0.78 0.78 0.80 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 BIC 0.78 0.78 0.80 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 BIC 0.78 0.78 0.80 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.78 0.80 0.71 BIC 0.78 0.78 0.80 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.78 0.80 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.78 0.80 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.78 0.80 0.71 BIC 0.78 0.78 0.78 0.80 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.78 0.80 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.78 0.80 0.71 $\rho = 0.5$ AIC 0.78 0.78 0.78 0.80 0.71 $\rho = 0.5$ AIC 0.79 0.79 0.70 0.70 0.70 0.70 0.70 0.70  |        |       |                                |       |             |       |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |       |                                |       |             | 1.61  |                                       |
| BIC         1.89         1.89         1.92         1.77         Oracle: 1.09           CV.Ise         1.76         1.68         1.59         0.92         1.46         CV-min         1.27         1.26         1.37         0.75         1.13 $sd(\mu)/\sigma = 2$ AIC         0.75         0.75         0.76         0.73         Oracle: 0.43           CV.Ise         0.38         0.36         0.32         0.26         0.33           CV.min         0.29         0.29         0.20         0.28 $sd(\mu)/\sigma = 2$ AIC         0.19         0.19         0.20         0.28 $sd(\mu)/\sigma = 2$ AIC         0.29         0.33         0.32         0.22 $\rho = 0.9$ AIC         0.19         0.19         0.20         0.18         Oracle: 0.11           CV.lse         7.53         7.48         7.59         6.10         7.45 $cd(\mu)/\sigma = 1$ AIC         6.35         7.08         7.66         5.83 $\rho = 0$ AIC         6.65         7.71         7.80         7.42         Oracle: 4.37           CV.lse         3.04         3.03         3.00         2.54   |        |       |                                |       |             |       | $\rho = 0$                            |
| Section   Se  |        |       |                                |       |             |       | $Oracle \cdot 1.09$                   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        |       |                                |       |             |       | 074666 . 1.05                         |
| AICc 1.32 1.51 0.95 1.00 $\rho = 0.5$ AIC 0.75 0.75 0.76 0.73 $\rho = 0.5$ AIC 0.75 0.75 0.76 0.78 $\rho = 0.5$ Oracle : 0.43 $\rho = 0.5$ Oracle : 0.44 $\rho = 0.5$ Oracle : 0.45 $\rho = 0.5$ Oracle : 0.47 $\rho = 0.5$ Oracle : 0.48 $\rho = 0.5$ Oracle : 0.49 $\rho = 0.5$ Oracle : 0.45 $\rho = 0.5$ Oracle : 0.48 $\rho = 0.5$ Oracle : 0.48 $\rho = 0.5$ Oracle : 0.48 $\rho = 0.5$ Oracle : 0.45 $\rho = 0.5$ Oracle : 0.48 $\rho = 0.5$ Oracle : 0.48 $\rho = 0.5$ Oracle : 0.45 $\rho = 0.5$ Oracle : 0.48 $\rho = 0.$   |        |       |                                |       |             |       |                                       |
| AIC 0.75 0.75 0.76 0.76 0.85  |        |       |                                |       |             | 1.13  |                                       |
| BIC 0.75 0.75 0.76 0.85   |        |       |                                |       |             |       | $\rho = 0.5$                          |
| BIC         0.75         0.75         0.76         0.85           CV.Ise         0.38         0.36         0.32         0.26         0.33         CV.min         0.29         0.29         0.20         0.28         sd(μ)/σ = 2 $\rho = 0.9$ AICc         0.29         0.33         0.32         0.22 $\rho = 0.9$ AICc         0.19         0.19         0.20         0.18         Oracle : 0.11         Oracle : 0.11         0.19         0.20         0.20         0.30         Oracle : 0.11         Oracle : 0.11         0.19         0.20         0.30         Oracle : 0.11         0.19         0.20         0.20         0.30         Oracle : 0.11         0.20         0.18         0.20   |        |       |                                |       |             |       | $Oracle \cdot 0.43$                   |
| $\begin{array}{c} \text{CV.min} & 0.29 & 0.29 & 0.29 & 0.20 & 0.28 & \mathrm{sd}(\mu)/\sigma = 2 \\ \text{AICc} & 0.29 & 0.33 & 0.32 & 0.22 & \rho = 0.9 \\ \text{AIC} & 0.19 & 0.19 & 0.20 & 0.18 \\ \text{BIC} & 0.20 & 0.20 & 0.20 & 0.30 & \\ \text{CV.Ise} & 7.53 & 7.48 & 7.59 & 6.10 & 7.45 \\ \text{CV.min} & 6.40 & 6.61 & 7.19 & 6.97 & 6.46 & \mathrm{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 6.35 & 7.08 & 7.66 & 5.83 & \rho = 0 \\ \text{AIC} & 7.68 & 7.71 & 7.80 & 7.45 & \\ \text{BIC} & 7.67 & 7.71 & 7.80 & 7.42 & \\ \text{CV.nin} & 2.76 & 2.79 & 2.88 & 2.75 & 2.75 & \mathrm{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 2.72 & 2.92 & 2.94 & 2.47 & \rho = 0.5 \\ \text{AIC} & 3.01 & 3.02 & 3.05 & 2.93 \\ \text{BIC} & 3.00 & 3.01 & 3.04 & 2.92 & \\ \text{CV.nin} & 0.65 & 0.64 & 0.63 & 0.62 & 0.63 & \mathrm{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 0.76 & 0.74 & 0.68 & 0.65 & 0.71 & \\ \text{CV.nin} & 0.65 & 0.64 & 0.63 & 0.62 & 0.63 & \mathrm{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 0.78 & 0.78 & 0.80 & 0.64 & \\ \text{CV.Ise} & 19.79 & 19.80 & 19.81 & 23.84 & 19.80 \\ \text{CV.Ise} & 19.79 & 19.80 & 19.81 & 23.84 & 19.80 & \\ \text{CV.Ise} & 19.79 & 19.80 & 19.81 & 23.84 & 19.80 & \\ \text{CV.Ise} & 19.76 & 19.83 & 19.97 & 28.51 & 19.86 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \text{AIC} & 30.82 & 30.99 & 31.25 & 30.32 & \\ \text{BIC} & 30.81 & 30.98 & 31.25 & 30.30 & \\ \text{CV.Ise} & 7.76 & 7.76 & 7.77 & 7.81 & 10.85 & 7.79 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \text{AIC} & 12.08 & 12.13 & 12.24 & 11.88 & \\ \text{BIC} & 12.07 & 12.12 & 12.23 & 11.86 & \\ \text{CV.Ise} & 2.04 & 2.04 & 2.04 & 2.02 & 2.04 \\ \text{CV.min} & 2.00 & 2.00 & 2.02 & 2.23 & 2.00 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \text{AIC} & 1.98 & 2.01 & 2.75 & 2.08 & & \rho = 0.9 \\ \text{AIC} & 3.16 & 3.17 & 3.21 & 3.02 & \\ \text{Oracle} : 180 & \text{Oracle} : 180 \\ \text{Oracle} : 180 \\ \text{Oracle} : 180 \\ \text{Oracle} : 180 \\ Or$ |        |       |                                |       |             |       | 074666 . 0.43                         |
| AICc 0.29 0.33 0.32 0.22 $\rho = 0.9$ AIC 0.19 0.19 0.20 0.18 $\rho = 0.9$ Display 0.20 0.20 0.20 0.30 $\rho = 0.9$ Display 0.20 0.30 $\rho = 0.9$ Display 0.20 0.20 0.30 $\rho = 0.9$ Display 0.20 0.30 Display 0.20 0.20 0.30 Display 0.20 0.20 Display 0.20 0.20 Display 0.20 0.20 0.20 0.20 0.20 0.20 0.20 0.2   | CV.1se | 0.38  | 0.36                           | 0.32  | 0.26        | 0.33  |                                       |
| AIC 0.19 0.19 0.20 0.20 0.30  | CV.min |       |                                |       |             | 0.28  |                                       |
| BIC 0.20 0.20 0.20 0.30   |        |       |                                |       |             |       | $\rho = 0.9$                          |
| BIC         0.20         0.20         0.20         0.30           CV.1se         7.53         7.48         7.59         6.10         7.45           CV.min         6.40         6.61         7.19         6.97         6.46 $sd(\mu)/\sigma = 1$ AIC         6.35         7.08         7.66         5.83 $\rho = 0$ AIC         7.68         7.71         7.80         7.45         Oracle : 4.37           CV.1se         3.04         3.03         3.00         2.54         3.00         cv.min           CV.min         2.76         2.79         2.88         2.75         2.75 $sd(\mu)/\sigma = 1$ AIC         3.01         3.02         3.05         2.93         Oracle : 1.71           CV.nin         0.50         0.74         0.68         0.65         0.71           DV.1se         0.76         0.74         0.68         0.65         0.71           CV.min         0.65         0.64         0.63         0.62         0.63 $sd(\mu)/\sigma = 1$ AIC         0.78         0.78         0.80         0.71         Oracle : 0.45           CV.lse         19.79         19.80         19.81   |        |       |                                |       |             |       | Oracle : 0.11                         |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    |       |                                |       |             |       | 074666.0.11                           |
| AICc 6.35 7.08 7.66 5.83 $\rho = 0$ AIC 7.68 7.71 7.80 7.45 $\rho = 0$ BIC 7.67 7.71 7.80 7.42 $\rho = 0$ CV.1se 3.04 3.03 3.00 2.54 3.00 $\rho = 0$ CV.min 2.76 2.79 2.88 2.75 2.75 $\rho = 0.5$ AIC 3.01 3.02 3.05 2.93 $\rho = 0.5$ BIC 3.00 3.01 3.04 2.92 $\rho = 0.5$ CV.se 0.76 0.74 0.68 0.65 0.71 $\rho = 0.5$ AICc 0.64 0.68 0.66 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.64 $\rho = 0.9$ CV.se 19.79 19.80 19.81 23.84 19.80 $\rho = 0.5$ AIC 30.82 30.99 31.25 30.32 $\rho = 0.5$ AIC 30.82 30.99 31.25 30.32 $\rho = 0.5$ AIC 30.81 30.98 31.25 30.30 $\rho = 0.5$ AIC 7.68 7.76 7.77 7.81 10.85 7.79 $\rho = 0.5$ AIC 7.68 7.76 7.77 7.81 10.85 7.79 $\rho = 0.5$ AIC 12.08 12.13 12.24 11.88 BIC 12.07 12.12 12.23 11.86 $\rho = 0.5$ AIC 1.208 12.13 12.24 11.88 BIC 12.07 12.12 12.23 11.86 $\rho = 0.9$ AIC 1.98 2.01 2.75 2.08 $\rho = 0.9$   | CV.1se | 7.53  | 7.48                           | 7.59  |             | 7.45  |                                       |
| AIC 7.68 7.71 7.80 7.45 $Oracle: 4.37$ $Oracle: 4.38$ $Oracle: 4.38$ $Oracle: 4.38$ $Oracle: 4.38$ $Oracle: 4.39$ $Oracle: 4$   | CV.min | 6.40  | 6.61                           | 7.19  | 6.97        | 6.46  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         7.67         7.71         7.80         7.42         Oracle : 4.37           CV.1se         3.04         3.03         3.00         2.54         3.00 $sd(\mu)/\sigma = 1$ AIC         2.76         2.79         2.88         2.75         2.75 $sd(\mu)/\sigma = 1$ AIC         3.01         3.02         3.05         2.93         Oracle : 1.71           CV.1se         0.76         0.74         0.68         0.65         0.71           CV.nin         0.65         0.64         0.63         0.62         0.63 $sd(\mu)/\sigma = 1$ AIC         0.78         0.78         0.80         0.71         Oracle : 0.45           BIC         0.78         0.78         0.80         0.71         Oracle : 0.45           CV.1se         19.79         19.80         19.81         23.84         19.80 $sd(\mu)/\sigma = 0.5$ AIC         19.54         20.74         31.03         20.74 $\rho = 0.5$ $\rho = 0.5$ AIC         19.54         20.74         31.03         20.74 $\rho = 0.5$ $\rho = 0.5$ AIC         30.81         30.98         31.25         30.30 $\rho = 0.$   | AICc   | 6.35  | 7.08                           | 7.66  | 5.83        |       | $\rho = 0$                            |
| BIC         7.67         7.71         7.80         7.42           CV.1se         3.04         3.03         3.00         2.54         3.00           CV.min         2.76         2.79         2.88         2.75         2.75 $sd(\mu)/\sigma = 1$ AIC         2.72         2.92         2.94         2.47 $\rho = 0.5$ AIC         3.01         3.02         3.05         2.93         Oracle: 1.71           CV.1se         0.76         0.74         0.68         0.65         0.71         Oracle: 1.71           CV.min         0.65         0.64         0.63         0.62         0.63 $sd(\mu)/\sigma = 1$ AIC         0.78         0.78         0.80         0.71         Oracle: 0.45           CV.1se         19.79         19.80         19.81         23.84         19.80           CV.nin         19.76         19.83         19.97         28.51         19.86 $sd(\mu)/\sigma = 0.5$ AIC         19.54         20.74         31.03         20.74 $\rho = 0$ AIC         30.82         30.99         31.25         30.32         Oracle: 17.46           CV.1se         7.76         7.7   | AIC    | 7.68  | 7.71                           | 7.80  | 7.45        |       | Ongolo : 4 27                         |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 7.67  | 7.71                           | 7.80  | 7.42        |       | Oracie: 4.57                          |
| AICc 2.72 2.92 2.94 2.47 $\rho = 0.5$ AIC 3.01 3.02 3.05 2.93 $Oracle : 1.71$ BIC 3.00 3.01 3.04 2.92 $Oracle : 1.71$ CV.1se 0.76 0.74 0.68 0.65 0.71 $Oracle : 1.71$ AIC 0.65 0.64 0.63 0.62 0.63 $Oracle : 1.71$ AIC 0.78 0.78 0.80 0.71 $Oracle : 0.45$ BIC 0.78 0.78 0.80 0.64 $Oracle : 0.45$ BIC 0.78 0.78 0.80 0.64 $Oracle : 0.45$ CV.1se 19.79 19.80 19.81 23.84 19.80 $Oracle : 0.45$ AIC 19.54 20.74 31.03 20.74 $Oracle : 0.5$ AIC 30.82 30.99 31.25 30.32 $Oracle : 17.46$ BIC 30.81 30.98 31.25 30.30 $Oracle : 17.46$ CV.1se 7.76 7.76 7.77 9.11 7.76 $Oracle : 17.46$ CV.1se 7.76 7.77 7.81 10.85 7.79 $Oracle : 17.46$ AIC 12.08 12.13 12.24 11.88 BIC 12.07 12.12 12.23 11.86 $Oracle : 1.80$ AIC 1.98 2.01 2.75 2.08 $Oracle : 1.80$ AIC 1.98 2.01 2.75 2.08 $Oracle : 1.80$ AIC 1.98 2.01 2.75 2.08 $Oracle : 1.80$   | CV.1se | 3.04  | 3.03                           | 3.00  | 2.54        | 3.00  |                                       |
| AIC 3.01 3.02 3.05 2.93 $Oracle : 1.71$ BIC 3.00 3.01 3.04 2.92  CV.1se 0.76 0.74 0.68 0.65 0.71 $Oracle : 1.71$ AIC 0.65 0.64 0.63 0.62 0.63 $Oracle : 1.71$ AIC 0.78 0.78 0.78 0.80 0.71 $Oracle : 0.45$ BIC 0.78 0.78 0.80 0.64  CV.min 19.76 19.83 19.97 28.51 19.86 $Oracle : 0.45$ AIC 30.82 30.99 31.25 30.32 $Oracle : 1.71$ BIC 30.81 30.98 31.25 30.30  CV.1se 7.76 7.77 7.81 10.85 7.79 $Oracle : 1.71$ AIC 7.68 7.76 12.06 8.19 $Oracle : 0.81$ AIC 12.08 12.13 12.24 11.88 $Oracle : 0.81$ BIC 12.07 12.12 12.23 11.86  CV.1se 2.04 2.04 2.04 2.02 2.04 $Oracle : 1.80$ AIC 1.98 2.01 2.75 2.08 $Oracle : 1.80$ AIC 1.98 2.01 2.75 2.08 $Oracle : 1.80$ AIC 1.98 2.01 2.75 2.08  AIC 1.71  AIC 1.72  AIC 1.74  AIC 1.75  AI  | CV.min | 2.76  | 2.79                           | 2.88  | 2.75        | 2.75  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         3.00         3.01         3.04         2.92           CV.1se         0.76         0.74         0.68         0.65         0.71           CV.min         0.65         0.64         0.63         0.62         0.63 $sd(\mu)/\sigma = 1$ AIC         0.64         0.68         0.66 <b>0.61</b> $\rho = 0.9$ AIC         0.78         0.78         0.80         0.71         Oracle : 0.45           BIC         0.78         0.78         0.80         0.64         Dracle : 0.45           CV.1se         19.79         19.80         19.81         23.84         19.80           CV.nin         19.76         19.83         19.97         28.51         19.86 $sd(\mu)/\sigma = 0.5$ AIC         19.54         20.74         31.03         20.74 $\rho = 0$ AIC         30.82         30.99         31.25         30.32         Oracle : 17.46           CV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79 $sd(\mu)/\sigma = 0.5$ AIC         12.08         12.13         12.2  | AICc   | 2.72  | 2.92                           | 2.94  | 2.47        |       | $\rho = 0.5$                          |
| BIC         3.00         3.01         3.04         2.92           CV.1se         0.76         0.74         0.68         0.65         0.71           CV.min         0.65         0.64         0.63         0.62         0.63 $sd(\mu)/\sigma = 1$ AIC         0.64         0.68         0.66 <b>0.61</b> $\rho = 0.9$ AIC         0.78         0.78         0.80         0.71         Oracle: 0.45           CV.1se         19.79         19.80         19.81         23.84         19.80 $sd(\mu)/\sigma = 0.5$ CV.min         19.76         19.83         19.97         28.51         19.86 $sd(\mu)/\sigma = 0.5$ AIC         30.82         30.99         31.25         30.32         Oracle: 17.46           BIC         30.81         30.98         31.25         30.30         Oracle: 17.46           CV.1se         7.76         7.77         9.11         7.76 $\rho = 0.5$ AIC         7.68         7.76         7.77         7.81         10.85         7.79 $sd(\mu)/\sigma = 0.5$ AIC         12.08         12.13         12.24         11.88         Oracle: 6.84           BIC <td>AIC</td> <td>3.01</td> <td>3.02</td> <td>3.05</td> <td>2.93</td> <td></td> <td>Ongolo : 1.71</td>  | AIC    | 3.01  | 3.02                           | 3.05  | 2.93        |       | Ongolo : 1.71                         |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 3.00  | 3.01                           | 3.04  | 2.92        |       | Oracie: 1.71                          |
| AICc 0.64 0.68 0.66 0.61 $\rho = 0.9$ AIC 0.78 0.78 0.80 0.71 $\rho = 0.9$ Oracle : 0.45 DIC 0.78 0.78 0.80 0.64 $\rho = 0.9$ Oracle : 0.45 DIC 0.78 0.78 0.80 0.64 $\rho = 0.9$ Oracle : 0.45 DIC 0.78 0.78 0.80 0.64 $\rho = 0.9$ Oracle : 0.45 DIC 0.78 0.79 0.80 0.64 $\rho = 0.9$ Oracle : 0.45 DIC 0.78 0.79 0.80 0.64 $\rho = 0.9$ Oracle : 0.45 DIC 0.79 0.79 0.79 0.79 DIC 0.70 DIC 0.79 DIC 0   | CV.1se | 0.76  | 0.74                           | 0.68  | 0.65        | 0.71  |                                       |
| AIC 0.78 0.78 0.80 0.80 0.64 $Oracle : 0.45$  | CV.min | 0.65  | 0.64                           | 0.63  | 0.62        | 0.63  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         0.78         0.78         0.80         0.64           CV.1se         19.79         19.80         19.81         23.84         19.80           CV.min         19.76         19.83         19.97         28.51         19.86 $sd(\mu)/\sigma = 0.5$ AICc         19.54         20.74         31.03         20.74 $\rho = 0$ AIC         30.82         30.99         31.25         30.32         Oracle: 17.46           CV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79 $sd(\mu)/\sigma = 0.5$ AICc         7.68         7.76         12.06         8.19 $\rho = 0.5$ AIC         12.08         12.13         12.24         11.88         Oracle: 6.84           CV.1se         2.04         2.04         2.04         2.02         2.04           CV.min         2.00         2.00         2.02         2.23         2.00 $sd(\mu)/\sigma = 0.5$ AICc         1.98         2.01         2.75         2.08 $\rho = 0.9$ AIC         3.16         3.17         3.21  | AICc   | 0.64  | 0.68                           | 0.66  | 0.61        |       | $\rho = 0.9$                          |
| BIC $0.78$ $0.78$ $0.80$ $0.64$ CV.1se         19.79         19.80         19.81         23.84         19.80           CV.min         19.76         19.83         19.97         28.51         19.86 $sd(\mu)/\sigma = 0.5$ AICc         19.54         20.74         31.03         20.74 $\rho = 0$ AIC         30.82         30.99         31.25         30.32         Oracle: 17.46           EV.1se         7.76         7.76         7.77         9.11         7.76 $raccle: 17.46$ CV.nin         7.76         7.77         7.81         10.85         7.79 $sd(\mu)/\sigma = 0.5$ AICc         7.68         7.76         12.06         8.19 $\rho = 0.5$ AIC         12.08         12.13         12.24         11.88 $\rho = 0.5$ BIC         12.07         12.12         12.23         11.86 $\rho = 0.5$ CV.nin         2.00         2.04         2.04         2.02         2.04           CV.min         2.00         2.00         2.02         2.23         2.00 $sd(\mu)/\sigma = 0.5$ AIC         1.98 <td>AIC</td> <td>0.78</td> <td>0.78</td> <td>0.80</td> <td>0.71</td> <td></td> <td>Oma ala . 0.45</td>  | AIC    | 0.78  | 0.78                           | 0.80  | 0.71        |       | Oma ala . 0.45                        |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 0.78  | 0.78                           | 0.80  | 0.64        |       | Oracie: 0.43                          |
| AICc 19.54 20.74 31.03 20.74 $\rho = 0$ AIC 30.82 30.99 31.25 30.32 $\rho = 0$ Oracle : 17.46 BIC 30.81 30.98 31.25 30.30 $\rho = 0$ Oracle : 17.46 CV.1se 7.76 7.76 7.77 9.11 7.76 CV.min 7.76 7.77 7.81 10.85 7.79 $\rho = 0.5$ AIC 12.08 12.13 12.24 11.88 BIC 12.07 12.12 12.23 11.86 $\rho = 0.5$ CV.1se 2.04 2.04 2.04 2.02 2.04 $\rho = 0.5$ AIC 1.98 2.01 2.75 2.08 $\rho = 0.5$ AIC 3.16 3.17 3.21 3.02 $\rho = 0.5$ $\rho = 0.9$ AIC 3.16 3.17 3.21 3.02  | CV.1se | 19.79 | 19.80                          | 19.81 | 23.84       | 19.80 |                                       |
| AIC         30.82         30.99         31.25         30.32         Oracle: 17.46           BIC         30.81         30.98         31.25         30.30         Oracle: 17.46           CV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79         sd(μ)/σ = 0.5           AICc         7.68         7.76         12.06         8.19         ρ = 0.5           AIC         12.08         12.13         12.24         11.88         Oracle: 6.84           BIC         12.07         12.12         12.23         11.86         Oracle: 6.84           CV.1se         2.04         2.04         2.02         2.04         column (column)         column  | CV.min | 19.76 | 19.83                          | 19.97 | 28.51       | 19.86 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| BIC         30.81         30.98         31.25         30.30         Oracle: 17.46           CV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79 $sd(\mu)/\sigma = 0.5$ AICc         7.68         7.76         12.06         8.19 $\rho = 0.5$ AIC         12.08         12.13         12.24         11.88         Oracle: 6.84           BIC         12.07         12.12         12.23         11.86         Oracle: 6.84           CV.1se         2.04         2.04         2.02         2.04 $cd(\mu)/\sigma = 0.5$ AICc         1.98         2.01         2.75         2.08 $\rho = 0.9$ AIC         3.16         3.17         3.21         3.02         Oracle: 1.80   | AICc   | 19.54 | 20.74                          | 31.03 | 20.74       |       | $\rho = 0$                            |
| BIC         30.81         30.98         31.25         30.30           CV.1se         7.76         7.76         7.77         9.11         7.76           CV.min         7.76         7.77         7.81         10.85         7.79 $sd(\mu)/\sigma = 0.5$ AIC         7.68         7.76         12.06         8.19 $\rho = 0.5$ AIC         12.08         12.13         12.24         11.88         Oracle: 6.84           BIC         12.07         12.12         12.23         11.86         Oracle: 6.84           CV.1se         2.04         2.04         2.02         2.04 $sd(\mu)/\sigma = 0.5$ AIC         1.98         2.01         2.75         2.08 $\rho = 0.9$ AIC         3.16         3.17         3.21         3.02         Oracle: 1.80   | AIC    | 30.82 | 30.99                          | 31.25 | 30.32       |       | Oma ala . 17 46                       |
| CV.min       7.76       7.77       7.81 $10.85$ 7.79 $sd(\mu)/\sigma = 0.5$ AIC       7.68       7.76       12.06       8.19 $\rho = 0.5$ AIC       12.08       12.13       12.24       11.88 $Oracle : 6.84$ BIC       12.07       12.12       12.23       11.86 $Oracle : 6.84$ CV.1se       2.04       2.04       2.02       2.04         CV.min       2.00       2.00       2.02       2.23       2.00 $sd(\mu)/\sigma = 0.5$ AIC       3.16       3.17       3.21       3.02 $Oracle : 1.80$   | BIC    | 30.81 | 30.98                          | 31.25 | 30.30       |       | Oracie: 17.40                         |
| AICc       7.68       7.76       12.06       8.19 $\rho = 0.5$ AIC       12.08       12.13       12.24       11.88 $Oracle: 6.84$ BIC       12.07       12.12       12.23       11.86 $Oracle: 6.84$ CV.1se       2.04       2.04       2.02       2.04         CV.min       2.00       2.00       2.02       2.23       2.00 $sd(\mu)/\sigma = 0.5$ AICc       1.98       2.01       2.75       2.08 $\rho = 0.9$ AIC       3.16       3.17       3.21       3.02 $Oracle: 1.80$   | CV.1se | 7.76  | 7.76                           | 7.77  | 9.11        | 7.76  |                                       |
| AIC       12.08       12.13       12.24       11.88       Oracle: 6.84         BIC       12.07       12.12       12.23       11.86       Oracle: 6.84         CV.1se       2.04       2.04       2.02       2.04         CV.min       2.00       2.00       2.02       2.23       2.00 $sd(\mu)/\sigma = 0.5$ AIC       3.16       3.17       3.21       3.02       Oracle: 1.80  | CV.min | 7.76  | 7.77                           | 7.81  | 10.85       | 7.79  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| BIC         12.07         12.12         12.23         11.86         Oracle: 6.84           CV.1se         2.04         2.04         2.02         2.04           CV.min         2.00         2.00         2.02         2.23         2.00 $sd(\mu)/\sigma = 0.5$ AICc         1.98         2.01         2.75         2.08 $\rho = 0.9$ AIC         3.16         3.17         3.21         3.02         Oracle: 1.80   | AICc   | 7.68  | 7.76                           | 12.06 | 8.19        |       | $\rho = 0.5$                          |
| BIC       12.07       12.12       12.23       11.86         CV.1se       2.04       2.04       2.02       2.04         CV.min       2.00       2.00       2.02       2.23       2.00 $sd(\mu)/\sigma = 0.5$ AIC       3.16       3.17       3.21       3.02 $\rho = 0.9$ AIC       3.16       3.17       3.21       3.02 $\rho = 0.9$   | AIC    | 12.08 | 12.13                          | 12.24 | 11.88       |       | Omada : 604                           |
| CV.min       2.00       2.00       2.02       2.23       2.00 $sd(\mu)/\sigma = 0.5$ AIC       1.98       2.01       2.75       2.08 $\rho = 0.9$ AIC       3.16       3.17       3.21       3.02   | BIC    | 12.07 | 12.12                          | 12.23 | 11.86       |       | Oracie: 0.84                          |
| AICc 1.98 2.01 2.75 2.08 $\rho = 0.9$ AIC 3.16 3.17 3.21 3.02   | CV.1se | 2.04  | 2.04                           | 2.04  | 2.02        | 2.04  |                                       |
| AIC 3.16 3.17 3.21 3.02 Oracle: 1.80  | CV.min | 2.00  | 2.00                           | 2.02  | 2.23        | 2.00  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| Uracle: 1 XII   | AICc   | 1.98  | 2.01                           | 2.75  | 2.08        |       | $\rho = 0.9$                          |
| BIC 3.16 3.17 3.21 2.43   | AIC    | 3.16  | 3.17                           | 3.21  | 3.02        |       | Omada . 1 90                          |
|   | BIC    | 3.16  | 3.17                           | 3.21  | 2.43        |       | Oracie: 1.00                          |

Table 56: Estimation MSE for n=100, continuous design, sparse covariates, and decay 50.

|        | lasso | $\operatorname{GL} \gamma = 1$ |       |       |       |                                       |
|--------|-------|--------------------------------|-------|-------|-------|---------------------------------------|
| CV.1se | 6.03  | 5.47                           | 7.37  | 3.39  | 4.50  |                                       |
| CV.min | 3.66  | 3.54                           | 5.12  | 3.45  | 3.45  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.24  | 3.93                           | 3.83  | 3.46  |       | $\rho = 0$                            |
| AIC    | 3.93  | 3.94                           | 4.01  | 3.72  |       | Oracle: 2.26                          |
| BIC    | 3.93  | 3.94                           | 4.00  | 3.71  |       | Oracic . 2.20                         |
| CV.1se | 3.71  | 3.68                           | 3.68  | 1.86  | 3.59  |                                       |
| CV.min | 2.90  | 3.04                           | 3.39  | 1.52  | 2.83  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 2.94  | 3.45                           | 1.54  | 2.11  |       | $\rho = 0.5$                          |
| AIC    | 1.51  | 1.51                           | 1.53  | 1.48  |       | Oracle: 0.86                          |
| BIC    | 1.51  | 1.51                           | 1.53  | 1.51  |       | 07466.0.00                            |
| CV.1se | 0.76  | 0.73                           | 0.66  | 0.55  | 0.64  |                                       |
| CV.min | 0.55  | 0.55                           | 0.57  | 0.41  | 0.54  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.56  | 0.68                           | 0.61  | 0.47  |       | $\rho = 0.9$                          |
| AIC    | 0.34  | 0.34                           | 0.34  | 0.33  |       | Oracle: 0.19                          |
| BIC    | 0.34  | 0.34                           | 0.34  | 0.55  |       | 07466.0.19                            |
| CV.1se | 15.86 | 15.92                          | 16.11 | 12.87 | 15.83 |                                       |
| CV.min | 13.74 | 14.70                          | 15.65 | 14.59 | 13.88 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 13.72 | 15.18                          | 16.02 | 12.39 |       | $\rho = 0$                            |
| AIC    | 15.92 | 16.01                          | 16.18 | 15.51 |       | Oracle : 9.05                         |
| BIC    | 15.91 | 16.00                          | 16.18 | 15.49 |       | Oracie : 9.03                         |
| CV.1se | 6.15  | 6.15                           | 6.15  | 5.16  | 6.14  |                                       |
| CV.min | 5.74  | 5.87                           | 6.06  | 5.58  | 5.74  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.67  | 6.04                           | 6.02  | 5.09  |       | $\rho = 0.5$                          |
| AIC    | 6.05  | 6.07                           | 6.13  | 5.93  |       | <i>Oracle</i> : 3.43                  |
| BIC    | 6.05  | 6.07                           | 6.13  | 5.92  |       | 07 acte . 5.45                        |
| CV.1se | 1.38  | 1.37                           | 1.35  | 1.20  | 1.34  |                                       |
| CV.min | 1.24  | 1.24                           | 1.28  | 1.13  | 1.21  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.22  | 1.34                           | 1.32  | 1.13  |       | $\rho = 0.9$                          |
| AIC    | 1.36  | 1.37                           | 1.38  | 1.30  |       | Oracle: 0.78                          |
| BIC    | 1.36  | 1.36                           | 1.38  | 1.25  |       | Oracie: 0.78                          |
| CV.1se | 41.10 | 41.10                          | 41.16 | 49.82 | 41.10 |                                       |
| CV.min | 41.17 | 41.36                          | 41.49 | 59.63 | 41.39 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 40.65 | 49.38                          | 64.74 | 43.30 |       | $\rho = 0$                            |
| AIC    | 64.05 | 64.49                          | 65.00 | 63.04 |       | Oracle : 36.24                        |
| BIC    | 64.02 | 64.47                          | 64.99 | 63.01 |       | 07 acte : 30.24                       |
| CV.1se | 15.53 | 15.54                          | 15.54 | 18.34 | 15.53 |                                       |
| CV.min | 15.56 | 15.59                          | 15.65 | 21.83 | 15.63 | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 15.41 | 15.84                          | 24.32 | 16.43 |       | $\rho = 0.5$                          |
| AIC    | 24.20 | 24.32                          | 24.53 | 23.82 |       | <i>Oracle</i> : 13.70                 |
| BIC    | 24.18 | 24.31                          | 24.52 | 23.81 |       | Oracle : 15.70                        |
| CV.1se | 3.54  | 3.54                           | 3.54  | 3.58  | 3.54  |                                       |
| CV.min | 3.52  | 3.54                           | 3.55  | 3.95  | 3.53  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 3.49  | 3.53                           | 5.40  | 3.67  |       | $\rho = 0.9$                          |
| AIC    | 5.47  | 5.49                           | 5.56  | 5.28  |       | Oracle : 3.12                         |
| BIC    | 5.46  | 5.49                           | 5.56  | 4.57  |       | 01 ucie : 5.12                        |
|        |       |                                |       |       |       |                                       |

Table 57: Estimation MSE for n=100, continuous design, sparse covariates, and decay 100.

|        | lasso | $\operatorname{GL} \gamma = 1$ |       |       | sparsenet MCP |                                       |
|--------|-------|--------------------------------|-------|-------|---------------|---------------------------------------|
| CV.1se | 6.74  | 6.11                           | 8.34  | 3.77  | 5.04          |                                       |
| CV.min | 4.07  | 3.93                           | 5.96  | 3.83  | 3.85          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.70  | 4.30                           | 4.30  | 3.84  |               | $\rho = 0$                            |
| AIC    | 4.38  | 4.39                           | 4.46  | 4.14  |               | Oracle: 2.52                          |
| BIC    | 4.37  | 4.39                           | 4.46  | 4.13  |               | Oracic . 2.32                         |
| CV.1se | 4.12  | 4.10                           | 4.10  | 2.07  | 4.02          |                                       |
| CV.min | 3.23  | 3.39                           | 3.79  | 1.69  | 3.19          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 3.30  | 3.84                           | 1.71  | 2.35  |               | $\rho = 0.5$                          |
| AIC    | 1.67  | 1.68                           | 1.70  | 1.64  |               | Oracle: 0.95                          |
| BIC    | 1.67  | 1.68                           | 1.70  | 1.69  |               | Oracle . 0.93                         |
| CV.1se | 0.84  | 0.81                           | 0.74  | 0.61  | 0.71          |                                       |
| CV.min | 0.61  | 0.61                           | 0.63  | 0.46  | 0.60          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.62  | 0.75                           | 0.66  | 0.51  |               | $\rho = 0.9$                          |
| AIC    | 0.37  | 0.37                           | 0.38  | 0.36  |               | Oracle : 0.21                         |
| BIC    | 0.37  | 0.38                           | 0.38  | 0.59  |               | 07acie . 0.21                         |
| CV.1se | 17.65 | 17.73                          | 17.88 | 14.30 | 17.57         |                                       |
| CV.min | 15.29 | 16.38                          | 17.43 | 16.22 | 15.41         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 15.27 | 16.82                          | 17.83 | 13.78 |               | $\rho = 0$                            |
| AIC    | 17.69 | 17.80                          | 17.98 | 17.24 |               | Oracle : 10.05                        |
| BIC    | 17.68 | 17.79                          | 17.98 | 17.21 |               | Oracie: 10.03                         |
| CV.1se | 6.83  | 6.83                           | 6.83  | 5.74  | 6.82          |                                       |
| CV.min | 6.38  | 6.54                           | 6.74  | 6.19  | 6.38          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.30  | 6.72                           | 6.70  | 5.66  |               | $\rho = 0.5$                          |
| AIC    | 6.71  | 6.74                           | 6.80  | 6.59  |               | Oracle : 3.80                         |
| BIC    | 6.71  | 6.73                           | 6.80  | 6.58  |               | Oracle . 5.80                         |
| CV.1se | 1.53  | 1.52                           | 1.50  | 1.33  | 1.49          |                                       |
| CV.min | 1.37  | 1.37                           | 1.43  | 1.25  | 1.35          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 1.35  | 1.49                           | 1.45  | 1.25  |               | $\rho = 0.9$                          |
| AIC    | 1.50  | 1.51                           | 1.53  | 1.44  |               | Oracle : 0.86                         |
| BIC    | 1.50  | 1.51                           | 1.53  | 1.40  |               | Oracie: 0.80                          |
| CV.1se | 45.57 | 45.59                          | 45.62 | 55.20 | 45.57         |                                       |
| CV.min | 45.65 | 45.85                          | 45.98 | 66.11 | 45.94         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 45.06 | 56.09                          | 71.78 | 48.00 |               | $\rho = 0$                            |
| AIC    | 70.97 | 71.48                          | 72.03 | 69.85 |               | Oracle : 40.18                        |
| BIC    | 70.94 | 71.46                          | 72.01 | 69.82 |               | 07 acte : 40.16                       |
| CV.1se | 17.26 | 17.26                          | 17.27 | 20.38 | 17.26         |                                       |
| CV.min | 17.28 | 17.32                          | 17.40 | 24.29 | 17.37         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 17.13 | 17.71                          | 27.06 | 18.28 |               | $\rho = 0.5$                          |
| AIC    | 26.90 | 27.05                          | 27.27 | 26.48 |               | Oracle: 15.23                         |
| BIC    | 26.89 | 27.04                          | 27.27 | 26.47 |               | Oracle: 13.23                         |
| CV.1se | 3.90  | 3.90                           | 3.90  | 3.96  | 3.90          |                                       |
| CV.min | 3.89  | 3.90                           | 3.92  | 4.37  | 3.90          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 3.86  | 3.90                           | 5.99  | 4.06  |               | $\rho = 0.9$                          |
| AIC    | 6.03  | 6.06                           | 6.14  | 5.83  |               | Oracle : 3.44                         |
| BIC    | 6.03  | 6.06                           | 6.13  | 5.05  |               | 07 acie : 5.44                        |
|        |       |                                |       |       |               |                                       |

Table 58: Estimation MSE for n=100, continuous design, sparse covariates, and decay 200.

|        | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | marginal AL | sparsenet MCP |                                     |
|--------|-------------|--------------------------------|------------------------------|-------------|---------------|-------------------------------------|
| CV.1se | 7.14        | 6.46                           | 8.81                         | 3.97        | 5.31          |                                     |
| CV.min | 4.29        | 4.15                           | 6.14                         | 4.04        | 4.07          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 5.01        | 4.53                           | 4.53                         | 4.04        |               | $\rho = 0$                          |
| AIC    | 4.62        | 4.63                           | 4.71                         | 4.36        |               | Oracle : 2.65                       |
| BIC    | 4.61        | 4.62                           | 4.70                         | 4.35        |               | Oracie . 2.03                       |
| CV.1se | 4.35        | 4.31                           | 4.32                         | 2.18        | 4.24          |                                     |
| CV.min | 3.40        | 3.59                           | 4.01                         | 1.78        | 3.37          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 3.48        | 4.06                           | 1.81                         | 2.47        |               | $\rho = 0.5$                        |
| AIC    | 1.77        | 1.77                           | 1.79                         | 1.73        |               | Oracle: 1.00                        |
| BIC    | 1.77        | 1.77                           | 1.79                         | 1.79        |               | Oracie: 1.00                        |
| CV.1se | 0.89        | 0.85                           | 0.78                         | 0.65        | 0.75          |                                     |
| CV.min | 0.64        | 0.64                           | 0.67                         | 0.49        | 0.63          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 0.66        | 0.79                           | 0.69                         | 0.54        |               | $\rho = 0.9$                        |
| AIC    | 0.39        | 0.40                           | 0.40                         | 0.38        |               | , , , , , , ,                       |
| BIC    | 0.39        | 0.40                           | 0.40                         | 0.62        |               | Oracle: 0.23                        |
| CV.1se | 18.66       | 18.75                          | 18.91                        | 15.12       | 18.55         |                                     |
| CV.min | 16.14       | 17.34                          | 18.41                        | 17.11       | 16.33         | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 16.16       | 17.75                          | 18.84                        | 14.55       |               | $\rho = 0$                          |
| AIC    | 18.68       | 18.80                          | 18.99                        | 18.21       |               | ,                                   |
| BIC    | 18.67       | 18.79                          | 18.99                        | 18.18       |               | <i>Oracle</i> : 10.62               |
| CV.1se | 7.19        | 7.19                           | 7.19                         | 6.05        | 7.19          |                                     |
| CV.min | 6.72        | 6.89                           | 7.10                         | 6.52        | 6.72          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 6.63        | 7.07                           | 7.06                         | 5.96        |               | $\rho = 0.5$                        |
| AIC    | 7.07        | 7.10                           | 7.17                         | 6.94        |               | ,                                   |
| BIC    | 7.07        | 7.10                           | 7.17                         | 6.93        |               | Oracle: 4.01                        |
| CV.1se | 1.61        | 1.60                           | 1.58                         | 1.40        | 1.56          |                                     |
| CV.min | 1.45        | 1.45                           | 1.50                         | 1.32        | 1.42          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 1.42        | 1.57                           | 1.53                         | 1.32        |               | $\rho = 0.9$                        |
| AIC    | 1.59        | 1.59                           | 1.61                         | 1.52        |               | ,                                   |
| BIC    | 1.58        | 1.59                           | 1.61                         | 1.47        |               | Oracle: 0.91                        |
| CV.1se | 48.12       | 48.15                          | 48.19                        | 58.23       | 48.13         |                                     |
| CV.min | 48.20       | 48.43                          | 48.57                        | 69.84       | 48.51         | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 47.6        | 59.96                          | 75.78                        | 50.67       |               | $\rho = 0$                          |
| AIC    | 74.93       | 75.47                          | 76.04                        | 73.75       |               | ,                                   |
| BIC    | 74.89       | 75.44                          | 76.03                        | 73.72       |               | Oracle: 42.43                       |
| CV.1se | 18.22       | 18.22                          | 18.23                        | 21.49       | 18.22         |                                     |
| CV.min | 18.26       | 18.28                          | 18.35                        | 25.58       | 18.33         | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 18.08       | 18.83                          | 28.56                        | 19.27       | 10.55         | $\rho = 0.5$                        |
| AIC    | 28.38       | 28.53                          | 28.78                        | 27.94       |               | ,                                   |
| BIC    | 28.36       | 28.52                          | 28.77                        | 27.92       |               | Oracle: 16.07                       |
| CV.1se | 4.11        | 4.11                           | 4.11                         | 4.17        | 4.11          |                                     |
| CV.13c | 4.10        | 4.11                           | 4.14                         | 4.61        | 4.11          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | <b>4.07</b> | 4.11                           | 6.32                         | 4.28        | 1.11          | $\rho = 0.9$                        |
| AIC    | 6.36        | 6.39                           | 6.47                         | 6.14        |               | ,                                   |
| BIC    | 6.36        | 6.39                           | 6.47                         | 5.28        |               | Oracle: 3.62                        |
| DIC    | 0.50        | 0.37                           | 0.47                         | 3.20        |               |                                     |

Table 59: Estimation MSE for n=1000, binary design, dense covariates, and decay 10.

|                   | lasso | $\operatorname{GL} \gamma = 1$ |              | marginal AL | sparsenet MCP |  |
|-------------------|-------|--------------------------------|--------------|-------------|---------------|--|
| CV.1se            | 0.34  | 0.34                           | 0.33         | 0.33        | 0.32          |  |
| CV.min            | 0.32  | 0.32                           | 0.31         | 0.32        | 0.31          | $\operatorname{sd}(\mu)/\sigma = 2$      |
| AICc              | 0.32  | 0.32                           | 0.31         | 0.32        |               | $\rho = 0$                               |
| AIC               | 0.42  | 0.42                           | 0.45         | 0.32        |               | Oracle : 0.30                            |
| BIC               | 0.35  | 0.34                           | 0.32         | 0.33        |               | 07466 . 0.30                             |
| CV.1se            | 0.31  | 0.30                           | 0.29         | 0.30        | 0.29          |  |
| CV.min            | 0.29  | 0.29                           | 0.28         | 0.29        | 0.28          | $\operatorname{sd}(\mu)/\sigma = 2$      |
| AICc              | 0.29  | 0.29                           | 0.28         | 0.29        |               | $\rho = 0.5$                             |
| AIC               | 0.37  | 0.38                           | 0.40         | 0.29        |               | Oracle : 0.26                            |
| BIC               | 0.32  | 0.31                           | 0.29         | 0.30        |               | Oracle . 0.20                            |
| CV.1se            | 0.29  | 0.29                           | 0.28         | 0.28        | 0.27          |  |
| CV.min            | 0.28  | 0.27                           | 0.26         | 0.27        | 0.26          | $\operatorname{sd}(\mu)/\sigma = 2$      |
| AICc              | 0.28  | 0.27                           | 0.26         | 0.27        |               | $\rho = 0.9$                             |
| AIC               | 0.35  | 0.35                           | 0.37         | 0.27        |               | Oma ala . 0.25                           |
| BIC               | 0.30  | 0.29                           | 0.27         | 0.28        |               | Oracle: 0.25                             |
| CV.1se            | 1.34  | 1.32                           | 1.29         | 1.25        | 1.27          |  |
| CV.min            | 1.26  | 1.25                           | 1.23         | 1.28        | 1.23          | $\operatorname{sd}(\mu)/\sigma = 1$      |
| AICc              | 1.26  | 1.25                           | 1.27         | 1.27        |               | $\rho = 0$                               |
| AIC               | 1.85  | 1.87                           | 2.00         | 1.31        |               | ·  |
| BIC               | 1.35  | 1.31                           | 1.28         | 1.27        |               | Oracle: 1.17                             |
| CV.1se            | 1.21  | 1.18                           | 1.15         | 1.12        | 1.13          |  |
| CV.min            | 1.14  | 1.12                           | 1.1          | 1.15        | 1.1           | $\operatorname{sd}(\mu)/\sigma = 1$      |
| AICc              | 1.14  | 1.12                           | 1.13         | 1.13        |               | $\rho = 0.5$                             |
| AIC               | 1.65  | 1.67                           | 1.78         | 1.18        |               |  |
| BIC               | 1.22  | 1.18                           | 1.15         | 1.14        |               | Oracle: 1.05                             |
| CV.1se            | 1.14  | 1.12                           | 1.09         | 1.06        | 1.07          |  |
| CV.min            | 1.08  | 1.06                           | 1.04         | 1.08        | 1.04          | $\operatorname{sd}(\mu)/\sigma = 1$      |
| AICc              | 1.08  | 1.06                           | 1.07         | 1.08        |               | $\rho = 0.9$                             |
| AIC               | 1.55  | 1.57                           | 1.68         | 1.11        |               |  |
| BIC               | 1.16  | 1.12                           | 1.09         | 1.09        |               | Oracle: 0.99                             |
| CV.1se            | 5.21  | 5.16                           | 5.11         | 4.90        | 5.07          |  |
| CV.nin            | 4.93  | 4.89                           | 4.90         | 5.20        | 4.89          | $sd(\mu)/\sigma = 0.5$                   |
| AICc              | 4.92  | 4.89                           | 5.17         | 5.08        | .,,,          | $\rho = 0$                               |
| AIC               | 7.90  | 8.06                           | 8.55         | 6.07        |               | ·  |
| BIC               | 5.13  | 5.09                           | 5.21         | 4.95        |               | Oracle: 4.66                             |
| CV.1se            | 4.68  | 4.62                           | 4.57         | 4.39        | 4.53          |  |
| CV.rise<br>CV.min | 4.42  | 4.38                           | 4.38         | 4.67        | 4.37          | $sd(\mu)/\sigma = 0.5$                   |
| AICc              | 4.41  | 4.38                           | 4.62         | 4.55        | 11.07         | $\rho = 0.5$                             |
| AIC               | 7.06  | 7.19                           | 7.62         | 5.44        |               | ,  |
| BIC               | 4.62  | 4.57                           | 4.64         | 4.46        |               | Oracle: 4.16                             |
| CV.1se            | 4.43  | 4.38                           | 4.33         | 4.17        | 4.28          |  |
| CV.1sc<br>CV.min  | 4.18  | 4.15                           | 4.16         | 4.40        | 4.14          | $\operatorname{sd}(\mu)/\sigma = 0.5$    |
| AICc              | 4.18  | 4.15                           | 4.10         | 4.40        | 7.17          | $\beta d(\mu)/\delta = 0.3$ $\rho = 0.9$ |
| AICC              | 6.66  | 6.78                           | 7.20         | 5.08        |               | ,  |
| BIC               | 4.39  |                                | 7.20<br>4.41 | 4.23        |               | Oracle: 3.93                             |
| БІС               | 4.39  | 4.34                           | 4.41         | 4.23        |               |  |

Table 60: Estimation MSE for n=1000, binary design, dense covariates, and decay 50.

|        | lasso | $\operatorname{GL} \gamma = 1$ |       | marginal AL | *     |                                       |
|--------|-------|--------------------------------|-------|-------------|-------|---------------------------------------|
| CV.1se | 2.22  | 2.18                           | 2.18  | 2.15        | 2.10  |                                       |
| CV.min | 2.07  | 2.03                           | 2.05  | 2.07        | 2.01  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 2.14  | 2.06                           | 2.04  | 2.09        |       | $\rho = 0$                            |
| AIC    | 2.52  | 2.56                           | 2.73  | 2.07        |       | Oracle : 1.77                         |
| BIC    | 2.82  | 2.60                           | 2.38  | 2.47        |       | Oracic . 1.77                         |
| CV.1se | 1.99  | 1.96                           | 1.95  | 1.95        | 1.88  |                                       |
| CV.min | 1.85  | 1.82                           | 1.83  | 1.87        | 1.79  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.93  | 1.85                           | 1.82  | 1.89        |       | $\rho = 0.5$                          |
| AIC    | 2.25  | 2.28                           | 2.43  | 1.87        |       | Oracle : 1.57                         |
| BIC    | 2.63  | 2.38                           | 2.13  | 2.27        |       | Oracle . 1.57                         |
| CV.1se | 1.87  | 1.84                           | 1.83  | 1.85        | 1.77  |                                       |
| CV.min | 1.75  | 1.71                           | 1.72  | 1.77        | 1.69  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.82  | 1.75                           | 1.71  | 1.79        |       | $\rho = 0.9$                          |
| AIC    | 2.11  | 2.14                           | 2.28  | 1.77        |       | Oracle : 1.48                         |
| BIC    | 2.50  | 2.27                           | 2.00  | 2.16        |       | Oracie: 1.48                          |
| CV.1se | 8.48  | 8.43                           | 8.71  | 7.83        | 8.19  |                                       |
| CV.min | 7.81  | 7.79                           | 8.13  | 7.85        | 7.79  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.91  | 7.76                           | 8.54  | 7.80        |       | $\rho = 0$                            |
| AIC    | 10.67 | 10.91                          | 11.60 | 8.52        |       |                                       |
| BIC    | 10.46 | 9.64                           | 10.63 | 8.90        |       | Oracle: 6.88                          |
| CV.1se | 7.64  | 7.56                           | 7.75  | 7.05        | 7.34  |                                       |
| CV.min | 7.00  | 6.96                           | 7.23  | 7.05        | 6.98  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.11  | 6.95                           | 7.54  | 7.01        |       | $\rho = 0.5$                          |
| AIC    | 9.49  | 9.69                           | 10.29 | 7.65        |       |                                       |
| BIC    | 9.75  | 8.86                           | 9.54  | 8.14        |       | <i>Oracle</i> : 6.11                  |
| CV.1se | 7.20  | 7.13                           | 7.36  | 6.69        | 6.92  |                                       |
| CV.min | 6.61  | 6.57                           | 6.86  | 6.67        | 6.59  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.72  | 6.56                           | 7.11  | 6.64        |       | $\rho = 0.9$                          |
| AIC    | 8.92  | 9.11                           | 9.68  | 7.18        |       |                                       |
| BIC    | 9.29  | 8.44                           | 9.08  | 7.77        |       | <i>Oracle</i> : 5.75                  |
| CV.1se | 30.41 | 30.51                          | 30.62 | 28.92       | 30.45 |                                       |
| CV.min | 28.91 | 29.51                          | 30.38 | 30.23       | 28.94 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 28.81 | 29.04                          | 32.33 | 29.50       |       | $\rho = 0$                            |
| AIC    | 44.19 | 45.58                          | 47.69 | 36.58       |       |                                       |
| BIC    | 30.59 | 30.57                          | 30.65 | 30.31       |       | <i>Oracle</i> : 26.71                 |
| CV.1se | 27.07 | 27.11                          | 27.19 | 25.86       | 27.08 |                                       |
| CV.min | 25.89 | 26.35                          | 27.03 | 27.01       | 25.93 | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 25.77 | 25.89                          | 29.02 | 26.38       |       | $\rho = 0.5$                          |
| AIC    | 39.26 | 40.45                          | 42.30 | 32.78       |       | ,                                     |
| BIC    | 27.17 | 27.16                          | 27.20 | 26.98       |       | Oracle: 23.69                         |
| CV.1se | 25.52 | 25.57                          | 25.62 | 24.47       | 25.56 |                                       |
| CV.nsc | 24.45 | 24.87                          | 25.48 | 25.45       | 24.47 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 24.32 | 24.42                          | 27.06 | 24.91       |       | $\rho = 0.9$                          |
| AIC    | 36.90 | 38.04                          | 39.80 | 30.65       |       | ,                                     |
| BIC    | 25.60 | 25.59                          | 25.63 | 25.45       |       | <i>Oracle</i> : 22.33                 |
|        | 25.00 | 43.33                          | 45.05 | 4J.7J       |       |                                       |

Table 61: Estimation MSE for n=1000, binary design, dense covariates, and decay 100.

|                  | lasso              | $\operatorname{GL} \gamma = 1$ |       |       |        |                                     |
|------------------|--------------------|--------------------------------|-------|-------|--------|-------------------------------------|
| CV.1se           | 4.93               | 4.93                           | 5.13  | 4.95  | 4.74   |                                     |
| CV.min           | 4.56               | 4.55                           | 4.77  | 4.69  | 4.54   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 4.97               | 4.74                           | 4.69  | 4.82  |        | $\rho = 0$                          |
| AIC              | 5.26               | 5.36                           | 5.71  | 4.65  |        | Oracle: 3.92                        |
| BIC              | 11.76              | 7.65                           | 5.74  | 6.80  |        | 074666 . 3.72                       |
| CV.1se           | 4.43               | 4.41                           | 4.59  | 4.50  | 4.26   |                                     |
| CV.min           | 4.09               | 4.06                           | 4.25  | 4.25  | 4.06   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 4.49               | 4.27                           | 4.16  | 4.37  |        | $\rho = 0.5$                        |
| AIC              | 4.68               | 4.76                           | 5.06  | 4.19  |        | Oracle : 3.47                       |
| BIC              | 12.00              | 7.34                           | 5.10  | 6.48  |        | Oracie: 5.47                        |
| CV.1se           | 4.17               | 4.16                           | 4.31  | 4.30  | 4.00   |                                     |
| CV.min           | 3.86               | 3.83                           | 3.99  | 4.04  | 3.83   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 4.24               | 4.03                           | 3.93  | 4.17  |        | $\rho = 0.9$                        |
| AIC              | 4.40               | 4.47                           | 4.76  | 3.97  |        | Oracle : 3.27                       |
| BIC              | 11.64              | 7.13                           | 4.80  | 6.31  |        | Oracle : 5.21                       |
| CV.1se           | 18.86              | 19.46                          | 22.40 | 17.23 | 18.29  |                                     |
| CV.min           | 16.91              | 17.35                          | 20.03 | 17.04 | 16.91  | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | 17.48              | 17.08                          | 18.88 | 17.04 |        | $\rho = 0$                          |
| AIC              | 21.90              | 22.52                          | 23.77 | 18.38 |        |                                     |
| BIC              | 24.64              | 24.28                          | 24.73 | 22.96 |        | <i>Oracle</i> : 14.88               |
| CV.1se           | 17.09              | 17.59                          | 20.25 | 15.52 | 16.55  |                                     |
| CV.min           | 15.17              | 15.53                          | 18.18 | 15.31 | 15.17  | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | 15.75              | 15.30                          | 16.73 | 15.32 |        | $\rho = 0.5$                        |
| AIC              | 19.43              | 19.95                          | 21.04 | 16.45 |        |                                     |
| BIC              | 21.85              | 21.67                          | 21.93 | 20.83 |        | <i>Oracle</i> : 13.17               |
| CV.1se           | 16.11              | 16.52                          | 19.24 | 14.72 | 15.62  |                                     |
| CV.min           | 14.32              | 14.64                          | 17.15 | 14.48 | 14.33  | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | 14.91              | 14.44                          | 15.77 | 14.52 | - 1.00 | $\rho = 0.9$                        |
| AIC              | 18.27              | 18.76                          | 19.80 | 15.47 |        |                                     |
| BIC              | 20.60              | 20.48                          | 20.64 | 19.70 |        | <i>Oracle</i> : 12.42               |
| CV.1se           | 61.85              | 61.95                          | 61.96 | 59.96 | 61.90  |                                     |
| CV.nin           | 60.09              | 61.49                          | 61.94 | 62.57 | 60.06  | $sd(\mu)/\sigma = 0.5$              |
| AICc             | 59.74              | 61.12                          | 64.65 | 60.97 |        | $\rho = 0$                          |
| AIC              | 89.79              | 93.17                          | 96.87 | 76.06 |        |                                     |
| BIC              | 61.93              | 61.94                          | 61.96 | 61.79 |        | <i>Oracle</i> : 56.30               |
| CV.1se           | 54.84              | 54.89                          | 54.90 | 53.43 | 54.87  |                                     |
| CV.nsc<br>CV.min | 53.63              | 54.59                          | 54.90 | 55.72 | 53.68  | $sd(\mu)/\sigma = 0.5$              |
| AICc             | 53.28              | 54.24                          | 57.69 | 54.35 | 33.00  | $\rho = 0.5$                        |
| AIC              | 79.60              | 82.49                          | 85.78 | 67.95 |        |                                     |
| BIC              | 54.88              | 54.89                          | 54.90 | 54.78 |        | <i>Oracle</i> : 49.87               |
| CV.1se           | 51.68              | 51.71                          | 51.72 | 50.51 | 51.71  |                                     |
| CV.1se<br>CV.min | 50.61              | 51.71                          | 51.72 | 52.52 | 50.62  | $sd(\mu)/\sigma = 0.5$              |
| AICc             | <b>50.01 50.25</b> | 51.47                          | 54.14 | 51.30 | 50.02  | $\rho = 0.9$                        |
| AICC             | 74.83              | 77.59                          | 80.74 | 63.52 |        | $\rho = 0.9$                        |
| BIC              |                    |                                |       | 51.63 |        | <i>Oracle</i> : 46.94               |
| ыс               | 51.70              | 51.70                          | 51.72 | 31.03 |        |                                     |

Table 62: Estimation MSE for n=1000, binary design, dense covariates, and decay 200.

| CV.1se       11.14       11.67       14.02       11.52       10.67         CV.min       10.01       10.28       11.57       10.65       9.96 $sd(\mu)/\sigma =$ AIC       12.40       11.26       10.74       11.43 $\rho =$ AIC       10.87       11.12       11.75       10.29       Oracle : 8.         BIC       31.02       30.70       22.48       28.59 | = 0<br>.99<br>= 2<br>0.5 |
|--|--------------------------|
| AICc 12.40 11.26 10.74 11.43 $\rho = AIC$ 10.87 11.12 11.75 10.29 BIC 31.02 30.70 22.48 28.59 Oracle : 8.  | = 0<br>.99<br>= 2<br>0.5 |
| AIC 10.87 11.12 11.75 10.29<br>BIC 31.02 30.70 22.48 28.59 Oracle : 8.   | .99<br>= 2<br>0.5        |
| BIC 31.02 30.70 22.48 28.59 <i>Oracle</i> : 8.   | = 2<br>0.5               |
| BIC 31.02 30.70 22.48 28.59  | = 2<br>0.5               |
|  | 0.5                      |
| CV.1se 10.11 10.55 13.01 10.54 9.67  | 0.5                      |
| CV.min 8.99 9.22 10.54 9.69 <b>8.93</b> $sd(\mu)/\sigma =$   |                          |
| AICc 11.39 10.18 9.56 10.45 $\rho = 0$   | .97                      |
| AIC 9.65 9.86 10.40 9.29 Oracle: 7.  | .97                      |
| BIC 27.48 27.38 21.35 26.13  |                          |
| CV.1se 9.46 9.91 12.60 10.08 9.07  |                          |
| CV.min 8.46 8.67 9.98 9.21 <b>8.41</b> $sd(\mu)/\sigma =$  | = 2                      |
| AICc 10.75 9.61 9.01 9.99 $\rho = 0$   | 0.9                      |
| AIC 9.07 9.27 9.78 8.78 Oracle : 7.  | 51                       |
| BIC 25.87 25.76 20.43 24.77  | .31                      |
| CV.1se 42.32 46.60 49.69 37.25 41.22   |                          |
| CV.min 36.36 40.66 48.78 36.41 <b>36.32</b> $sd(\mu)/\sigma =$   | = 1                      |
| AICc 38.68 36.96 40.79 36.80 $\rho =$  |                          |
| AIC 44.46 45.96 48.21 38.73  | 70                       |
| BIC 49.76 49.76 49.81 49.26 Oracle: 32.  | ./8                      |
| CV.1se 38.81 42.45 44.07 33.54 38.03   |                          |
| CV.min 32.89 37.27 43.45 <b>32.7</b> 32.83 $sd(\mu)/\sigma =$  | = 1                      |
| AICc 35.14 33.13 36.23 33.10 $\rho = 0$  |                          |
| AIC 39.44 40.71 42.68 34.60  | 0.2                      |
| BIC 44.09 44.08 44.12 43.75 Oracle: 29.  | .03                      |
| CV.1se 36.66 39.88 41.48 31.83 36.00   |                          |
| CV.min 31.09 34.94 40.95 <b>30.91</b> 31.05 $sd(\mu)/\sigma =$   | = 1                      |
| AICc 33.09 31.24 34.04 31.35 $\rho = 0$  |                          |
| AIC 37.06 38.26 40.14 32.51  |                          |
| BIC 41.50 41.50 41.53 41.22 Oracle: 27.  | .37                      |
| CV.1se 124.61 124.67 124.67 122.31 124.65  |                          |
| CV.min 122.59 124.58 124.76 127.56 122.60 $\operatorname{sd}(\mu)/\sigma = 0$  | 0.5                      |
| AICc <b>121.94</b> 127.84 127.54 124.38 $\rho =$   |                          |
| AIC 181 11 180 10 105 52 155 43  |                          |
| BIC 124.65 124.67 126.69 124.53 Oracle: 118.   | .96                      |
| CV.1se 110.36 110.39 110.40 108.74 110.39  |                          |
| CV.min 109.04 110.34 110.47 113.45 109.10 $\operatorname{sd}(\mu)/\sigma = 0$  | 0.5                      |
| AICc <b>108.53</b> 112.85 113.18 110.60 $\rho = 0$   |                          |
| AIC 160.43 167.20 173.04 138.30  |                          |
| BIC 110.38 110.39 110.77 110.31 Oracle: 105.   | .41                      |
| CV.1se 103.91 103.92 103.92 102.63 103.92  |                          |
| CV.min 102.75 103.86 103.98 106.77 102.85 $sd(\mu)/\sigma = 0$   | 0.5                      |
| AICc <b>102.27</b> 106.26 106.53 104.36 $\rho = 0$   |                          |
| AIC 150.74 157.20 162.82 129.44  |                          |
| BIC 103.90 103.92 104.37 103.84 Oracle: 99.  | .15                      |

Table 63: Estimation MSE for n=1000, continuous design, dense covariates, and decay 10.

|        | lasso |       |       | marginal AL |       |                                       |
|--------|-------|-------|-------|-------------|-------|---------------------------------------|
| CV.1se | 1.38  | 1.35  | 1.31  | 1.32        | 1.28  |                                       |
| CV.min | 1.30  | 1.28  | 1.25  | 1.27        | 1.24  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.30  | 1.28  | 1.27  | 1.27        |       | $\rho = 0$                            |
| AIC    | 1.68  | 1.69  | 1.78  | 1.27        |       | Oracle : 1.18                         |
| BIC    | 1.42  | 1.37  | 1.32  | 1.32        |       | Oracle . 1.16                         |
| CV.1se | 0.56  | 0.55  | 0.51  | 0.61        | 0.49  |                                       |
| CV.min | 0.53  | 0.51  | 0.49  | 0.59        | 0.47  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.53  | 0.52  | 0.49  | 0.59        |       | $\rho = 0.5$                          |
| AIC    | 0.61  | 0.61  | 0.63  | 0.59        |       | Oracle : 0.45                         |
| BIC    | 0.64  | 0.60  | 0.54  | 0.61        |       | Oracie : 0.43                         |
| CV.1se | 0.16  | 0.15  | 0.14  | 0.17        | 0.14  |                                       |
| CV.min | 0.15  | 0.15  | 0.14  | 0.17        | 0.13  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.15  | 0.15  | 0.14  | 0.17        |       | $\rho = 0.9$                          |
| AIC    | 0.15  | 0.14  | 0.14  | 0.17        |       | Oma ala . 0.12                        |
| BIC    | 0.20  | 0.19  | 0.17  | 0.17        |       | Oracle: 0.12                          |
| CV.1se | 5.39  | 5.29  | 5.15  | 5.00        | 5.10  |                                       |
| CV.min | 5.08  | 5.01  | 4.95  | 5.13        | 4.94  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.08  | 5.02  | 5.06  | 5.08        |       | $\rho = 0$                            |
| AIC    | 7.41  | 7.50  | 8.01  | 5.27        |       | ·                                     |
| BIC    | 5.41  | 5.32  | 5.32  | 5.09        |       | Oracle: 4.70                          |
| CV.1se | 2.19  | 2.12  | 2.01  | 2.08        | 1.94  |                                       |
| CV.min | 2.04  | 1.99  | 1.92  | 2.07        | 1.88  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 2.04  | 1.99  | 1.94  | 2.06        |       | $\rho = 0.5$                          |
| AIC    | 2.69  | 2.72  | 2.89  | 2.07        |       |                                       |
| BIC    | 2.34  | 2.25  | 2.12  | 2.23        |       | Oracle: 1.77                          |
| CV.1se | 0.64  | 0.61  | 0.56  | 0.54        | 0.54  |                                       |
| CV.min | 0.58  | 0.57  | 0.54  | 0.52        | 0.53  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.58  | 0.57  | 0.55  | 0.52        |       | $\rho = 0.9$                          |
| AIC    | 0.61  | 0.61  | 0.65  | 0.52        |       | ,                                     |
| BIC    | 0.69  | 0.68  | 0.68  | 0.54        |       | Oracle: 0.48                          |
| CV.1se | 20.93 | 20.70 | 20.51 | 19.70       | 20.35 |                                       |
| CV.min | 19.78 | 19.65 | 19.69 | 20.92       | 19.64 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 19.76 | 19.76 | 20.60 | 20.41       |       | $\rho = 0$                            |
| AIC    | 31.66 | 32.29 | 34.25 | 24.31       |       | ·                                     |
| BIC    | 20.61 | 20.65 | 21.70 | 19.92       |       | <i>Oracle</i> : 18.68                 |
| CV.1se | 8.31  | 8.18  | 8.01  | 7.93        | 7.74  |                                       |
| CV.min | 7.81  | 7.71  | 7.65  | 8.19        | 7.48  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 7.78  | 7.73  | 7.97  | 8.10        |       | $\rho = 0.5$                          |
| AIC    | 11.66 | 11.85 | 12.62 | 8.89        |       | ,                                     |
| BIC    | 8.21  | 8.20  | 8.22  | 8.11        |       | <i>Oracle</i> : 7.04                  |
| CV.1se | 2.18  | 2.17  | 2.12  | 2.05        | 2.15  |                                       |
| CV.min | 2.09  | 2.09  | 2.08  | 2.02        | 2.07  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 2.09  | 2.09  | 2.08  | 2.03        |       | $\rho = 0.9$                          |
| AIC    | 2.66  | 2.74  | 3.05  | 2.03        |       |                                       |
| BIC    | 2.10  | 2.09  | 2.08  | 2.07        |       | <i>Oracle</i> : 1.91                  |
|        |       |       |       |             |       |                                       |

Table 64: Estimation MSE for n=1000, continuous design, dense covariates, and decay 50.

|        | lasso  | $\operatorname{GL} \gamma = 1$ |        | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------|-------------|---------------|---------------------------------------|
| CV.1se | 8.89   | 8.75                           | 8.73   | 8.62        | 8.46          |                                       |
| CV.min | 8.29   | 8.15                           | 8.22   | 8.31        | 8.07          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 8.58   | 8.33                           | 8.21   | 8.36        |               | $\rho = 0$                            |
| AIC    | 10.11  | 10.26                          | 10.96  | 8.32        |               | <i>Oracle</i> : 7.12                  |
| BIC    | 11.38  | 10.69                          | 10.16  | 9.86        |               | 074666.7.12                           |
| CV.1se | 3.36   | 3.26                           | 3.14   | 3.80        | 3.02          |                                       |
| CV.min | 3.10   | 3.02                           | 2.95   | 3.53        | 2.89          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 3.36   | 3.18                           | 2.92   | 3.60        |               | $\rho = 0.5$                          |
| AIC    | 3.44   | 3.46                           | 3.65   | 3.49        |               | Oracle: 2.44                          |
| BIC    | 7.68   | 5.31                           | 3.78   | 5.59        |               | 07 acte . 2.44                        |
| CV.1se | 0.63   | 0.61                           | 0.58   | 1.17        | 0.56          |                                       |
| CV.min | 0.59   | 0.57                           | 0.55   | 1.10        | 0.55          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.65   | 0.61                           | 0.55   | 1.10        |               | $\rho = 0.9$                          |
| AIC    | 0.59   | 0.57                           | 0.56   | 1.10        |               | Oracle: 0.44                          |
| BIC    | 1.67   | 1.66                           | 1.65   | 1.25        |               | Oracie : 0.44                         |
| CV.1se | 34.06  | 33.85                          | 34.98  | 31.42       | 32.94         |                                       |
| CV.min | 31.34  | 31.26                          | 32.68  | 31.51       | 31.30         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 31.83  | 31.40                          | 33.52  | 31.27       |               | $\rho = 0$                            |
| AIC    | 42.77  | 43.75                          | 46.49  | 34.15       |               | 0 1 27 62                             |
| BIC    | 42.03  | 40.64                          | 48.29  | 35.76       |               | <i>Oracle</i> : 27.62                 |
| CV.1se | 13.53  | 12.89                          | 13.06  | 12.68       | 11.78         |                                       |
| CV.min | 11.81  | 11.55                          | 11.96  | 12.24       | 11.26         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 12.25  | 11.78                          | 11.53  | 12.34       |               | $\rho = 0.5$                          |
| AIC    | 14.53  | 14.78                          | 15.67  | 12.45       |               | 0 1 0 15                              |
| BIC    | 16.62  | 16.65                          | 16.79  | 16.24       |               | <i>Oracle</i> : 9.45                  |
| CV.1se | 2.91   | 2.78                           | 2.71   | 2.50        | 2.29          |                                       |
| CV.min | 2.64   | 2.45                           | 2.48   | 2.35        | 2.15          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 2.67   | 2.67                           | 2.62   | 2.35        |               | $\rho = 0.9$                          |
| AIC    | 2.29   | 2.32                           | 2.52   | 2.34        |               | ,                                     |
| BIC    | 2.84   | 2.84                           | 2.82   | 2.79        |               | Oracle: 1.72                          |
| CV.1se | 122.32 | 122.70                         | 123.15 | 116.28      | 122.44        |                                       |
| CV.min | 116.26 | 118.42                         | 122.17 | 121.45      | 116.33        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 115.83 | 118.96                         | 123.27 | 118.51      |               | $\rho = 0$                            |
| AIC    | 177.17 | 182.78                         | 191.21 | 146.86      |               |                                       |
| BIC    | 123.05 | 123.19                         | 123.26 | 121.93      |               | Oracle: 107.15                        |
| CV.1se | 42.16  | 42.17                          | 42.17  | 41.75       | 42.16         |                                       |
| CV.min | 41.82  | 41.91                          | 42.11  | 43.03       | 41.82         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 41.56  | 42.03                          | 42.18  | 42.51       |               | $\rho = 0.5$                          |
| AIC    | 60.25  | 61.81                          | 64.90  | 50.74       |               |                                       |
| BIC    | 42.13  | 42.15                          | 42.17  | 42.06       |               | <i>Oracle</i> : 36.65                 |
| CV.1se | 7.70   | 7.69                           | 7.67   | 7.60        | 7.70          |                                       |
| CV.min | 7.50   | 7.49                           | 7.47   | 7.50        | 7.46          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 7.49   | 7.51                           | 7.49   | 7.52        |               | $\rho = 0.9$                          |
| AIC    | 9.77   | 10.11                          | 11.15  | 7.60        |               | ,                                     |
| BIC    | 7.53   | 7.54                           | 7.54   | 7.48        |               | <i>Oracle</i> : 6.68                  |

Table 65: Estimation MSE for n=1000, continuous design, dense covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ |        | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------|-------------|---------------|---------------------------------------|
| CV.1se | 19.75  | 19.76                          | 20.62  | 19.85       | 19.04         |                                       |
| CV.min | 18.30  | 18.24                          | 19.12  | 18.83       | 18.2          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 19.91  | 19.17                          | 18.81  | 19.30       |               | $\rho = 0$                            |
| AIC    | 21.09  | 21.49                          | 22.88  | 18.63       |               | Oracle: 15.73                         |
| BIC    | 46.55  | 33.24                          | 24.57  | 27.18       |               | 07 acic . 13.73                       |
| CV.1se | 7.50   | 7.32                           | 7.19   | 9.12        | 7.09          |                                       |
| CV.min | 6.74   | 6.63                           | 6.69   | 8.03        | 6.70          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 8.11   | 7.40                           | 6.65   | 8.66        |               | $\rho = 0.5$                          |
| AIC    | 7.16   | 7.24                           | 7.62   | 7.58        |               | <i>Oracle</i> : 5.31                  |
| BIC    | 20.78  | 20.81                          | 17.61  | 20.27       |               | Oracie . 3.31                         |
| CV.1se | 1.32   | 1.28                           | 1.23   | 2.70        | 1.26          |                                       |
| CV.min | 1.18   | 1.16                           | 1.15   | 2.39        | 1.19          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.51   | 1.32                           | 1.16   | 2.40        |               | $\rho = 0.9$                          |
| AIC    | 1.18   | 1.14                           | 1.15   | 2.36        |               | Oracle: 0.90                          |
| BIC    | 3.33   | 3.33                           | 3.31   | 3.28        |               | Oracie: 0.90                          |
| CV.1se | 75.68  | 78.22                          | 89.56  | 69.05       | 73.29         |                                       |
| CV.min | 67.78  | 69.59                          | 80.16  | 68.33       | 67.80         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 70.19  | 69.24                          | 77.65  | 68.32       |               | $\rho = 0$                            |
| AIC    | 87.75  | 90.22                          | 95.25  | 73.65       |               |                                       |
| BIC    | 98.91  | 98.92                          | 99.42  | 91.76       |               | <i>Oracle</i> : 59.71                 |
| CV.1se | 32.61  | 32.35                          | 33.50  | 27.99       | 31.66         |                                       |
| CV.min | 27.83  | 28.32                          | 32.85  | 26.47       | 27.79         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 28.71  | 27.60                          | 27.00  | 27.01       |               | $\rho = 0.5$                          |
| AIC    | 29.61  | 30.23                          | 31.88  | 26.46       |               | 0 1 2016                              |
| BIC    | 33.51  | 33.54                          | 33.58  | 33.30       |               | <i>Oracle</i> : 20.16                 |
| CV.1se | 5.69   | 5.68                           | 5.64   | 5.37        | 5.66          |                                       |
| CV.min | 5.46   | 5.44                           | 5.46   | 4.96        | 5.37          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.41   | 5.49                           | 5.47   | 4.92        |               | $\rho = 0.9$                          |
| AIC    | 4.51   | 4.59                           | 5.00   | 4.75        |               | ,                                     |
| BIC    | 5.51   | 5.51                           | 5.48   | 5.47        |               | <i>Oracle</i> : 3.43                  |
| CV.1se | 248.48 | 248.75                         | 248.83 | 240.83      | 248.64        |                                       |
| CV.min | 241.25 | 246.89                         | 248.80 | 251.00      | 241.20        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 239.87 | 247.57                         | 248.98 | 244.78      |               | $\rho = 0$                            |
| AIC    | 359.81 | 373.33                         | 388.16 | 305.32      |               | 225.74                                |
| BIC    | 248.75 | 248.83                         | 260.38 | 248.16      |               | Oracle: 225.74                        |
| CV.1se | 84.04  | 84.04                          | 84.04  | 83.70       | 84.04         |                                       |
| CV.min | 83.75  | 83.95                          | 84.07  | 86.35       | 83.78         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 83.45  | 84.01                          | 84.08  | 85.29       |               | $\rho = 0.5$                          |
| AIC    | 120.66 | 124.51                         | 130.20 | 103.48      |               | ,                                     |
| BIC    | 84.03  | 84.04                          | 84.04  | 83.99       |               | <i>Oracle</i> : 76.23                 |
| CV.1se | 14.33  | 14.33                          | 14.33  | 14.29       | 14.34         |                                       |
| CV.min | 14.17  | 14.16                          | 14.17  | 14.21       | 14.15         | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 14.13  | 14.20                          | 14.25  | 14.25       |               | $\rho = 0.9$                          |
| AIC    | 18.82  | 19.62                          | 21.33  | 14.53       |               | ,                                     |
| BIC    | 14.23  | 14.25                          | 14.31  | 14.17       |               | Oracle : 12.97                        |

Table 66: Estimation MSE for n=1000, continuous design, dense covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 44.42  | 46.71                          | 56.79                           | 46.06       | 42.76         |                                       |
| CV.min | 40.06  | 41.17                          | 46.59                           | 42.63       | 39.87         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 49.74  | 45.58                          | 43.24                           | 45.76       |               | $\rho = 0$                            |
| AIC    | 43.49  | 44.52                          | 47.03                           | 41.20       |               | Oracle : 36.05                        |
| BIC    | 124.28 | 124.46                         | 72.81                           | 114.38      |               | Oracie: 30.03                         |
| CV.1se | 20.11  | 21.43                          | 39.27                           | 23.34       | 19.23         |                                       |
| CV.min | 15.20  | 15.65                          | 34.29                           | 19.50       | 15.17         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 26.86  | 19.33                          | 15.30                           | 22.13       |               | $\rho = 0.5$                          |
| AIC    | 14.76  | 14.97                          | 15.68                           | 16.30       |               | Omasla . 12.00                        |
| BIC    | 41.76  | 41.80                          | 41.06                           | 41.46       |               | Oracle: 12.09                         |
| CV.1se | 5.61   | 5.64                           | 6.78                            | 6.32        | 6.14          |                                       |
| CV.min | 4.01   | 4.16                           | 6.49                            | 5.32        | 4.91          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 6.40   | 6.11                           | 2.57                            | 5.28        |               | $\rho = 0.9$                          |
| AIC    | 2.40   | 2.37                           | 2.43                            | 4.53        |               | O11-00                                |
| BIC    | 6.66   | 6.66                           | 6.64                            | 6.60        |               | Oracle: 1.98                          |
| CV.1se | 169.30 | 187.88                         | 199.29                          | 149.02      | 165.35        |                                       |
| CV.min | 145.46 | 163.65                         | 195.22                          | 145.76      | 145.47        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 155.35 | 149.68                         | 176.34                          | 147.26      |               | $\rho = 0$                            |
| AIC    | 178.00 | 184.00                         | 193.01                          | 154.99      |               | ,                                     |
| BIC    | 199.52 | 199.72                         | 199.19                          | 197.28      |               | Oracle: 131.43                        |
| CV.1se | 66.93  | 67.00                          | 67.02                           | 59.80       | 66.97         |                                       |
| CV.min | 64.04  | 65.70                          | 66.87                           | 55.90       | 63.97         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 63.18  | 65.26                          | 63.30                           | 57.33       |               | $\rho = 0.5$                          |
| AIC    | 59.68  | 61.25                          | 64.28                           | 54.73       |               |                                       |
| BIC    | 66.99  | 67.02                          | 67.02                           | 66.86       |               | Oracle: 44.09                         |
| CV.1se | 11.00  | 11.00                          | 10.99                           | 10.89       | 11.01         |                                       |
| CV.min | 10.74  | 10.74                          | 10.76                           | 10.35       | 10.73         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 10.65  | 10.82                          | 10.84                           | 10.27       |               | $\rho = 0.9$                          |
| AIC    | 9.05   | 9.31                           | 10.04                           | 9.44        |               |                                       |
| BIC    | 10.86  | 10.87                          | 10.92                           | 10.78       |               | Oracle: 7.22                          |
| CV.1se | 499.75 | 499.92                         | 499.94                          | 490.79      | 499.87        |                                       |
| CV.min | 491.34 | 499.45                         | 500.31                          | 511.49      | 491.87        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 488.97 | 501.61                         | 499.93                          | 498.68      |               | $\rho = 0$                            |
| AIC    | 725.13 | 757.08                         | 782.66                          | 623.41      |               | ·                                     |
| BIC    | 499.85 | 499.93                         | 702.82                          | 499.40      |               | Oracle: 476.83                        |
| CV.1se | 167.73 | 167.73                         | 167.73                          | 167.37      | 167.73        |                                       |
| CV.min | 167.35 | 167.70                         | 167.82                          | 172.56      | 167.40        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 166.89 | 167.74                         | 167.73                          | 170.57      |               | $\rho = 0.5$                          |
| AIC    | 241.13 | 250.55                         | 260.98                          | 208.44      |               | 1 150.04                              |
| BIC    | 167.72 | 167.73                         | 169.58                          | 167.68      |               | Oracle: 159.94                        |
| CV.1se | 27.55  | 27.55                          | 27.55                           | 27.53       | 27.55         |                                       |
| CV.min | 27.44  | 27.45                          | 27.50                           | 27.54       | 27.44         | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 27.39  | 27.50                          | 27.54                           | 27.60       |               | $\rho = 0.9$                          |
| AIC    | 36.95  | 38.80                          | 41.67                           | 28.31       |               | ·                                     |
| BIC    | 27.52  | 27.53                          | 27.55                           | 27.47       |               | Oracle: 26.20                         |
|        |        |                                |                                 |             |               |                                       |

Table 67: Estimation MSE for n=1000, binary design, sparse covariates, and decay 10.

|                  | lasso | $\operatorname{GL} \gamma = 1$ |      | marginal AL | sparsenet MCP |  |
|------------------|-------|--------------------------------|------|-------------|---------------|--|
| CV.1se           | 0.34  | 0.34                           | 0.33 | 0.33        | 0.32          |  |
| CV.min           | 0.32  | 0.32                           | 0.31 | 0.32        | 0.31          | $\operatorname{sd}(\mu)/\sigma = 2$    |
| AICc             | 0.32  | 0.32                           | 0.31 | 0.32        |               | $\rho = 0$                             |
| AIC              | 0.42  | 0.42                           | 0.45 | 0.32        |               | Oracle : <b>0.31</b>                   |
| BIC              | 0.35  | 0.34                           | 0.32 | 0.33        |               | 07 acte : 0.51                         |
| CV.1se           | 0.31  | 0.30                           | 0.29 | 0.30        | 0.29          |  |
| CV.min           | 0.29  | 0.29                           | 0.28 | 0.29        | 0.28          | $\operatorname{sd}(\mu)/\sigma = 2$    |
| AICc             | 0.29  | 0.29                           | 0.28 | 0.29        |               | $\rho = 0.5$                           |
| AIC              | 0.37  | 0.38                           | 0.40 | 0.29        |               | Oracle : <b>0.28</b>                   |
| BIC              | 0.32  | 0.31                           | 0.29 | 0.30        |               | 07 acte . <b>0.26</b>                  |
| CV.1se           | 0.29  | 0.29                           | 0.28 | 0.28        | 0.27          |  |
| CV.min           | 0.28  | 0.27                           | 0.26 | 0.27        | 0.26          | $\operatorname{sd}(\mu)/\sigma = 2$    |
| AICc             | 0.28  | 0.27                           | 0.26 | 0.27        |               | $\rho = 0.9$                           |
| AIC              | 0.35  | 0.35                           | 0.37 | 0.27        |               | 0                                      |
| BIC              | 0.30  | 0.29                           | 0.27 | 0.28        |               | Oracle : <b>0.26</b>                   |
| CV.1se           | 1.34  | 1.32                           | 1.29 | 1.25        | 1.27          |  |
| CV.min           | 1.26  | 1.25                           | 1.23 | 1.28        | 1.23          | $\operatorname{sd}(\mu)/\sigma = 1$    |
| AICc             | 1.26  | 1.25                           | 1.27 | 1.27        |               | $\rho = 0$                             |
| AIC              | 1.85  | 1.87                           | 2.00 | 1.31        |               |  |
| BIC              | 1.35  | 1.31                           | 1.29 | 1.27        |               | Oracle: 1.24                           |
| CV.1se           | 1.21  | 1.18                           | 1.15 | 1.12        | 1.13          |  |
| CV.min           | 1.14  | 1.12                           | 1.1  | 1.15        | 1.1           | $\operatorname{sd}(\mu)/\sigma = 1$    |
| AICc             | 1.14  | 1.12                           | 1.13 | 1.14        |               | $\rho = 0.5$                           |
| AIC              | 1.65  | 1.67                           | 1.78 | 1.18        |               |  |
| BIC              | 1.22  | 1.18                           | 1.15 | 1.14        |               | Oracle: 1.11                           |
| CV.1se           | 1.14  | 1.12                           | 1.09 | 1.06        | 1.07          |  |
| CV.min           | 1.08  | 1.06                           | 1.04 | 1.08        | 1.04          | $\operatorname{sd}(\mu)/\sigma = 1$    |
| AICc             | 1.08  | 1.06                           | 1.07 | 1.08        | 1.0.          | $\rho = 0.9$                           |
| AIC              | 1.55  | 1.57                           | 1.68 | 1.11        |               |  |
| BIC              | 1.16  | 1.12                           | 1.09 | 1.09        |               | Oracle: 1.05                           |
| CV.1se           | 5.21  | 5.16                           | 5.11 | 4.90        | 5.07          |  |
| CV.13C           | 4.93  | 4.89                           | 4.90 | 5.20        | 4.89          | $sd(\mu)/\sigma = 0.5$                 |
| AICc             | 4.92  | 4.89                           | 5.17 | 5.08        | 1.07          | $\rho = 0$                             |
| AIC              | 7.90  | 8.06                           | 8.55 | 6.07        |               | ·                                      |
| BIC              | 5.14  | 5.09                           | 5.21 | 4.96        |               | Oracle: 4.98                           |
| CV.1se           | 4.68  | 4.62                           | 4.56 | 4.39        | 4.53          |  |
| CV.1sc<br>CV.min | 4.42  | 4.38                           | 4.38 | 4.67        | <b>4.37</b>   | $sd(\mu)/\sigma = 0.5$                 |
| AICc             | 4.41  | 4.38                           | 4.62 | 4.55        | 7.07          | $\rho = 0.5$                           |
| AIC              | 7.06  | 7.19                           | 7.62 | 5.44        |               |  |
| BIC              | 4.62  | 4.57                           | 4.64 | 4.46        |               | Oracle: 4.44                           |
| CV.1se           | 4.62  | 4.37                           | 4.04 | 4.40        | 4.28          |  |
| CV.1se<br>CV.min | 4.43  |                                |      |             |               | $\int \operatorname{ad}(u)/\sigma = 0$ |
|                  |       | 4.15                           | 4.16 | 4.40        | 4.13          | $sd(\mu)/\sigma = 0.5$                 |
| AICc             | 4.18  | 4.15                           | 4.38 | 4.31        |               | $\rho = 0.9$                           |
| AIC              | 6.65  | 6.78                           | 7.20 | 5.08        |               | Oracle: 4.20                           |
| BIC              | 4.39  | 4.34                           | 4.40 | 4.23        |               |  |

Table 68: Estimation MSE for n=1000, binary design, sparse covariates, and decay 50.

|        | lasso | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL |        |                                       |
|--------|-------|--------------------------------|---------------------------------|-------------|--------|---------------------------------------|
| CV.1se | 2.11  | 2.06                           | 2.02                            | 2.04        | 1.97   |                                       |
| CV.min | 1.98  | 1.93                           | 1.91                            | 1.97        | 1.89   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 2.03  | 1.95                           | 1.93                            | 1.98        |        | $\rho = 0$                            |
| AIC    | 2.47  | 2.50                           | 2.68                            | 1.98        |        | Oracle : 1.66                         |
| BIC    | 2.59  | 2.38                           | 2.18                            | 2.29        |        | 07acic . 1.00                         |
| CV.1se | 1.90  | 1.85                           | 1.81                            | 1.85        | 1.76   |                                       |
| CV.min | 1.78  | 1.73                           | 1.71                            | 1.78        | 1.69   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.83  | 1.76                           | 1.71                            | 1.79        |        | $\rho = 0.5$                          |
| AIC    | 2.20  | 2.23                           | 2.38                            | 1.79        |        | Oracle : 1.47                         |
| BIC    | 2.40  | 2.19                           | 1.95                            | 2.12        |        | Oracle . 1.47                         |
| CV.1se | 1.79  | 1.74                           | 1.70                            | 1.76        | 1.65   |                                       |
| CV.min | 1.68  | 1.64                           | 1.61                            | 1.69        | 1.59   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.73  | 1.66                           | 1.62                            | 1.70        |        | $\rho = 0.9$                          |
| AIC    | 2.07  | 2.09                           | 2.23                            | 1.69        |        | Oracle : 1.38                         |
| BIC    | 2.28  | 2.08                           | 1.84                            | 2.02        |        | Oracie : 1.38                         |
| CV.1se | 8.24  | 8.17                           | 8.39                            | 7.62        | 7.95   |                                       |
| CV.min | 7.60  | 7.57                           | 7.86                            | 7.64        | 7.58   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.69  | 7.54                           | 8.30                            | 7.58        |        | $\rho = 0$                            |
| AIC    | 10.46 | 10.70                          | 11.38                           | 8.30        |        |                                       |
| BIC    | 10.06 | 9.29                           | 10.18                           | 8.59        |        | <i>Oracle</i> : 6.62                  |
| CV.1se | 7.42  | 7.33                           | 7.47                            | 6.86        | 7.11   |                                       |
| CV.min | 6.82  | 6.77                           | 6.99                            | 6.87        | 6.78   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.92  | 6.76                           | 7.35                            | 6.82        |        | $\rho = 0.5$                          |
| AIC    | 9.31  | 9.51                           | 10.10                           | 7.46        |        |                                       |
| BIC    | 9.38  | 8.53                           | 9.14                            | 7.86        |        | <i>Oracle</i> : 5.88                  |
| CV.1se | 6.99  | 6.92                           | 7.11                            | 6.51        | 6.71   |                                       |
| CV.min | 6.44  | 6.39                           | 6.65                            | 6.49        | 6.40   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.54  | 6.38                           | 6.88                            | 6.46        |        | $\rho = 0.9$                          |
| AIC    | 8.75  | 8.94                           | 9.50                            | 7.00        |        |                                       |
| BIC    | 8.98  | 8.13                           | 8.69                            | 7.50        |        | <i>Oracle</i> : 5.54                  |
| CV.1se | 29.81 | 29.91                          | 30.03                           | 28.31       | 29.84  |                                       |
| CV.min | 28.31 | 28.88                          | 29.78                           | 29.60       | 28.34  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 28.2  | 28.41                          | 31.56                           | 28.90       |        | $\rho = 0$                            |
| AIC    | 43.35 | 44.71                          | 46.79                           | 35.84       |        |                                       |
| BIC    | 30.01 | 29.97                          | 30.07                           | 29.69       |        | <i>Oracle</i> : 26.48                 |
| CV.1se | 26.57 | 26.62                          | 26.70                           | 25.36       | 26.60  |                                       |
| CV.min | 25.38 | 25.82                          | 26.53                           | 26.50       | 25.42  | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 25.25 | 25.38                          | 28.50                           | 25.87       |        | $\rho = 0.5$                          |
| AIC    | 38.55 | 39.72                          | 41.54                           | 32.20       |        |                                       |
| BIC    | 26.68 | 26.67                          | 26.72                           | 26.49       |        | Oracle: 23.53                         |
| CV.1se | 25.05 | 25.11                          | 25.16                           | 23.99       | 25.10  |                                       |
| CV.nsc | 23.95 | 24.36                          | 25.01                           | 24.95       | 23.99  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 23.85 | 23.94                          | 26.63                           | 24.43       | _2.,,, | $\rho = 0.9$                          |
| AIC    | 36.24 | 37.35                          | 39.09                           | 30.06       |        |                                       |
| BIC    | 25.15 | 25.13                          | 25.18                           | 24.98       |        | <i>Oracle</i> : 22.16                 |
|        | 23.13 | 43.13                          | 23.10                           | ۷٦،۶۵       |        |                                       |

Table 69: Estimation MSE for n=1000, binary design, sparse covariates, and decay 100.

|        | lasso | $\operatorname{GL} \gamma = 1$ |       | marginal AL |       |                                       |
|--------|-------|--------------------------------|-------|-------------|-------|---------------------------------------|
| CV.1se | 3.76  | 3.61                           | 3.36  | 3.65        | 3.30  |                                       |
| CV.min | 3.56  | 3.43                           | 3.26  | 3.53        | 3.26  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 3.67  | 3.47                           | 3.35  | 3.55        |       | $\rho = 0$                            |
| AIC    | 4.47  | 4.55                           | 4.87  | 3.57        |       | Oracle: 2.94                          |
| BIC    | 4.59  | 4.06                           | 3.62  | 4.07        |       | 074666.2.54                           |
| CV.1se | 3.38  | 3.23                           | 2.98  | 3.31        | 2.91  |                                       |
| CV.min | 3.20  | 3.08                           | 2.90  | 3.20        | 2.88  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 3.30  | 3.11                           | 2.98  | 3.23        |       | $\rho = 0.5$                          |
| AIC    | 3.98  | 4.05                           | 4.32  | 3.23        |       | Oracle : 2.61                         |
| BIC    | 4.23  | 3.69                           | 3.20  | 3.78        |       | Oracle . 2.01                         |
| CV.1se | 3.18  | 3.04                           | 2.83  | 3.16        | 2.76  |                                       |
| CV.min | 3.02  | 2.91                           | 2.75  | 3.04        | 2.72  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 3.12  | 2.94                           | 2.81  | 3.07        |       | $\rho = 0.9$                          |
| AIC    | 3.74  | 3.81                           | 4.07  | 3.06        |       | Oracle : 2.46                         |
| BIC    | 4.04  | 3.51                           | 3.04  | 3.63        |       | Oracie : 2.40                         |
| CV.1se | 15.29 | 15.35                          | 16.83 | 14.13       | 14.78 |                                       |
| CV.min | 13.96 | 14.04                          | 15.26 | 14.06       | 13.95 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 14.24 | 13.96                          | 15.45 | 14.00       |       | $\rho = 0$                            |
| AIC    | 18.83 | 19.34                          | 20.48 | 15.33       |       |                                       |
| BIC    | 21.17 | 19.98                          | 21.18 | 17.90       |       | <i>Oracle</i> : 11.78                 |
| CV.1se | 13.82 | 13.84                          | 15.21 | 12.77       | 13.33 |                                       |
| CV.min | 12.54 | 12.58                          | 13.66 | 12.68       | 12.53 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 12.85 | 12.52                          | 13.71 | 12.65       |       | $\rho = 0.5$                          |
| AIC    | 16.74 | 17.18                          | 18.16 | 13.77       |       |                                       |
| BIC    | 18.86 | 18.33                          | 18.89 | 16.72       |       | <i>Oracle</i> : 10.46                 |
| CV.1se | 13.02 | 13.04                          | 14.46 | 12.13       | 12.59 |                                       |
| CV.min | 11.84 | 11.86                          | 13.02 | 12.00       | 11.83 | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 12.15 | 11.82                          | 12.94 | 11.98       |       | $\rho = 0.9$                          |
| AIC    | 15.75 | 16.16                          | 17.10 | 12.95       |       |                                       |
| BIC    | 17.80 | 17.37                          | 17.79 | 16.04       |       | <i>Oracle</i> : 9.86                  |
| CV.1se | 53.36 | 53.48                          | 53.51 | 51.35       | 53.41 |                                       |
| CV.min | 51.39 | 52.79                          | 53.45 | 53.56       | 51.43 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 51.14 | 52.09                          | 55.86 | 52.29       |       | $\rho = 0$                            |
| AIC    | 77.50 | 80.32                          | 83.64 | 65.12       |       |                                       |
| BIC    | 53.49 | 53.50                          | 53.52 | 53.31       |       | <i>Oracle</i> : 47.14                 |
| CV.1se | 47.42 | 47.49                          | 47.51 | 45.88       | 47.46 |                                       |
| CV.min | 46.02 | 46.99                          | 47.48 | 47.86       | 46.06 | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 45.75 | 46.41                          | 50.02 | 46.73       |       | $\rho = 0.5$                          |
| AIC    | 68.81 | 71.22                          | 74.17 | 58.32       |       |                                       |
| BIC    | 47.49 | 47.49                          | 47.51 | 47.37       |       | <i>Oracle</i> : 41.82                 |
| CV.1se | 44.74 | 44.79                          | 44.80 | 43.44       | 44.78 |                                       |
| CV.13C | 43.47 | 44.38                          | 44.80 | 45.16       | 43.50 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 43.18 | 43.79                          | 46.92 | 44.14       | 15.50 | $\rho = 0.9$                          |
| AIC    | 64.73 | 67.04                          | 69.87 | 54.55       |       |                                       |
| BIC    | 44.79 | 44.79                          | 44.81 | 44.69       |       | <i>Oracle</i> : 39.43                 |
|        | 77.13 | 77.13                          | 77.01 | 77.02       |       |                                       |

Table 70: Estimation MSE for n=1000, binary design, sparse covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 5.50   | 5.19                           | 4.63                     | 5.29        | 4.56          |                                       |
| CV.min | 5.24   | 4.99                           | 4.60                     | 5.13        | 4.55          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.39   | 5.03                           | 4.76                     | 5.16        |               | $\rho = 0$                            |
| AIC    | 6.62   | 6.76                           | 7.25                     | 5.24        |               | Oracle : 4.33                         |
| BIC    | 6.47   | 5.65                           | 4.98                     | 5.74        |               | Oracle . 4.33                         |
| CV.1se | 4.93   | 4.64                           | 4.09                     | 4.81        | 4.01          |                                       |
| CV.min | 4.70   | 4.46                           | 4.08                     | 4.66        | 4             | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.85   | 4.51                           | 4.20                     | 4.69        |               | $\rho = 0.5$                          |
| AIC    | 5.89   | 6.00                           | 6.43                     | 4.73        |               | <i>Oracle</i> : 3.84                  |
| BIC    | 5.94   | 5.10                           | 4.38                     | 5.31        |               | Oracie : 5.64                         |
| CV.1se | 4.65   | 4.38                           | 3.88                     | 4.59        | 3.81          |                                       |
| CV.min | 4.44   | 4.22                           | 3.88                     | 4.43        | 3.78          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.59   | 4.26                           | 3.97                     | 4.46        |               | $\rho = 0.9$                          |
| AIC    | 5.54   | 5.65                           | 6.05                     | 4.49        |               | Oracle: 3.62                          |
| BIC    | 5.65   | 4.82                           | 4.15                     | 5.08        |               | Oracie: 5.62                          |
| CV.1se | 22.82  | 23.17                          | 26.71                    | 21.08       | 22.03         |                                       |
| CV.min | 20.74  | 21.00                          | 23.69                    | 20.92       | 20.74         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 21.25  | 20.81                          | 23.26                    | 20.86       |               | $\rho = 0$                            |
| AIC    | 27.81  | 28.66                          | 30.26                    | 22.86       |               |                                       |
| BIC    | 31.33  | 30.68                          | 31.31                    | 28.86       |               | <i>Oracle</i> : 17.32                 |
| CV.1se | 20.66  | 20.93                          | 24.44                    | 19.07       | 19.93         |                                       |
| CV.min | 18.64  | 18.82                          | 21.57                    | 18.87       | 18.64         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 19.17  | 18.65                          | 20.58                    | 18.86       |               | $\rho = 0.5$                          |
| AIC    | 24.70  | 25.42                          | 26.82                    | 20.50       |               |                                       |
| BIC    | 27.83  | 27.60                          | 27.86                    | 26.46       |               | <i>Oracle</i> : 15.36                 |
| CV.1se | 19.48  | 19.76                          | 23.30                    | 18.14       | 18.83         |                                       |
| CV.min | 17.62  | 17.78                          | 20.53                    | 17.88       | 17.61         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 18.13  | 17.63                          | 19.45                    | 17.89       |               | $\rho = 0.9$                          |
| AIC    | 23.26  | 23.95                          | 25.28                    | 19.30       |               | ,                                     |
| BIC    | 26.26  | 26.12                          | 26.29                    | 25.22       |               | <i>Oracle</i> : 14.49                 |
| CV.1se | 78.47  | 78.59                          | 78.62                    | 75.90       | 78.53         |                                       |
| CV.min | 76.00  | 78.08                          | 78.62                    | 79.15       | 76.01         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 75.6   | 77.89                          | 81.00                    | 77.21       |               | $\rho = 0$                            |
| AIC    | 114.01 | 118.59                         | 123.13                   | 96.44       |               | ,                                     |
| BIC    | 78.59  | 78.61                          | 78.62                    | 78.42       |               | <i>Oracle</i> : 69.25                 |
| CV.1se | 69.71  | 69.78                          | 69.79                    | 67.79       | 69.75         |                                       |
| CV.min | 68.02  | 69.44                          | 69.81                    | 70.68       | 68.07         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 67.61  | 69.22                          | 72.36                    | 68.97       |               | $\rho = 0.5$                          |
| AIC    | 101.21 | 105.15                         | 109.20                   | 86.21       |               | ,                                     |
| BIC    | 69.77  | 69.78                          | 69.79                    | 69.65       |               | <i>Oracle</i> : 61.43                 |
| CV.1se | 65.81  | 65.86                          | 65.86                    | 64.21       | 65.85         |                                       |
| CV.min | 64.32  | 65.58                          | 65.89                    | 66.75       | 64.36         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 63.9   | 65.37                          | 68.08                    | 65.23       |               | $\rho = 0.9$                          |
| AIC    | 95.28  | 99.04                          | 102.94                   | 80.65       |               |                                       |
| BIC    | 65.85  | 65.85                          | 65.86                    | 65.75       |               | <i>Oracle</i> : 57.96                 |
|        | 05.05  | 05.05                          | 05.00                    | 05.15       |               |                                       |

Table 71: Estimation MSE for n=1000, continuous design, sparse covariates, and decay 10.

|        | lasso | $\operatorname{GL} \gamma = 1$ | <u>'</u> | marginal AL |       |                                       |
|--------|-------|--------------------------------|----------|-------------|-------|---------------------------------------|
| CV.1se | 1.38  | 1.35                           | 1.31     | 1.32        | 1.28  |                                       |
| CV.min | 1.30  | 1.28                           | 1.25     | 1.27        | 1.24  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.30  | 1.28                           | 1.27     | 1.27        |       | $\rho = 0$                            |
| AIC    | 1.68  | 1.69                           | 1.79     | 1.27        |       | Oracle: 1.25                          |
| BIC    | 1.42  | 1.37                           | 1.32     | 1.32        |       | 07 dete : 1:25                        |
| CV.1se | 0.56  | 0.55                           | 0.51     | 0.61        | 0.49  |                                       |
| CV.min | 0.53  | 0.51                           | 0.49     | 0.59        | 0.47  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.53  | 0.52                           | 0.49     | 0.59        |       | $\rho = 0.5$                          |
| AIC    | 0.61  | 0.61                           | 0.63     | 0.59        |       | Oracle : <b>0.47</b>                  |
| BIC    | 0.64  | 0.60                           | 0.54     | 0.61        |       | 07 acic : 0.47                        |
| CV.1se | 0.16  | 0.15                           | 0.14     | 0.17        | 0.14  |                                       |
| CV.min | 0.15  | 0.15                           | 0.14     | 0.17        | 0.13  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.15  | 0.15                           | 0.14     | 0.17        |       | $\rho = 0.9$                          |
| AIC    | 0.15  | 0.14                           | 0.14     | 0.17        |       | Oracle : <b>0.13</b>                  |
| BIC    | 0.20  | 0.19                           | 0.17     | 0.17        |       | 07 acte . <b>0.13</b>                 |
| CV.1se | 5.39  | 5.29                           | 5.15     | 5.00        | 5.10  |                                       |
| CV.min | 5.08  | 5.01                           | 4.95     | 5.13        | 4.94  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.08  | 5.02                           | 5.06     | 5.08        |       | $\rho = 0$                            |
| AIC    | 7.41  | 7.50                           | 8.01     | 5.27        |       | Oma ala . 4 00                        |
| BIC    | 5.42  | 5.32                           | 5.32     | 5.09        |       | Oracle: 4.99                          |
| CV.1se | 2.19  | 2.12                           | 2.01     | 2.08        | 1.94  |                                       |
| CV.min | 2.04  | 1.99                           | 1.92     | 2.07        | 1.88  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 2.04  | 1.99                           | 1.94     | 2.06        |       | $\rho = 0.5$                          |
| AIC    | 2.69  | 2.72                           | 2.89     | 2.07        |       | O 1 1 1                               |
| BIC    | 2.34  | 2.25                           | 2.12     | 2.23        |       | Oracle : <b>1.88</b>                  |
| CV.1se | 0.64  | 0.61                           | 0.56     | 0.54        | 0.54  |                                       |
| CV.min | 0.58  | 0.57                           | 0.54     | 0.52        | 0.53  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.58  | 0.57                           | 0.55     | 0.52        |       | $\rho = 0.9$                          |
| AIC    | 0.61  | 0.61                           | 0.65     | 0.52        |       | 0 1 0.51                              |
| BIC    | 0.69  | 0.68                           | 0.68     | 0.54        |       | Oracle: 0.51                          |
| CV.1se | 20.93 | 20.70                          | 20.50    | 19.70       | 20.35 |                                       |
| CV.min | 19.78 | 19.65                          | 19.69    | 20.92       | 19.64 | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 19.76 | 19.76                          | 20.60    | 20.41       |       | $\rho = 0$                            |
| AIC    | 31.66 | 32.29                          | 34.25    | 24.31       |       | 0 1 10.07                             |
| BIC    | 20.61 | 20.65                          | 21.70    | 19.91       |       | <i>Oracle</i> : 19.97                 |
| CV.1se | 8.31  | 8.18                           | 8.01     | 7.93        | 7.74  |                                       |
| CV.min | 7.82  | 7.71                           | 7.66     | 8.19        | 7.48  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 7.78  | 7.74                           | 7.98     | 8.10        |       | $\rho = 0.5$                          |
| AIC    | 11.66 | 11.85                          | 12.62    | 8.89        |       | , , , , , , , ,                       |
| BIC    | 8.22  | 8.21                           | 8.22     | 8.12        |       | <i>Oracle</i> : 7.53                  |
| CV.1se | 2.18  | 2.17                           | 2.12     | 2.05        | 2.15  |                                       |
| CV.min | 2.09  | 2.09                           | 2.08     | 2.02        | 2.07  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 2.09  | 2.09                           | 2.08     | 2.03        |       | $\rho = 0.9$                          |
| AIC    | 2.66  | 2.74                           | 3.05     | 2.03        |       | ·                                     |
| BIC    | 2.10  | 2.09                           | 2.08     | 2.07        |       | Oracle: 2.04                          |
|        |       |                                |          |             |       |                                       |

Table 72: Estimation MSE for n=1000, continuous design, sparse covariates, and decay 50.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | marginal AL | sparsenet MCP |                                     |
|--------|--------|--------------------------------|------------------------------|-------------|---------------|-------------------------------------|
| CV.1se | 8.47   | 8.27                           | 8.11                         | 8.19        | 7.90          |                                     |
| CV.min | 7.94   | 7.76                           | 7.67                         | 7.92        | 7.61          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 8.15   | 7.88                           | 7.74                         | 7.95        |               | $\rho = 0$                          |
| AIC    | 9.89   | 10.03                          | 10.73                        | 7.94        |               | <i>Oracle</i> : 6.65                |
| BIC    | 10.42  | 9.81                           | 9.31                         | 9.16        |               | 07 acre . 0.03                      |
| CV.1se | 3.20   | 3.09                           | 2.93                         | 3.63        | 2.81          |                                     |
| CV.min | 2.98   | 2.89                           | 2.78                         | 3.38        | 2.71          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 3.18   | 3.01                           | 2.76                         | 3.44        |               | $\rho = 0.5$                        |
| AIC    | 3.35   | 3.38                           | 3.57                         | 3.36        |               | Oracle: 2.28                        |
| BIC    | 6.83   | 4.77                           | 3.50                         | 5.19        |               | 07466 . 2.20                        |
| CV.1se | 0.61   | 0.59                           | 0.55                         | 1.14        | 0.53          |                                     |
| CV.min | 0.57   | 0.55                           | 0.53                         | 1.08        | 0.52          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc   | 0.62   | 0.58                           | 0.53                         | 1.08        |               | $\rho = 0.9$                        |
| AIC    | 0.57   | 0.55                           | 0.54                         | 1.08        |               | Oracle: 0.42                        |
| BIC    | 1.64   | 1.64                           | 1.59                         | 1.21        |               | 07466 . 0.42                        |
| CV.1se | 33.07  | 32.79                          | 33.77                        | 30.55       | 31.94         |                                     |
| CV.min | 30.50  | 30.37                          | 31.59                        | 30.66       | 30.41         | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 30.93  | 30.49                          | 32.44                        | 30.41       |               | $\rho = 0$                          |
| AIC    | 41.93  | 42.89                          | 45.60                        | 33.25       |               | Oracle : 26.59                      |
| BIC    | 40.50  | 39.02                          | 47.09                        | 34.53       |               | Oracie . 20.39                      |
| CV.1se | 13.10  | 12.48                          | 12.58                        | 12.37       | 11.41         |                                     |
| CV.min | 11.51  | 11.24                          | 11.59                        | 11.95       | 10.93         | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 11.92  | 11.46                          | 11.22                        | 12.03       |               | $\rho = 0.5$                        |
| AIC    | 14.26  | 14.50                          | 15.38                        | 12.16       |               | Oracle : 9.11                       |
| BIC    | 16.31  | 16.34                          | 16.49                        | 15.92       |               | 07466. 9.11                         |
| CV.1se | 2.86   | 2.70                           | 2.63                         | 2.46        | 2.21          |                                     |
| CV.min | 2.56   | 2.37                           | 2.38                         | 2.31        | 2.09          | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc   | 2.60   | 2.59                           | 2.53                         | 2.31        |               | $\rho = 0.9$                        |
| AIC    | 2.26   | 2.28                           | 2.48                         | 2.30        |               | Oracle : 1.68                       |
| BIC    | 2.80   | 2.80                           | 2.78                         | 2.75        |               | Oracie . 1.06                       |
| CV.1se | 119.93 | 120.31                         | 120.82                       | 113.86      | 120.03        |                                     |
| CV.min | 113.81 | 115.93                         | 119.70                       | 118.93      | 113.89        | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 113.42 | 116.46                         | 120.93                       | 116.06      |               | $\rho = 0$                          |
| AIC    | 173.78 | 179.27                         | 187.58                       | 144.00      |               | Oracle: 106.35                      |
| BIC    | 120.69 | 120.84                         | 120.92                       | 119.52      |               | Oracie . 100.55                     |
| CV.1se | 41.42  | 41.42                          | 41.42                        | 40.99       | 41.42         |                                     |
| CV.min | 41.07  | 41.14                          | 41.36                        | 42.25       | 41.06         | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 40.82  | 41.28                          | 41.44                        | 41.71       |               | $\rho = 0.5$                        |
| AIC    | 59.16  | 60.69                          | 63.73                        | 49.77       |               | Oracle: 36.43                       |
| BIC    | 41.38  | 41.40                          | 41.42                        | 41.31       |               | 07466.30.43                         |
| CV.1se | 7.60   | 7.59                           | 7.57                         | 7.50        | 7.60          |                                     |
| CV.min | 7.40   | 7.39                           | 7.37                         | 7.40        | 7.36          | $sd(\mu)/\sigma = 0.5$              |
| AICc   | 7.39   | 7.41                           | 7.39                         | 7.42        |               | $\rho = 0.9$                        |
| AIC    | 9.64   | 9.97                           | 11.00                        | 7.50        |               | Oracle : 6.70                       |
| BIC    | 7.43   | 7.44                           | 7.43                         | 7.38        |               | Oracie . 0.70                       |

Table 73: Estimation MSE for n=1000, continuous design, sparse covariates, and decay 100.

|                   | lasso         | $\operatorname{GL} \gamma = 1$ |        | marginal AL | *      |                                       |
|-------------------|---------------|--------------------------------|--------|-------------|--------|---------------------------------------|
| CV.1se            | 15.10         | 14.47                          | 13.52  | 14.64       | 13.24  |                                       |
| CV.min            | 14.30         | 13.80                          | 13.11  | 14.18       | 13.12  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 14.72         | 14.01                          | 13.45  | 14.25       |        | $\rho = 0$                            |
| AIC               | 17.93         | 18.24                          | 19.55  | 14.33       |        | Oracle: 11.82                         |
| BIC               | 18.30         | 16.69                          | 14.97  | 16.28       |        | 07acic . 11.02                        |
| CV.1se            | 5.57          | 5.26                           | 4.71   | 6.67        | 4.41   |                                       |
| CV.min            | 5.32          | 5.06                           | 4.65   | 6.10        | 4.39   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 5.67          | 5.23                           | 4.64   | 6.35        |        | $\rho = 0.5$                          |
| AIC               | 6.07          | 6.12                           | 6.49   | 5.98        |        | Oracle: 4.01                          |
| BIC               | 17.96         | 17.51                          | 5.13   | 16.69       |        | 07 acte . 4.01                        |
| CV.1se            | 1.01          | 0.96                           | 0.86   | 2.24        | 0.82   |                                       |
| CV.min            | 0.97          | 0.92                           | 0.85   | 2.01        | 0.81   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 1.06          | 0.97                           | 0.85   | 2.02        |        | $\rho = 0.9$                          |
| AIC               | 0.96          | 0.93                           | 0.94   | 2.01        |        | Omasla : 0.70                         |
| BIC               | 2.91          | 2.92                           | 2.88   | 2.82        |        | Oracle: 0.70                          |
| CV.1se            | 61.30         | 61.63                          | 67.80  | 56.69       | 59.40  |                                       |
| CV.min            | 56.03         | 56.36                          | 61.20  | 56.45       | 56.05  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 57.25         | 56.51                          | 61.22  | 56.21       |        | $\rho = 0$                            |
| AIC               | 75.47         | 77.53                          | 82.05  | 61.51       |        | ·                                     |
| BIC               | 85.09         | 84.04                          | 85.85  | 71.78       |        | <i>Oracle</i> : 47.30                 |
| CV.1se            | 26.22         | 25.20                          | 28.27  | 23.25       | 23.48  |                                       |
| CV.min            | 21.83         | 21.47                          | 26.06  | 22.17       | 21.11  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 22.98         | 21.55                          | 21.26  | 22.50       |        | $\rho = 0.5$                          |
| AIC               | 25.54         | 26.06                          | 27.54  | 22.37       |        |                                       |
| BIC               | 29.05         | 29.08                          | 29.14  | 28.80       |        | <i>Oracle</i> : 16.04                 |
| CV.1se            | 5.02          | 4.99                           | 4.96   | 4.61        | 4.79   |                                       |
| CV.min            | 4.76          | 4.68                           | 4.79   | 4.25        | 4.36   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 4.74          | 4.81                           | 4.76   | 4.23        |        | $\rho = 0.9$                          |
| AIC               | 3.92          | 3.98                           | 4.36   | 4.11        |        |                                       |
| BIC               | 4.86          | 4.86                           | 4.83   | 4.81        |        | Oracle: 2.80                          |
| CV.1se            | 214.42        | 214.86                         | 215.02 | 206.23      | 214.59 |                                       |
| CV.min            | 206.43        | 212.06                         | 214.78 | 214.96      | 206.33 | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 205.31        | 212.39                         | 215.21 | 209.69      |        | $\rho = 0$                            |
| AIC               | 310.41        | 321.76                         | 335.07 | 261.14      |        | ,                                     |
| BIC               | 214.89        | 215.00                         | 217.26 | 214.16      |        | Oracle: 189.14                        |
| CV.1se            | 72.92         | 72.92                          | 72.92  | 72.56       | 72.92  |                                       |
| CV.min            | 72.61         | 72.80                          | 72.95  | 74.88       | 72.64  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 72.32         | 72.89                          | 72.96  | 73.92       | 72.01  | $\rho = 0.5$                          |
| AIC               | 104.61        | 107.80                         | 112.84 | 89.35       |        |                                       |
| BIC               | 72.91         | 72.92                          | 72.92  | 72.88       |        | <i>Oracle</i> : 64.15                 |
| CV.1se            | 12.72         | 12.72                          | 12.71  | 12.66       | 12.72  |                                       |
| CV.rise<br>CV.min | 12.53         | 12.53                          | 12.53  | 12.57       | 12.72  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 12.55<br>12.5 | 12.58                          | 12.60  | 12.60       | 12.31  | $\rho = 0.9$                          |
| AIC               | 16.60         | 17.27                          | 18.84  | 12.81       |        | ·                                     |
| BIC               | 12.61         | 12.62                          | 12.69  | 12.54       |        | Oracle: 11.20                         |
| DIC               | 12.01         | 12.02                          | 14.09  | 14.34       |        |                                       |

Table 74: Estimation MSE for n=1000, continuous design, sparse covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 22.06  | 20.83                          | 18.60                           | 21.21       | 18.31         |                                       |
| CV.min | 21.02  | 20.04                          | 18.49                           | 20.59       | 18.26         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 21.63  | 20.28                          | 19.18                           | 20.69       |               | $\rho = 0$                            |
| AIC    | 26.52  | 27.07                          | 29.04                           | 21.02       |               | Oracle: 17.37                         |
| BIC    | 26.07  | 23.17                          | 20.23                           | 23.08       |               | 01466.11.31                           |
| CV.1se | 8.07   | 7.45                           | 6.44                            | 9.77        | 6.03          |                                       |
| CV.min | 7.79   | 7.30                           | 6.54                            | 8.91        | 6.04          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 8.27   | 7.47                           | 6.47                            | 9.35        |               | $\rho = 0.5$                          |
| AIC    | 8.98   | 9.08                           | 9.65                            | 8.69        |               | <i>Oracle</i> : 5.87                  |
| BIC    | 26.50  | 25.09                          | 6.71                            | 25.92       |               | 01466.3.61                            |
| CV.1se | 1.44   | 1.33                           | 1.17                            | 3.34        | 1.09          |                                       |
| CV.min | 1.39   | 1.31                           | 1.18                            | 2.88        | 1.10          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 1.51   | 1.35                           | 1.16                            | 2.90        |               | $\rho = 0.9$                          |
| AIC    | 1.39   | 1.34                           | 1.41                            | 2.84        |               | Oracle: 1.01                          |
| BIC    | 4.27   | 4.28                           | 3.44                            | 4.21        |               | Oracie : 1.01                         |
| CV.1se | 91.40  | 92.90                          | 107.18                          | 84.53       | 88.38         |                                       |
| CV.min | 83.20  | 84.26                          | 95.00                           | 83.92       | 83.19         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 85.14  | 84.21                          | 93.73                           | 83.70       |               | $\rho = 0$                            |
| AIC    | 111.39 | 114.82                         | 121.21                          | 91.72       |               | 0 1 (0.47                             |
| BIC    | 125.83 | 125.78                         | 126.15                          | 116.17      |               | Oracle: 69.47                         |
| CV.1se | 40.67  | 40.08                          | 42.55                           | 34.99       | 39.34         |                                       |
| CV.min | 34.02  | 34.26                          | 41.87                           | 33.17       | 33.76         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 35.81  | 32.73                          | 32.27                           | 33.80       |               | $\rho = 0.5$                          |
| AIC    | 37.63  | 38.50                          | 40.63                           | 33.23       |               | 0122.40                               |
| BIC    | 42.62  | 42.64                          | 42.67                           | 42.42       |               | Oracle: 23.49                         |
| CV.1se | 7.28   | 7.27                           | 7.23                            | 6.96        | 7.25          |                                       |
| CV.min | 6.96   | 6.94                           | 6.98                            | 6.41        | 6.89          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.90   | 7.03                           | 7.00                            | 6.35        |               | $\rho = 0.9$                          |
| AIC    | 5.77   | 5.89                           | 6.45                            | 5.97        |               | 01402                                 |
| BIC    | 7.09   | 7.11                           | 7.11                            | 7.01        |               | Oracle: 4.03                          |
| CV.1se | 315.28 | 315.72                         | 315.85                          | 304.89      | 315.47        |                                       |
| CV.min | 305.33 | 313.63                         | 315.86                          | 317.57      | 305.18        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 303.58 | 314.44                         | 315.81                          | 309.81      |               | $\rho = 0$                            |
| AIC    | 456.70 | 475.12                         | 493.35                          | 386.66      |               | Omasla . 277 99                       |
| BIC    | 315.72 | 315.81                         | 351.65                          | 314.97      |               | Oracle : 277.88                       |
| CV.1se | 106.78 | 106.79                         | 106.78                          | 106.40      | 106.79        |                                       |
| CV.min | 106.43 | 106.70                         | 106.84                          | 109.83      | 106.46        | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 106.08 | 106.77                         | 106.79                          | 108.39      |               | $\rho = 0.5$                          |
| AIC    | 153.36 | 158.62                         | 165.71                          | 131.58      |               |                                       |
| BIC    | 106.77 | 106.78                         | 106.79                          | 106.75      |               | <i>Oracle</i> : 93.96                 |
| CV.1se | 18.33  | 18.33                          | 18.32                           | 18.28       | 18.33         |                                       |
| CV.min | 18.14  | 18.15                          | 18.20                           | 18.18       | 18.14         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 18.1   | 18.22                          | 18.29                           | 18.23       |               | $\rho = 0.9$                          |
| AIC    | 24.24  | 25.34                          | 27.45                           | 18.64       |               |                                       |
| BIC    | 18.25  | 18.28                          | 18.32                           | 18.18       |               | <i>Oracle</i> : 16.13                 |
|        |        |                                |                                 |             |               | L                                     |

Table 75: Nonzero coefficients at n=100, binary design, dense covariates, and decay 10.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                     |
|---|--------|--------|--------------------------------|--------------------------|-------------|---------------|-------------------------------------|
| AIC 20.3 15.31 49.62 26.53 $\rho = 0$ AIC 109.15 96.42 74.5 86.93 BIC 107.58 94.95 73.11 80.43 $\rho = 0$ CV.lse 8.49 5.59 1.91 41.74 5.52 $\rho = 0.5$ AIC 110.09 97.3 75.5 88.14 $\rho = 0.5$ AIC 110.09 97.3 75.5 88.14 $\rho = 0.5$ AIC 110.36 95.99 74.14 83.13 $\rho = 0.5$ AIC 108.36 95.99 74.14 83.13 $\rho = 0.5$ CV.min 40.17 22.04 4.69 70.46 26.4 $\rho = 0.5$ AIC 109.97 97.37 75.89 88.06 $\rho = 0.9$ AIC 108.41 95.98 74.52 82.55 $\rho = 0.9$ AIC 108.41 95.98 74.52 82.55 $\rho = 0.9$ AIC 10.38 12.39 52.62 23.34 $\rho = 0.9$ AIC 10.38 12.39 52.62 23.34 $\rho = 0.0$ AIC 112.87 97.64 75.83 93.21 $\rho = 0.0$ AIC 113.35 98.15 76.48 93.57 $\rho = 0.0$ AIC 113.09 98.35 74.6 92.26 $\rho = 0.0$ AIC 113.09 98.35 76.9 93.64 BIC 111.6 96.94 74.91 92.05 $\rho = 0.0$ AIC 113.09 98.35 76.9 93.64 BIC 111.6 96.94 74.91 92.05 $\rho = 0.0$ AIC 115.24 95.81 73.4 96.25 $\rho = 0.0$ AIC 115.25 96.35 74.18 96.43 BIC 114.03 94.19 71.41 95.64 $\rho = 0.0$ AIC 115.25 96.35 74.18 96.43 BIC 114.03 94.19 71.41 95.64 $\rho = 0.0$ Oracle : 14.05 CV.lie 0.29 0.1 0.03 48.6 0.5 $\rho = 0.0$ AIC 115.25 96.35 74.18 96.43 BIC 114.03 94.19 71.41 95.64 $\rho = 0.0$ Oracle : 7.82 AIC 5.61 26.75 54.85 21.48 $\rho = 0.0$ Oracle : 7.82 AIC 5.61 26.75 54.85 21.48 $\rho = 0.0$ Oracle : 7.82 AIC 115.14 96.36 74.23 96.08 $\rho = 0.0$ Oracle : 7.82 AIC 5.84 25.25 54.94 21.38 $\rho = 0.0$ AIC 115.14 96.36 74.23 96.08 $\rho = 0.0$ Oracle : 7.85 AIC 5.84 25.25 54.94 21.38 $\rho = 0.0$ AIC 115.14  |        |        | 6.8                            | 2.15                     | 40.73       | 7.02          |                                     |
| AIC 109.15 96.42 74.5 86.93 $Oracle: 21.25$ BIC 107.58 94.95 73.11 80.43 $Oracle: 21.25$ CV.lse 8.49 5.59 1.91 41.74 5.52 $Oracle: 21.25$ CV.min 41.33 23.91 5.15 72.56 28.29 $oracle: 20.95$ AIC 110.09 97.3 75.5 88.14 BIC 110.09 97.3 75.5 88.14 S1.3 $Oracle: 20.95$ CV.lse 7.83 5.05 1.68 40.55 5.59 $Oracle: 20.95$ AIC 109.97 97.37 75.89 88.06 $Oracle: 20.95$ AIC 109.97 97.37 75.89 88.06 $Oracle: 20.95$ AIC 109.97 97.37 75.89 88.06 $Oracle: 20.95$ AIC 108.41 95.98 74.52 82.55 $Oracle: 20.95$ AIC 108.41 95.98 74.52 82.55 $Oracle: 20.95$ AIC 10.841 95.98 74.52 82.55 $Oracle: 20.95$ AIC 10.38 12.39 52.62 23.34 $oracle: 20.95$ AIC 111.57 95.91 73.99 92.05 $Oracle: 20.95$ Oracle: 14.52 $Oracle: 20.95$ AIC 111.57 95.91 73.99 92.05 $Oracle: 20.95$ AIC 113.35 98.15 76.48 93.57 $oracle: 20.95$ AIC 113.35 98.15 76.48 93.57 $oracle: 20.95$ AIC 113.02 98.35 76.9 93.64 BIC 112.01 96.85 74.6 92.26 $oracle: 20.95$ AIC 113.02 98.35 76.9 93.64 BIC 111.09 98.85 76  | CV.min |        |                                | 5.6                      |             | 34.93         | $\operatorname{sd}(\mu)/\sigma = 2$ |
| BIC 107.58 94.95 73.11 80.43 $Cracte: 21.25$ CV.1se 8.49 5.59 1.91 41.74 5.52 $CV.min$ 41.33 23.91 5.15 72.56 28.29 $sd(\mu)/\sigma = 2$ AICc 18.79 14.63 50.08 26.91 $\rho = 0.5$ AIC 110.09 97.3 75.5 88.14 $\rho = 0.5$ BIC 108.36 95.99 74.14 83.13 $\rho = 0.5$ CV.1se 7.83 5.05 1.68 40.55 5.59 $\rho = 0.9$ AIC 18.22 13.82 49.99 26.66 $\rho = 0.9$ AIC 109.97 97.37 75.89 88.06 $\rho = 0.9$ AIC 10.38 12.39 52.62 23.34 $\rho = 0.0$ AIC 112.87 97.64 75.83 93.21 $\rho = 0.0$ AIC 111.57 95.91 73.99 92.05 $\rho = 0.0$ AIC 112.87 97.64 75.83 93.21 $\rho = 0.0$ AIC 113.35 98.15 76.48 93.57 BIC 112.01 96.85 74.6 92.26 $\rho = 0.0$ AIC 113.35 98.15 76.48 93.57 BIC 112.01 96.85 74.6 92.26 $\rho = 0.0$ AIC 113.30 98.15 76.48 93.57 $\rho = 0.0$ AIC 113.02 98.35 76.9 93.64 $\rho = 0.0$ AIC 115.24 95.81 73.4 96.25 $\rho = 0.0$ AIC 115.25 96.35 74.8 96.25 $\rho = 0.0$ AIC 115.25 96.35 74.18 96.43 BIC 114.03 94.19 71.41 95.64 $\rho = 0.0$ AIC 115.25 96.35 74.18 96.43 BIC 114.03 94.19 71.41 95.64 $\rho = 0.0$ AIC 115.25 96.35 74.18 96.43 BIC 113.81 94.91 72.11 95.78 $\rho = 0.5$ AIC 15.25 96.35 74.18 96.43 BIC 113.81 94.91 72.11 95.78 $\rho = 0.5$ AIC 15.24 95.81 74.18 96.43 $\rho = 0.0$ AIC 115.14 96.36 74.23 96.08 $\rho = 0.0$ AIC 115.14 96.36 74.23 96.08 $\rho = 0.0$   |        |        |                                |                          |             |               | $\rho = 0$                          |
| Signature   Si  |        | 109.15 |                                |                          |             |               | Oracle : 21 25                      |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    |        |                                |                          | 80.43       |               | Oracic . 21.23                      |
| AICc 18.79 14.63 50.08 26.91 $\rho = 0.5$ AIC 110.09 97.3 75.5 88.14 $\rho = 0.5$ Dracle : 20.95 $\rho = 0.9$ Dracle : 20.95 $\rho = 0.9$ Dracle : 20.97 Dra  |        | 8.49   | 5.59                           | 1.91                     | 41.74       | 5.52          |                                     |
| AIC 110.09 97.3 75.5 88.14 $Oracle: 20.95$ BIC 108.36 95.99 74.14 83.13 $Oracle: 20.95$ CV.lse 7.83 5.05 1.68 40.55 5.59 $Olderightarrow$ AlC 17 22.04 4.69 70.46 26.4 $olderightarrow$ AIC 109.97 97.37 75.89 88.06 BIC 108.41 95.98 74.52 82.55 $Olderightarrow$ CV.lse 1.81 0.77 0.25 45.13 1.53 $Olderightarrow$ CV.lse 1.81 0.77 0.25 45.13 1.53 $olderightarrow$ CV.lse 1.81 0.77 0.25 45.13 1.53 $olderightarrow$ AIC 112.87 97.64 75.83 93.21 $olderightarrow$ AIC 112.87 97.64 75.83 93.21 $olderightarrow$ AIC 111.57 95.91 73.99 92.05 $olderightarrow$ AIC 113.35 98.15 76.48 93.57 $olderightarrow$ AIC 113.35 98.15 76.48 93.57 $olderightarrow$ AIC 113.35 98.15 76.48 93.57 $olderightarrow$ AIC 113.02 98.35 76.9 93.64 $olderightarrow$ AIC 115.24 95.81 73.4 96.25 $olderightarrow$ AIC 115.24 95.81 73.4 96.25 $olderightarrow$ AIC 115.24 95.81 73.4 96.25 $olderightarrow$ AIC 115.25 96.35 74.18 96.45 $olderightarrow$ AIC 115.26 96.35 74.18 96.45 $olderightarrow$ AIC 115  | CV.min |        |                                |                          |             | 28.29         | $\operatorname{sd}(\mu)/\sigma = 2$ |
| BIC         108.36         95.99         74.14         83.13         Oracle: 20.95           CV.Ise         7.83         5.05         1.68         40.55         5.59           CV.min         40.17         22.04         4.69         70.46         26.4         sd(μ)/σ = 2           AIC         18.22         13.82         49.99         26.66 $\rho = 0.9$ AIC         109.97         97.37         75.89         88.06 $\rho = 0.9$ BIC         108.41         95.98         74.52         82.55         Oracle: 20.71           CV.Ise         1.81         0.77         0.25         45.13         1.53           CV.min         19.6         6.41         1.06         78.51         17.37         sd(μ)/σ = 1           AIC         112.87         97.64         75.83         93.21         Oracle: 14.52           CV.Ise         1.2         0.53         0.23         47.02         1.04           CV.Ise         1.2         0.53         0.23         47.02         1.04           CV.min         16.82         5.74         0.95         79.98         14.55         sd(μ)/σ = 0.5           AIC         113.35  |        |        |                                |                          |             |               | $\rho = 0.5$                        |
| BIC         108.36         95.99         /4.14         83.13           CV.Isie         7.83         5.05         1.68         40.55         5.59           CV.min         40.17         22.04         4.69         70.46         26.4         sd( $\mu$ )/ $\sigma$ = 2           AICc         18.22         13.82         49.99         26.66 $\rho$ = 0.9           AIC         109.97         97.37         75.89         88.06         Oracle : 20.71           CV.Isie         1.81         0.77         0.25         45.13         1.53           CV.min         19.6         6.41         1.06         78.51         17.37         sd( $\mu$ )/ $\sigma$ = 1           AIC         10.38         12.39         52.62         23.34 $\rho$ = 0           AIC         112.87         97.64         75.83         93.21         Oracle : 14.52           CV.lise         1.2         0.53         0.23         47.02         1.04           CV.min         16.82         5.74         0.95         79.98         14.55         sd( $\mu$ )/ $\sigma$ = 1           AIC         113.35         98.15         76.48         93.57         Oracle : 14.39           CV.lise         1.36 <td< td=""><td>AIC</td><td>110.09</td><td>97.3</td><td>75.5</td><td>88.14</td><td></td><td>Oracle : 20.05</td></td<>  | AIC    | 110.09 | 97.3                           | 75.5                     | 88.14       |               | Oracle : 20.05                      |
| $\begin{array}{c} \text{CV.min} & 40.17 & 22.04 & 4.69 & 70.46 & 26.4 & \mathrm{sd}(\mu)/\sigma = 2\\ \text{AICc} & 18.22 & 13.82 & 49.99 & 26.66 & \rho = 0.9\\ \text{AIC} & 109.97 & 97.37 & 75.89 & 88.06 & Oracle : 20.71\\ \text{BIC} & 108.41 & 95.98 & 74.52 & 82.55 & Oracle : 20.71\\ \hline \text{CV.lse} & 1.81 & 0.77 & 0.25 & 45.13 & 1.53\\ \text{CV.min} & 19.6 & 6.41 & 1.06 & 78.51 & 17.37 & \mathrm{sd}(\mu)/\sigma = 1\\ \text{AICc} & 10.38 & 12.39 & 52.62 & 23.34 & \rho = 0\\ \text{AIC} & 112.87 & 97.64 & 75.83 & 93.21\\ \text{BIC} & 111.57 & 95.91 & 73.99 & 92.05\\ \hline \text{CV.lise} & 1.2 & 0.53 & 0.23 & 47.02 & 1.04\\ \text{CV.min} & 16.82 & 5.74 & 0.95 & 79.98 & 14.55 & \mathrm{sd}(\mu)/\sigma = 1\\ \text{AICc} & 10.03 & 10.77 & 52.56 & 23.15 & \rho = 0.5\\ \text{AIC} & 113.35 & 98.15 & 76.48 & 93.57\\ \text{BIC} & 112.01 & 96.85 & 74.6 & 92.26\\ \hline \text{CV.lise} & 1.36 & 0.77 & 0.26 & 44.47 & 1.26\\ \text{CV.min} & 16.81 & 6.04 & 1.02 & 77.34 & 14.41 & \mathrm{sd}(\mu)/\sigma = 1\\ \text{AICc} & 9.84 & 9.51 & 51.91 & 23.51 & \rho = 0.9\\ \text{AIC} & 113.02 & 98.35 & 76.9 & 93.64\\ \text{BIC} & 111.6 & 96.94 & 74.91 & 92.05\\ \hline \text{CV.lise} & 0.27 & 0.05 & 0.02 & 48.27 & 0.55\\ \text{AIC} & 115.24 & 95.81 & 73.4 & 96.25\\ \text{BIC} & 114.03 & 94.19 & 71.41 & 95.64\\ \hline \text{CV.lise} & 0.29 & 0.1 & 0.03 & 48.6\\ \text{CV.lis} & 0.29 & 0.1 & 0.03 & 48.6\\ \text{CV.lis} & 0.29 & 0.1 & 0.03 & 48.6\\ \text{CV.lis} & 0.38 & 0.1 & 0.04 & 46.61\\ $ |        |        |                                |                          |             |               | Oracic . 20.73                      |
| AICc 18.22 13.82 49.99 26.66 $\rho = 0.9$ AIC 109.97 97.37 75.89 88.06 $\rho = 0.9$ BIC 108.41 95.98 74.52 82.55 $\rho = 0.9$ AIC 108.41 95.98 74.52 82.55 $\rho = 0.9$ AIC 1.81 0.77 0.25 45.13 1.53 $\rho = 0.9$ AIC 1.81 0.77 0.25 45.13 1.53 $\rho = 0.9$ AIC 1.82 1.83 12.39 52.62 23.34 $\rho = 0.9$ AIC 1.12.87 97.64 75.83 93.21 $\rho = 0.9$ AIC 1.12.87 97.64 75.83 93.21 $\rho = 0.9$ AIC 1.12.87 95.91 73.99 92.05 $\rho = 0.9$ AIC 1.20 0.53 0.23 47.02 1.04 $\rho = 0.9$ AIC 1.21 0.25 5.74 0.95 79.98 14.55 $\rho = 0.5$ AIC 1.21 0.33 10.77 52.56 23.15 $\rho = 0.5$ AIC 1.335 98.15 76.48 93.57 $\rho = 0.5$ AIC 1.335 98.15 76.48 93.57 $\rho = 0.5$ AIC 1.36 0.77 0.26 44.47 1.26 $\rho = 0.5$ AIC 1.30 96.85 74.6 92.26 $\rho = 0.9$ AIC 1.30 98.35 76.9 93.64 $\rho = 0.9$ AIC 1.30 94.19 74.91 92.05 $\rho = 0.9$ AIC 1.524 95.81 73.4 96.25 $\rho = 0.9$ AIC 1.525 96.35 74.18 96.43 $\rho = 0.5$ AIC 5.61 26.75 54.85 21.48 $\rho = 0.5$ AIC 5.61 26.75 54.85 21.48 $\rho = 0.5$ AIC 1.525 96.35 74.18 96.43 $\rho = 0.5$ AIC 1.526 5.84 25.25 55.49 21.38 $\rho = 0.9$ AIC 1.51.14 96.36 74.23 96.08 $\rho = 0.9$ AIC 1.51.14 96.36 74.23 96.08 $\rho = 0.9$ AIC 1.51.14 96.36 74.23 96.08   | CV.1se | 7.83   | 5.05                           | 1.68                     | 40.55       | 5.59          |                                     |
| AIC 109.97 97.37 75.89 88.06 BIC 108.41 95.98 74.52 82.55 $Oracle: 20.71$ CV.1se 1.81 0.77 0.25 45.13 1.53 $Oracle: 20.71$ AIC 10.38 12.39 52.62 23.34 $\rho=0$ 0.38 12.39 52.62 23.34 $\rho=0$ 0.38 BIC 111.57 95.91 73.99 92.05 $Oracle: 14.52$ CV.1se 1.2 0.53 0.23 47.02 1.04 $Oracle: 10.03$ 10.77 52.56 23.15 $Oracle: 14.52$ AIC 113.35 98.15 76.48 93.57 $Oracle: 14.39$ CV.1se 1.36 0.77 0.26 44.47 1.26 $Oracle: 14.39$ CV.1se 1.36 0.77 0.26 44.47 1.26 $Oracle: 14.39$ CV.1se 1.36 0.77 0.26 44.47 1.26 $Oracle: 14.39$ CV.1se 1.30 98.35 76.9 93.64 $Oracle: 14.05$ BIC 111.6 96.94 74.91 92.05 $Oracle: 14.05$ CV.1se 0.27 0.05 0.02 48.27 0.55 $Oracle: 14.05$ CV.1se 0.27 0.05 0.02 48.27 0.55 $Oracle: 14.05$ CV.1se 0.27 0.05 0.02 48.27 0.55 $Oracle: 14.05$ CV.1se 0.29 0.1 0.03 48.6 0.5 $Oracle: 1.20$ Oracle: 7.82 BIC 115.24 95.81 73.4 96.25 $Oracle: 1.20$ Oracle: 7.82 BIC 115.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.24 95.81 73.4 96.25 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.25 96.35 74.18 96.43 $Oracle: 1.20$ Oracle: 7.96 AIC 15.24 95.81 72.11 95.78 $Oracle: 1.20$ Oracle: 7.96 AIC 15.14 96.36 74.23 96.08   | CV.min | 40.17  | 22.04                          | 4.69                     | 70.46       | 26.4          | $\operatorname{sd}(\mu)/\sigma = 2$ |
| BIC 108.41 95.98 74.52 82.55 $Oracle: 20.71$ CV.1se 1.81 0.77 0.25 45.13 1.53 $(\nabla V.)$ sin 19.6 6.41 1.06 78.51 17.37 $(\nabla V.)$ sin 19.6 78.51 17.37 $(\nabla V.)$ sin 19.6 112.87 97.64 75.83 93.21 $(\nabla V.)$ sin 112.87 97.64 75.83 93.21 $(\nabla V.)$ sin 11.57 95.91 73.99 92.05 $(\nabla V.)$ sin 16.82 5.74 0.95 79.98 14.55 $(\nabla V.)$ sin 16.81 98.15 76.48 93.57 $(\nabla V.)$ sin 16.81 6.04 1.02 77.34 14.41 $(\nabla V.)$ sin 16.81 6.04 74.91 92.05 $(\nabla V.)$ sin 11.6 96.94 74.91 92.05 $(\nabla V.)$ sin 7.44 1.22 0.23 81.9 7.52 $(\nabla V.)$ sin 7.44 1.25 0.23 81.9 7.52 $(\nabla V.)$ sin 7.44 1.27 0.05 0.00 48.27 0.55 $(\nabla V.)$ sin 7.44 1.27 0.03 48.6 0.5 $(\nabla V.)$ sin 7.44 1.29 0.23 81.9 7.52 $(\nabla V.)$ sin 7.44 1.29 0.23 81.9 7.52 $(\nabla V.)$ sin 7.44 1.25 0.23 81.9 7.52 $(\nabla V.)$ sin 7.44 1.27 0.28 81.9 7.52 $(\nabla V.)$ sin 7.44 1.29 0.23 81.9 7.52 $(\nabla V.)$ sin 7.44 1.29 0.25 83.11 73.4 96.25 $(\nabla V.)$ sin 7.44 1.95 83 $(\nabla V.)$ sin 7.54 95.81 73.4 96.25 $(\nabla V.)$ sin 7.52 $(\nabla V.)$ sin 7.54 1.74 95.64 $(\nabla V.)$ sin 7.55 $(\nabla V.)$ sin 7.59 1.24 0.25 80.87 7.52 $(\nabla V.)$ sin 7.57 $(\nabla V.)$ sin 7.59 1.24 0.25 80.87 7.52 $(\nabla V.)$ sin 7.57 $(\nabla V.)$ sin 7.59 1.24 0.25 80.87 7.52 $(\nabla V.)$ sin 7.57 $(\nabla V.)$ sin 7.59 1.24 0.25 80.87 7.52 $(\nabla V.)$ sin 7.57 $(\nabla V.)$                                 | AICc   | 18.22  | 13.82                          | 49.99                    | 26.66       |               | $\rho = 0.9$                        |
| BIC         108.41         95.98 $/4.52$ 82.55           CV.Ise         1.81         0.77         0.25         45.13         1.53           CV.min         19.6         6.41         1.06         78.51         17.37 $sd(\mu)/\sigma = 1$ AIC         10.38         12.39         52.62         23.34 $\rho = 0$ AIC         112.87         97.64         75.83         93.21         Oracle : 14.52           EV.1se         1.2         0.53         0.23         47.02         1.04           CV.min         16.82         5.74         0.95         79.98         14.55 $sd(\mu)/\sigma = 1$ AIC         113.35         98.15         76.48         93.57         Oracle : 14.39           CV.Ise         1.36         0.77         0.26         44.47         1.26         Oracle : 14.39           CV.Ise         1.36         0.77         0.26         44.47         1.26         Oracle : 14.39           CV.min         16.81         6.04         1.02         77.34         14.41 $sd(\mu)/\sigma = 1$ AIC         113.02         98.35         76.9         93.64         Oracle : 14.05  | AIC    | 109.97 | 97.37                          | 75.89                    | 88.06       |               | Oracle : 20.71                      |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 108.41 | 95.98                          | 74.52                    | 82.55       |               | Oracle . 20.71                      |
| AICc 10.38 12.39 52.62 23.34 $\rho = 0$ AIC 112.87 97.64 75.83 93.21 BIC 111.57 95.91 73.99 92.05  CV.1se 1.2 0.53 0.23 47.02 1.04  CV.min 16.82 5.74 0.95 79.98 14.55 $sd(\mu)/\sigma = 1$ AICc 10.03 10.77 52.56 23.15 $\rho = 0.5$ AIC 113.35 98.15 76.48 93.57  BIC 112.01 96.85 74.6 92.26  CV.1se 1.36 0.77 0.26 44.47 1.26  CV.min 16.81 6.04 1.02 77.34 14.41 $sd(\mu)/\sigma = 1$ AICc 9.84 9.51 51.91 23.51 $\rho = 0.9$ AIC 113.02 98.35 76.9 93.64 BIC 111.1.6 96.94 74.91 92.05  CV.1se 0.27 0.05 0.02 48.27 0.55  CV.min 7.44 1.22 0.23 81.9 7.52 $sd(\mu)/\sigma = 0.5$ AIC 115.24 95.81 73.4 96.25 BIC 114.03 94.19 71.41 95.64  CV.1se 0.29 0.1 0.03 48.6 0.5  CV.1se 0.29 0.1 0.04 46.61 0.51  CV.1se 0.38 0.1 0.04 46.61 0.51  CV.1se 0.584 25.25 55.49 21.38  AIC 115.14 96.36 74.23 96.08  | CV.1se | 1.81   | 0.77                           | 0.25                     | 45.13       | 1.53          |                                     |
| AICc 10.38 12.39 52.62 23.34 $\rho = 0$ AIC 112.87 97.64 75.83 93.21 BIC 111.57 95.91 73.99 92.05  CV.1se 1.2 0.53 0.23 47.02 1.04  CV.min 16.82 5.74 0.95 79.98 14.55 $sd(\mu)/\sigma = 1$ AICc 10.03 10.77 52.56 23.15 $\rho = 0.5$ AIC 113.35 98.15 76.48 93.57  BIC 112.01 96.85 74.6 92.26  CV.1se 1.36 0.77 0.26 44.47 1.26  CV.min 16.81 6.04 1.02 77.34 14.41 $sd(\mu)/\sigma = 1$ AICc 9.84 9.51 51.91 23.51 $\rho = 0.9$ AIC 113.02 98.35 76.9 93.64 BIC 111.1.6 96.94 74.91 92.05  CV.1se 0.27 0.05 0.02 48.27 0.55  CV.min 7.44 1.22 0.23 81.9 7.52 $sd(\mu)/\sigma = 0.5$ AIC 115.24 95.81 73.4 96.25 BIC 114.03 94.19 71.41 95.64  CV.1se 0.29 0.1 0.03 48.6 0.5  CV.1se 0.29 0.1 0.04 46.61 0.51  CV.1se 0.38 0.1 0.04 46.61 0.51  CV.1se 0.584 25.25 55.49 21.38  AIC 15.14 96.36 74.23 96.08  | CV.min | 19.6   | 6.41                           | 1.06                     | 78.51       | 17.37         | $sd(\mu)/\sigma = 1$                |
| BIC 111.57 95.91 73.99 92.05 $CV.1se$ 1.2 0.53 0.23 47.02 1.04 $CV.min$ 16.82 5.74 0.95 79.98 14.55 $sd(\mu)/\sigma = 1$ AICc 10.03 10.77 52.56 23.15 $\rho = 0.5$ AIC 113.35 98.15 76.48 93.57 $CV.1se$ 1.36 0.77 0.26 44.47 1.26 $CV.min$ 16.81 6.04 1.02 77.34 14.41 $sd(\mu)/\sigma = 1$ AICc 113.02 98.35 76.9 93.64 $CV.1se$ 1.16 96.94 74.91 92.05 $CV.1se$ 0.27 0.05 0.02 48.27 0.55 $CV.1se$ 0.28 95.81 73.4 96.25 $CV.1se$ 0.29 0.1 0.03 48.6 0.5 $CV.1se$ 0.29 0.1 0.04 46.61 0.51 $CV.1se$ 0.38 0.1 0.04 0.25 80.87 7.52 $CV.1se$ 0.38 0.1 0.04 0.25 80.87 7.52 $CV.1se$ 0.38 0.1 0.04 0.25 80.87 7.52 $CV.1se$ 0.38 0.1 0.10 0.04 0.   | AICc   | 10.38  | 12.39                          | 52.62                    | 23.34       |               |                                     |
| BIC         111.57         95.91         73.99         92.05           CV.Ise         1.2         0.53         0.23         47.02         1.04           CV.min         16.82         5.74         0.95         79.98         14.55 $sd(\mu)/\sigma = 1$ AIC         110.03         10.77         52.56         23.15 $\rho = 0.5$ AIC         113.35         98.15         76.48         93.57         Oracle: 14.39           CV.Ise         1.36         0.77         0.26         44.47         1.26           CV.min         16.81         6.04         1.02         77.34         14.41 $sd(\mu)/\sigma = 1$ AICe         9.84         9.51         51.91         23.51 $\rho = 0.9$ AIC         113.02         98.35         76.9         93.64         Oracle: 14.05           BIC         111.6         96.94         74.91         92.05         Oracle: 14.05           CV.Ise         0.27         0.05         0.02         48.27         0.55           CV.min         7.44         1.22         0.23         81.9         7.52 $sd(\mu)/\sigma = 0.5$ AICe         5.64         30.06  | AIC    | 112.87 | 97.64                          | 75.83                    | 93.21       |               | 0114.52                             |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 111.57 | 95.91                          | 73.99                    | 92.05       |               | Oracie: 14.52                       |
| AICc 10.03 10.77 52.56 23.15 $\rho = 0.5$ AIC 113.35 98.15 76.48 93.57 $\rho = 0.5$ Oracle : 14.39 $\rho = 0.5$ Dracle : 14.41 $\rho = 0.5$ Dracle : 14.41 $\rho = 0.5$ Dracle : 14.41 $\rho = 0.5$ Dracle : 14.45 $\rho = 0.5$ Dracle : 14.45 $\rho = 0.5$ Dracle : 14.05 Dracle : 14.05 $\rho = 0.5$ Dracle : 14.05 D   | CV.1se | 1.2    | 0.53                           | 0.23                     | 47.02       | 1.04          |                                     |
| AIC 113.35 98.15 76.48 93.57 $Oracle: 14.39$  | CV.min | 16.82  | 5.74                           | 0.95                     | 79.98       | 14.55         | $\operatorname{sd}(\mu)/\sigma = 1$ |
| BIC 112.01 96.85 74.6 92.26 $Oracle: 14.39$ CV.1se 1.36 0.77 0.26 44.47 1.26 CV.min 16.81 6.04 1.02 77.34 14.41 $sd(\mu)/\sigma = 1$ AICc 9.84 9.51 51.91 23.51 $\rho = 0.9$ AIC 113.02 98.35 76.9 93.64 BIC 111.6 96.94 74.91 92.05 $Oracle: 14.05$ CV.1se 0.27 0.05 0.02 48.27 0.55 $O.02 = 0.05$ AICc 5.64 30.06 55.3 20.57 $O.02 = 0.05$ AIC 115.24 95.81 73.4 96.25 $O.02 = 0.05$ AIC 114.03 94.19 71.41 95.64 $O.02 = 0.02$ CV.1se 0.29 0.1 0.03 48.6 0.5 $O.02 = 0.02$ CV.min 7.52 1.27 0.26 83.11 7.38 $o.02 = 0.02$ AIC 115.25 96.35 74.18 96.43 $o.02 = 0.02$ AIC 115.25 96.35 74.18 96.43 $o.02 = 0.02$ AIC 113.81 94.91 72.11 95.78 $O.02 = 0.02$ AIC 113.81 94.91 72.11 95.78 $O.02 = 0.02$ AIC 113.81 94.91 72.11 95.78 $O.02 = 0.02$ AIC 115.14 96.36 74.23 96.08 $O.02 = 0.02$ AIC 115.14 96.36 74.23 96.08   | AICc   | 10.03  | 10.77                          | 52.56                    | 23.15       |               | $\rho = 0.5$                        |
| BIC         112.01         96.85         74.6         92.26           CV.1se         1.36         0.77         0.26         44.47         1.26           CV.min         16.81         6.04         1.02         77.34         14.41 $sd(\mu)/\sigma = 1$ AICc         9.84         9.51         51.91         23.51 $\rho = 0.9$ AIC         113.02         98.35         76.9         93.64         Oracle: 14.05           BIC         111.6         96.94         74.91         92.05         Oracle: 14.05           CV.1se         0.27         0.05         0.02         48.27         0.55           CV.min         7.44         1.22         0.23         81.9         7.52 $sd(\mu)/\sigma = 0.5$ AIC         115.24         95.81         73.4         96.25         Oracle: 7.82           BIC         114.03         94.19         71.41         95.64         O.5           CV.1se         0.29         0.1         0.03         48.6         0.5           CV.min         7.52         1.27         0.26         83.11         7.38 $sd(\mu)/\sigma = 0.5$ AIC         115.25         96.35         74  | AIC    | 113.35 | 98.15                          | 76.48                    | 93.57       |               | Oma ala . 14 20                     |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 112.01 | 96.85                          | 74.6                     | 92.26       |               | Oracie: 14.39                       |
| AICc 9.84 9.51 51.91 23.51 $\rho = 0.9$ AIC 113.02 98.35 76.9 93.64 BIC 111.6 96.94 74.91 92.05 $\rho = 0.9$ CV.1se 0.27 0.05 0.02 48.27 0.55 $\rho = 0.5$ AICc 5.64 30.06 55.3 20.57 $\rho = 0$ AIC 115.24 95.81 73.4 96.25 BIC 114.03 94.19 71.41 95.64 $\rho = 0.5$ CV.min 7.52 1.27 0.26 83.11 7.38 $\rho = 0.5$ AICc 5.61 26.75 54.85 21.48 $\rho = 0.5$ AIC 115.25 96.35 74.18 96.43 BIC 113.81 94.91 72.11 95.78 $\rho = 0.5$ CV.1se 0.38 0.1 0.04 46.61 0.51 $\rho = 0.5$ AICc 5.84 25.25 55.49 21.38 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08   | CV.1se | 1.36   | 0.77                           | 0.26                     | 44.47       | 1.26          |                                     |
| AICc 9.84 9.51 51.91 23.51 $\rho = 0.9$ AIC 113.02 98.35 76.9 93.64 BIC 111.6 96.94 74.91 92.05 $\rho = 0.9$ CV.1se 0.27 0.05 0.02 48.27 0.55 $\rho = 0.5$ AICc 5.64 30.06 55.3 20.57 $\rho = 0$ AIC 115.24 95.81 73.4 96.25 BIC 114.03 94.19 71.41 95.64 $\rho = 0.5$ CV.min 7.52 1.27 0.26 83.11 7.38 $\rho = 0.5$ AICc 5.61 26.75 54.85 21.48 $\rho = 0.5$ AIC 115.25 96.35 74.18 96.43 BIC 113.81 94.91 72.11 95.78 $\rho = 0.5$ CV.1se 0.38 0.1 0.04 46.61 0.51 $\rho = 0.5$ AICc 5.84 25.25 55.49 21.38 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08   | CV.min | 16.81  | 6.04                           | 1.02                     | 77.34       | 14.41         | $sd(\mu)/\sigma = 1$                |
| BIC         111.6         96.94         74.91         92.05         Oracle: 14.05           CV.1se         0.27         0.05         0.02         48.27         0.55           CV.min         7.44         1.22         0.23         81.9         7.52 $sd(\mu)/\sigma = 0.5$ AICc         5.64         30.06         55.3         20.57 $\rho = 0$ AIC         115.24         95.81         73.4         96.25           BIC         114.03         94.19         71.41         95.64           CV.1se         0.29         0.1         0.03         48.6         0.5           CV.min         7.52         1.27         0.26         83.11         7.38 $sd(\mu)/\sigma = 0.5$ AIC         5.61         26.75         54.85         21.48 $\rho = 0.5$ AIC         115.25         96.35         74.18         96.43 $\rho = 0.5$ BIC         113.81         94.91         72.11         95.78 $\rho = 0.5$ CV.ise         0.38         0.1         0.04         46.61         0.51           CV.min         7.59         1.24         0.25         80.87         7.52   | AICc   | 9.84   | 9.51                           | 51.91                    | 23.51       |               | $\rho = 0.9$                        |
| BIC         111.6         96.94         74.91         92.05           CV.1se         0.27         0.05         0.02         48.27         0.55           CV.min         7.44         1.22         0.23         81.9         7.52 $sd(\mu)/\sigma = 0.5$ AICc         5.64         30.06         55.3         20.57 $\rho = 0$ AIC         115.24         95.81         73.4         96.25           BIC         114.03         94.19         71.41         95.64           CV.1se         0.29         0.1         0.03         48.6         0.5           CV.min         7.52         1.27         0.26         83.11         7.38 $sd(\mu)/\sigma = 0.5$ AICc         5.61         26.75         54.85         21.48 $\rho = 0.5$ AIC         115.25         96.35         74.18         96.43           BIC         113.81         94.91         72.11         95.78           CV.1se         0.38         0.1         0.04         46.61         0.51           CV.min         7.59         1.24         0.25         80.87         7.52 $sd(\mu)/\sigma = 0.5$ AIC         5.84<   | AIC    | 113.02 | 98.35                          | 76.9                     | 93.64       |               | Oma ala . 14 05                     |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 111.6  | 96.94                          | 74.91                    | 92.05       |               | Oracie: 14.03                       |
| AICc 5.64 30.06 55.3 20.57 $\rho = 0$ AIC 115.24 95.81 73.4 96.25 BIC 114.03 94.19 71.41 95.64  CV.1se 0.29 0.1 0.03 48.6 0.5 CV.min 7.52 1.27 0.26 83.11 7.38 $sd(\mu)/\sigma = 0.5$ AICc 5.61 26.75 54.85 21.48 $\rho = 0.5$ AIC 115.25 96.35 74.18 96.43 BIC 113.81 94.91 72.11 95.78  CV.1se 0.38 0.1 0.04 46.61 0.51 CV.min 7.59 1.24 0.25 80.87 7.52 $sd(\mu)/\sigma = 0.5$ AICc 5.84 25.25 55.49 21.38 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08   | CV.1se | 0.27   | 0.05                           | 0.02                     | 48.27       | 0.55          |                                     |
| AIC 115.24 95.81 73.4 96.25 $Oracle: 7.82$ BIC 114.03 94.19 71.41 95.64 $Oracle: 7.82$ CV.1se 0.29 0.1 0.03 48.6 0.5 CV.min 7.52 1.27 0.26 83.11 7.38 $sd(\mu)/\sigma = 0.5$ AICc 5.61 26.75 54.85 21.48 $\rho = 0.5$ AIC 115.25 96.35 74.18 96.43 $Oracle: 7.96$ BIC 113.81 94.91 72.11 95.78 $Oracle: 7.96$ CV.1se 0.38 0.1 0.04 46.61 0.51 $Oracle: 7.96$ CV.min 7.59 1.24 0.25 80.87 7.52 $sd(\mu)/\sigma = 0.5$ AICc 5.84 25.25 55.49 21.38 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08  | CV.min | 7.44   | 1.22                           | 0.23                     | 81.9        | 7.52          | $sd(\mu)/\sigma = 0.5$              |
| BIC         114.03         94.19         71.41         95.64         Oracle: 7.82           CV.1se         0.29         0.1         0.03         48.6         0.5           CV.min         7.52         1.27         0.26         83.11         7.38 $sd(\mu)/\sigma = 0.5$ AICc         5.61         26.75         54.85         21.48 $\rho = 0.5$ AIC         115.25         96.35         74.18         96.43         Oracle: 7.96           BIC         113.81         94.91         72.11         95.78         Oracle: 7.96           CV.1se         0.38         0.1         0.04         46.61         0.51           CV.min         7.59         1.24         0.25         80.87         7.52 $sd(\mu)/\sigma = 0.5$ AICc         5.84         25.25         55.49         21.38 $\rho = 0.9$ AIC         115.14         96.36         74.23         96.08  | AICc   | 5.64   | 30.06                          | 55.3                     | 20.57       |               | $\rho = 0$                          |
| BIC       114.03       94.19       71.41       95.64         CV.1se       0.29       0.1       0.03       48.6       0.5         CV.min       7.52       1.27       0.26       83.11       7.38 $sd(\mu)/\sigma = 0.5$ AICc       5.61       26.75       54.85       21.48 $\rho = 0.5$ AIC       115.25       96.35       74.18       96.43         BIC       113.81       94.91       72.11       95.78         CV.1se       0.38       0.1       0.04       46.61       0.51         CV.min       7.59       1.24       0.25       80.87       7.52 $sd(\mu)/\sigma = 0.5$ AICc       5.84       25.25       55.49       21.38 $\rho = 0.9$ AIC       115.14       96.36       74.23       96.08   | AIC    | 115.24 | 95.81                          | 73.4                     | 96.25       |               | Ongolo . 7.92                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 114.03 | 94.19                          | 71.41                    | 95.64       |               | Oracie: 1.82                        |
| AICc 5.61 26.75 54.85 21.48 $\rho = 0.5$ AIC 115.25 96.35 74.18 96.43 $\rho = 0.5$ BIC 113.81 94.91 72.11 95.78 $\rho = 0.5$ CV.1se 0.38 0.1 0.04 46.61 0.51 CV.min 7.59 1.24 0.25 80.87 7.52 $\rho = 0.5$ AICc 5.84 25.25 55.49 21.38 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08  | CV.1se | 0.29   | 0.1                            | 0.03                     | 48.6        | 0.5           |                                     |
| AIC       115.25       96.35       74.18       96.43         BIC       113.81       94.91       72.11       95.78         CV.1se       0.38       0.1       0.04       46.61       0.51         CV.min       7.59       1.24       0.25       80.87       7.52 $sd(\mu)/\sigma = 0.5$ AICc       5.84       25.25       55.49       21.38 $\rho = 0.9$ AIC       115.14       96.36       74.23       96.08   | CV.min | 7.52   | 1.27                           | 0.26                     | 83.11       | 7.38          | $sd(\mu)/\sigma = 0.5$              |
| BIC         113.81         94.91         72.11         95.78         Oracle: 7.96           CV.1se         0.38         0.1         0.04         46.61         0.51           CV.min         7.59         1.24         0.25         80.87         7.52 $sd(\mu)/\sigma = 0.5$ AICc         5.84         25.25         55.49         21.38 $\rho = 0.9$ AIC         115.14         96.36         74.23         96.08         Oracle: 7.57  | AICc   | 5.61   | 26.75                          | 54.85                    | 21.48       |               | $\rho = 0.5$                        |
| BIC       113.81       94.91       72.11       95.78         CV.1se       0.38       0.1       0.04       46.61       0.51         CV.min       7.59       1.24       0.25       80.87       7.52 $sd(\mu)/\sigma = 0.5$ AICc       5.84       25.25       55.49       21.38 $\rho = 0.9$ AIC       115.14       96.36       74.23       96.08  | AIC    | 115.25 | 96.35                          | 74.18                    | 96.43       |               | Oma ala . 7.06                      |
| CV.min 7.59 1.24 0.25 80.87 7.52 $sd(\mu)/\sigma = 0.5$<br>AICc 5.84 25.25 55.49 21.38 $\rho = 0.9$<br>AIC 115.14 96.36 74.23 96.08   | BIC    | 113.81 | 94.91                          | 72.11                    | 95.78       |               | <i>Oracie</i> : 7.96                |
| AICc 5.84 25.25 55.49 21.38 $\rho = 0.9$ AIC 115.14 96.36 74.23 96.08   | CV.1se | 0.38   | 0.1                            | 0.04                     | 46.61       | 0.51          |                                     |
| AIC 115.14 96.36 74.23 96.08  | CV.min | 7.59   | 1.24                           | 0.25                     | 80.87       | 7.52          | $sd(\mu)/\sigma = 0.5$              |
| 1 Oracle : 151  | AICc   | 5.84   | 25.25                          | 55.49                    | 21.38       |               | $\rho = 0.9$                        |
| BIC 114 94.73 72.25 95.28   | AIC    | 115.14 | 96.36                          | 74.23                    | 96.08       |               | Oragla : 7.57                       |
|   | BIC    | 114    | 94.73                          | 72.25                    | 95.28       |               | Oracle: 1.51                        |

Table 76: Nonzero coefficients at n=100, binary design, dense covariates, and decay 50.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 1.34   | 0.2                            | 0.07                            | 53.16       | 1.06          |                                       |
| CV.min | 17.15  | 2.34                           | 0.45                            | 85.15       | 18.97         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 8.05   | 37.06                          | 55.48                           | 22.98       |               | $\rho = 0$                            |
| AIC    | 113.89 | 93.58                          | 71.13                           | 95.05       |               | Oracle : 56.85                        |
| BIC    | 112.8  | 91.86                          | 69.5                            | 94.36       |               | 07466 . 30.03                         |
| CV.1se | 0.63   | 0.18                           | 0.06                            | 51.6        | 0.71          |                                       |
| CV.min | 15.5   | 2.1                            | 0.36                            | 84.16       | 15.71         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 7.89   | 35.41                          | 55.16                           | 23.4        |               | $\rho = 0.5$                          |
| AIC    | 114.46 | 94.27                          | 72.03                           | 95.35       |               | Oracle : 56.18                        |
| BIC    | 113.28 | 92.48                          | 70.15                           | 94.78       |               | 07acte . 30.16                        |
| CV.1se | 0.84   | 0.24                           | 0.05                            | 49.94       | 0.74          |                                       |
| CV.min | 14.96  | 1.93                           | 0.37                            | 82.39       | 13.87         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 7.28   | 33.16                          | 55.39                           | 22.38       |               | $\rho = 0.9$                          |
| AIC    | 114.37 | 94.58                          | 72.16                           | 95.4        |               | Oracle : 56.48                        |
| BIC    | 113.12 | 92.84                          | 70.35                           | 94.57       |               | 074666.30.40                          |
| CV.1se | 0.53   | 0.06                           | 0.03                            | 50.93       | 0.68          |                                       |
| CV.min | 10.62  | 1.05                           | 0.24                            | 84.51       | 9.83          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.39   | 42.84                          | 56.81                           | 22.2        |               | $\rho = 0$                            |
| AIC    | 114.97 | 92.18                          | 69.79                           | 96.23       |               | Oracle : 31.69                        |
| BIC    | 113.77 | 90.33                          | 68.38                           | 95.62       |               | 07466 . 31.07                         |
| CV.1se | 0.27   | 0.05                           | 0.03                            | 48.97       | 0.54          |                                       |
| CV.min | 9.01   | 0.9                            | 0.19                            | 84.28       | 8.51          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.15   | 42.39                          | 56.52                           | 22.08       |               | $\rho = 0.5$                          |
| AIC    | 115.07 | 93.07                          | 70.49                           | 96.3        |               | <i>Oracle</i> : 31.41                 |
| BIC    | 113.93 | 91.11                          | 68.92                           | 95.77       |               | 074666.31.41                          |
| CV.1se | 0.42   | 0.06                           | 0.04                            | 48.42       | 0.53          |                                       |
| CV.min | 9.6    | 0.98                           | 0.26                            | 81.83       | 9.33          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.76   | 41.57                          | 56.68                           | 21          |               | $\rho = 0.9$                          |
| AIC    | 114.81 | 92.9                           | 70.53                           | 95.92       |               | Oracle: 31                            |
| BIC    | 113.55 | 90.83                          | 69.07                           | 95.31       |               | Oracle . 31                           |
| CV.1se | 0.24   | 0.02                           | 0.04                            | 49.59       | 0.45          |                                       |
| CV.min | 6.35   | 0.36                           | 0.19                            | 84.57       | 6.02          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.92   | 48.6                           | 58.18                           | 20.96       |               | $\rho = 0$                            |
| AIC    | 115.61 | 88.57                          | 66.96                           | 96.64       |               | Oracle : 8.54                         |
| BIC    | 114.23 | 86.37                          | 66.14                           | 96.13       |               | 074666.0.54                           |
| CV.1se | 0.05   | 0.03                           | 0.01                            | 49.54       | 0.44          |                                       |
| CV.min | 5.77   | 0.4                            | 0.17                            | 83.22       | 5.16          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 4.98   | 48.24                          | 58.18                           | 20.31       |               | $\rho = 0.5$                          |
| AIC    | 115.49 | 89.44                          | 67.61                           | 96.86       |               | Oracle : 8.87                         |
| BIC    | 114.27 | 87.47                          | 66.68                           | 96.26       |               | 01466.0.01                            |
| CV.1se | 0.18   | 0.02                           | 0.02                            | 46.56       | 0.39          |                                       |
| CV.min | 6.85   | 0.36                           | 0.17                            | 80.99       | 6.62          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 5.24   | 47.74                          | 58.33                           | 20.57       |               | $\rho = 0.9$                          |
| AIC    | 115.34 | 89.16                          | 67.7                            | 96.66       |               | Oracle : 8.11                         |
| BIC    | 114.07 | 86.87                          | 66.81                           | 96.04       |               | 0, west . 0.11                        |

Table 77: Nonzero coefficients at n=100, binary design, dense covariates, and decay 100.

|                   | lasso  | $\operatorname{GL} \gamma = 1$ |       | marginal AL | sparsenet MCP |                                       |
|-------------------|--------|--------------------------------|-------|-------------|---------------|---------------------------------------|
| CV.1se            | 1.11   | 0.1                            | 0.05  | 53.43       | 0.91          |                                       |
| CV.min            | 14.36  | 1                              | 0.29  | 84.81       | 16.14         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 6.5    | 45.45                          | 56.62 | 22.86       |               | $\rho = 0$                            |
| AIC               | 114.51 | 90.73                          | 68.48 | 95.75       |               | <i>Oracle</i> : 78.12                 |
| BIC               | 113.45 | 88.83                          | 67.4  | 95.12       |               | 07 acre : 70.12                       |
| CV.1se            | 0.56   | 0.1                            | 0.04  | 52.87       | 0.6           |                                       |
| CV.min            | 12.21  | 0.9                            | 0.26  | 85.13       | 11.88         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 6.6    | 44.09                          | 56.53 | 22.42       |               | $\rho = 0.5$                          |
| AIC               | 114.74 | 91.78                          | 69.18 | 96.19       |               | <i>Oracle</i> : 77.79                 |
| BIC               | 113.45 | 89.75                          | 67.9  | 95.57       |               | Oracic . 11.17                        |
| CV.1se            | 0.64   | 0.09                           | 0.04  | 50.46       | 0.54          |                                       |
| CV.min            | 12.02  | 0.88                           | 0.24  | 83.31       | 12.45         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 6.38   | 43.96                          | 56.72 | 21.71       |               | $\rho = 0.9$                          |
| AIC               | 114.76 | 91.76                          | 69.19 | 95.71       |               | Oracle : 77.15                        |
| BIC               | 113.53 | 89.77                          | 67.95 | 95.1        |               | Oracie . 11.13                        |
| CV.1se            | 0.41   | 0.05                           | 0.02  | 51.4        | 0.57          |                                       |
| CV.min            | 9.65   | 0.48                           | 0.2   | 84.61       | 9.83          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 5.79   | 47.88                          | 57.85 | 21.65       |               | $\rho = 0$                            |
| AIC               | 115.06 | 88.95                          | 67.26 | 96.52       |               | 0129.01                               |
| BIC               | 113.92 | 86.81                          | 66.33 | 95.9        |               | <i>Oracle</i> : 38.01                 |
| CV.1se            | 0.34   | 0.05                           | 0.03  | 49.83       | 0.46          |                                       |
| CV.min            | 7.97   | 0.57                           | 0.16  | 83.96       | 8.55          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 5.34   | 47.05                          | 57.51 | 21.68       |               | $\rho = 0.5$                          |
| AIC               | 115.16 | 89.52                          | 67.85 | 96.67       |               | 0 1 26 00                             |
| BIC               | 114.03 | 87.41                          | 67    | 95.98       |               | <i>Oracle</i> : 36.88                 |
| CV.1se            | 0.39   | 0.03                           | 0.03  | 47.22       | 0.55          |                                       |
| CV.min            | 8.78   | 0.56                           | 0.23  | 81.79       | 8.64          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 5.61   | 46.79                          | 57.81 | 21.13       |               | $\rho = 0.9$                          |
| AIC               | 115.04 | 89.73                          | 68.06 | 96.25       |               |                                       |
| BIC               | 113.7  | 87.74                          | 67.02 | 95.4        |               | <i>Oracle</i> : 37.12                 |
| CV.1se            | 0.2    | 0.02                           | 0.02  | 49.77       | 0.4           |                                       |
| CV.min            | 5.81   | 0.28                           | 0.13  | 84.14       | 5.79          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 4.63   | 50.71                          | 59.3  | 20.93       |               | $\rho = 0$                            |
| AIC               | 115.53 | 84.84                          | 65.39 | 96.71       |               | 0 1 656                               |
| BIC               | 114.32 | 82.58                          | 64.67 | 96.11       |               | Oracle: 6.56                          |
| CV.1se            | 0.13   | 0.03                           | 0.01  | 49.55       | 0.47          |                                       |
| CV.min            | 5.85   | 0.31                           | 0.14  | 83.82       | 5.62          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 4.95   | 50.11                          | 58.96 | 20.32       |               | $\rho = 0.5$                          |
| AIC               | 115.3  | 85.71                          | 65.69 | 96.73       |               | ,                                     |
| BIC               | 114.2  | 83.42                          | 64.91 | 96.1        |               | Oracle: 6.85                          |
| CV.1se            | 0.21   | 0.01                           | 0.03  | 46.17       | 0.43          |                                       |
| CV.rise<br>CV.min | 6.48   | 0.31                           | 0.15  | 81.45       | 6.37          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 5.47   | 49.45                          | 59.13 | 20.78       | 0.57          | $\rho = 0.9$                          |
| AIC               | 115.3  | 85.99                          | 65.81 | 96.51       |               | ,                                     |
| BIC               | 113.86 | 83.58                          | 65.16 | 95.7        |               | Oracle: 6.4                           |
| DIC               | 113.00 | 05.50                          | 05.10 | 73.1        |               |                                       |

Table 78: Nonzero coefficients at n=100, binary design, dense covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ |       | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|-------|-------------|---------------|---------------------------------------|
| CV.1se | 0.71   | 0.07                           | 0.04  | 53.85       | 0.87          |                                       |
| CV.min | 12.91  | 0.69                           | 0.25  | 85.31       | 14.1          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 6.23   | 48.41                          | 58.08 | 22.78       |               | $\rho = 0$                            |
| AIC    | 114.65 | 87.76                          | 66.3  | 96.1        |               | Oracle : 91.18                        |
| BIC    | 113.48 | 85.63                          | 65.6  | 95.42       |               | 07acic . 71.16                        |
| CV.1se | 0.45   | 0.04                           | 0.04  | 52.25       | 0.53          |                                       |
| CV.min | 10.77  | 0.55                           | 0.25  | 85.36       | 10.92         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 6.18   | 47.28                          | 57.96 | 22.01       |               | $\rho = 0.5$                          |
| AIC    | 114.85 | 88.49                          | 66.77 | 96.21       |               | Oracle : 90.76                        |
| BIC    | 113.71 | 86.45                          | 65.87 | 95.66       |               | Oracie . 90.70                        |
| CV.1se | 0.54   | 0.06                           | 0.03  | 50.49       | 0.56          |                                       |
| CV.min | 9.88   | 0.6                            | 0.24  | 83.82       | 10.41         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 6.39   | 48.25                          | 57.97 | 21.66       |               | $\rho = 0.9$                          |
| AIC    | 114.67 | 88.17                          | 66.93 | 95.97       |               | Oracle : 90.33                        |
| BIC    | 113.42 | 85.92                          | 66.01 | 95.25       |               | Oracie: 90.55                         |
| CV.1se | 0.47   | 0.03                           | 0.02  | 51.32       | 0.48          |                                       |
| CV.min | 9.07   | 0.39                           | 0.21  | 85.17       | 8.91          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.45   | 49.11                          | 58.71 | 21.6        |               | $\rho = 0$                            |
| AIC    | 115.24 | 85.63                          | 65.62 | 96.59       |               | ,                                     |
| BIC    | 114.08 | 83.57                          | 64.94 | 96.04       |               | <i>Oracle</i> : 41.56                 |
| CV.1se | 0.4    | 0.04                           | 0.03  | 50.67       | 0.45          |                                       |
| CV.min | 7.8    | 0.49                           | 0.18  | 84.22       | 7.69          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.32   | 49.29                          | 58.67 | 21.02       |               | $\rho = 0.5$                          |
| AIC    | 115.28 | 86.49                          | 65.74 | 96.41       |               | ,                                     |
| BIC    | 114.05 | 84.25                          | 65.01 | 95.97       |               | <i>Oracle</i> : 41.26                 |
| CV.1se | 0.39   | 0.02                           | 0.02  | 48.12       | 0.54          |                                       |
| CV.min | 8.81   | 0.48                           | 0.2   | 82.08       | 8.01          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.9    | 49.58                          | 58.71 | 21.5        | ****          | $\rho = 0.9$                          |
| AIC    | 114.88 | 86.34                          | 66.1  | 96.19       |               | ,                                     |
| BIC    | 113.58 | 83.96                          | 65.35 | 95.67       |               | Oracle: 40.75                         |
| CV.1se | 0.18   | 0.02                           | 0.02  | 50.14       | 0.42          |                                       |
| CV.min | 5.9    | 0.25                           | 0.17  | 83.88       | 5.82          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.73   | 52.14                          | 60.03 | 20.23       |               | $\rho = 0$                            |
| AIC    | 115.4  | 81.59                          | 64.13 | 96.8        |               | ,                                     |
| BIC    | 114.27 | 79.24                          | 63.4  | 96.05       |               | Oracle: 5.09                          |
| CV.1se | 0.19   | 0.03                           | 0.01  | 49.14       | 0.47          |                                       |
| CV.min | 6.07   | 0.26                           | 0.13  | 83.68       | 5.63          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.82   | 51.51                          | 59.88 | 20.47       | 3.03          | $\rho = 0.5$                          |
| AIC    | 115.43 | 82.47                          | 64.43 | 96.7        |               | ,                                     |
| BIC    | 114.34 | 79.92                          | 63.69 | 96.1        |               | Oracle: 5.6                           |
| CV.1se | 0.18   | 0.02                           | 0.01  | 46.55       | 0.44          |                                       |
| CV.13C | 6.6    | 0.28                           | 0.13  | 81.7        | 6.85          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.19   | 51.64                          | 60.11 | 20.74       | 0.03          | $\rho = 0.9$                          |
| AIC    | 115.45 | 82.32                          | 64.49 | 96.47       |               |                                       |
| BIC    | 114.16 | 79.52                          | 63.78 | 95.85       |               | Oracle: 5.19                          |
| DIC    | 117.10 | 17.34                          | 03.70 | 75.05       |               |                                       |

Table 79: Nonzero coefficients at n=100, continuous design, dense covariates, and decay 10.

|        | lasso  | $\operatorname{GL} \gamma = 1$ |       | marginal AL |       |                                       |
|--------|--------|--------------------------------|-------|-------------|-------|---------------------------------------|
| CV.1se | 9.38   | 5.78                           | 2.06  | 39.46       | 6.53  |                                       |
| CV.min | 42.21  | 23.33                          | 5.17  | 69.95       | 33    | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 19.98  | 8.06                           | 49.38 | 26.11       |       | $\rho = 0$                            |
| AIC    | 109.18 | 96.34                          | 74.39 | 86.92       |       | Oracle : 20.75                        |
| BIC    | 107.66 | 94.99                          | 72.97 | 79.99       |       | Oracic . 20.73                        |
| CV.1se | 1.31   | 1.14                           | 0.63  | 37.72       | 1.69  |                                       |
| CV.min | 15.97  | 10.34                          | 1.86  | 70.04       | 10.04 | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 9.96   | 2.15                           | 39.05 | 21.17       |       | $\rho = 0.5$                          |
| AIC    | 110.04 | 99.51                          | 79.33 | 88.83       |       | Oracle : 20.43                        |
| BIC    | 108.73 | 98.46                          | 78.26 | 76.73       |       | 07466 . 20.43                         |
| CV.1se | 1.37   | 1.21                           | 1.03  | 12.61       | 1.04  |                                       |
| CV.min | 8.59   | 5.65                           | 1.7   | 34.12       | 3.12  | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 7.53   | 1.51                           | 1.07  | 19.16       |       | $\rho = 0.9$                          |
| AIC    | 103.15 | 92.8                           | 73.37 | 55.58       |       | Oracle : 18.27                        |
| BIC    | 83.55  | 83.5                           | 72.64 | 3.55        |       | Oracle . 16.27                        |
| CV.1se | 1.56   | 0.77                           | 0.25  | 45.1        | 1.08  |                                       |
| CV.min | 16.67  | 5.95                           | 1.02  | 78.33       | 16.1  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 10.94  | 1.75                           | 53.61 | 22.91       |       | $\rho = 0$                            |
| AIC    | 113.1  | 97.55                          | 75.58 | 93.22       |       | Oracle: 14.43                         |
| BIC    | 111.76 | 96.18                          | 74    | 91.6        |       | Oracie : 14.45                        |
| CV.1se | 0.51   | 0.34                           | 0.19  | 39.43       | 0.61  |                                       |
| CV.min | 9.68   | 3.89                           | 0.7   | 72.96       | 7.51  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.04   | 0.87                           | 51.96 | 20.33       |       | $\rho = 0.5$                          |
| AIC    | 113.8  | 100.8                          | 80.71 | 93.59       |       | Oma ala . 14 10                       |
| BIC    | 112.15 | 99.36                          | 78.76 | 90.59       |       | <i>Oracle</i> : 14.19                 |
| CV.1se | 1.1    | 0.96                           | 0.9   | 6.97        | 0.95  |                                       |
| CV.min | 9      | 5.41                           | 1.56  | 25.81       | 3.19  | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.81   | 1.47                           | 1.78  | 13.76       |       | $\rho = 0.9$                          |
| AIC    | 107.62 | 95.04                          | 76    | 74.16       |       | Oma ala . 11.62                       |
| BIC    | 105.62 | 94.71                          | 75.15 | 4.18        |       | <i>Oracle</i> : 11.62                 |
| CV.1se | 0.34   | 0.08                           | 0.03  | 48.1        | 0.51  |                                       |
| CV.min | 6.94   | 1.3                            | 0.23  | 81.96       | 6.86  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.64   | 7.83                           | 56.31 | 20.66       |       | $\rho = 0$                            |
| AIC    | 115.31 | 95.89                          | 73.5  | 96.41       |       | Oma ala . 7 97                        |
| BIC    | 114.09 | 94.57                          | 71.52 | 95.81       |       | <i>Oracle</i> : 7.87                  |
| CV.1se | 0.09   | 0.07                           | 0.02  | 40.22       | 0.43  |                                       |
| CV.min | 5.87   | 1.58                           | 0.28  | 74.78       | 5.28  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.28   | 0.63                           | 55.06 | 20.2        |       | $\rho = 0.5$                          |
| AIC    | 115.46 | 99.36                          | 78.25 | 96.17       |       | 0 1 765                               |
| BIC    | 113.7  | 97.86                          | 76.13 | 95.21       |       | <i>Oracle</i> : 7.65                  |
| CV.1se | 0.35   | 0.26                           | 0.17  | 8.47        | 0.51  |                                       |
| CV.min | 6.83   | 3.64                           | 0.81  | 28.53       | 5.08  | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 6.83   | 0.59                           | 38.76 | 14.49       |       | $\rho = 0.9$                          |
| AIC    | 114.01 | 97.56                          | 79.03 | 90.1        |       | Oma al - 15.52                        |
| BIC    | 113.06 | 97.15                          | 78.01 | 33.12       |       | <i>Oracle</i> : 5.53                  |
|        |        |                                |       |             |       | •                                     |

Table 80: Nonzero coefficients at n=100, continuous design, dense covariates, and decay 50.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   |
|--|
| AIC  |
| AIC 113.97 93.61 70.8 94.96 $PA.19$          |
| BIC 112.86 92.01 69.16 94.19 $CV.1se$ 0.21 0.09 0.03 41.73 0.53 $CV.min$ 7.5 1.72 0.24 76.39 7.17 $sd(\mu)/\sigma = 2$ AICc 5.7 1.12 55.6 20.13 $\rho = 0.5$ AIC 115.07 98.4 77 96.2 $CV.1se$ 0.51 0.45 0.31 7.67 0.61 $CV.min$ 7.71 4.6 1.2 27.5 5.56 $CV.1se$ 0.51 0.45 0.31 7.67 0.61 $CV.min$ 7.71 4.6 1.2 27.5 5.56 $CV.1se$ 0.51 0.48 25.08 14.94 $CV.1se$ 0.51 111.37 96.52 77.03 24.07 $CV.1se$ 0.43 0.07 0.02 51.02 0.54 $CV.1se$ 0.43 0.92 0.29 84.44 10.15 $cV.1se$ 0.40 0.40 68.37 95.48 $cV.1se$ 0.21 0.06 0.02 42.44 0.57 $cV.1se$ 0.21 0.22 $cV.1se$ 0.23 0.23 0.11 7.81 0.41 $cV.1se$ 0.24 0.25 $cV.1se$ 0.3 0.23 0.11 7.81 0.41 $cV.1se$ 0.41 $cV.1se$ 0.41 $cV.1se$ 0.41 $cV.1se$ 0.42 $cV.1se$ 0.41 |
| BIC         112.86         92.01         69.16         94.19           CV.1se         0.21         0.09         0.03         41.73         0.53           CV.min         7.5         1.72         0.24         76.39         7.17 $sd(\mu)/\sigma = 2$ AIC         115.07         98.4         77         96.2         0.61   |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| AICc 5.7 1.12 55.6 20.13 $\rho = 0.5$ AIC 115.07 98.4 77 96.2 $Oracle : 56.98$ BIC 113.5 96.83 74.87 95.46 $Oracle : 56.98$ CV.1se 0.51 0.45 0.31 7.67 0.61 CV.min 7.71 4.6 1.2 27.5 5.56 $sd(\mu)/\sigma = 2$ AICc 7.44 0.88 25.08 14.94 $\rho = 0.9$ AIC 112.43 96.94 78.26 87.64 BIC 111.37 96.52 77.03 24.07 $Oracle : 54.95$ CV.1se 0.43 0.07 0.02 51.02 0.54 CV.min 10.48 0.92 0.29 84.44 10.15 $sd(\mu)/\sigma = 1$ AICc 6.5 26.93 57.5 21.65 $\rho = 0$ AIC 114.66 92.06 69.78 96.07 BIC 113.67 90.44 68.37 95.48 $Oracle : 30.65$ CV.1se 0.21 0.06 0.02 42.44 0.57 $Oracle : 30.65$ CV.1se 0.21 0.06 0.02 42.44 0.57 $Oracle : 30.65$ AIC 115.47 96.49 74.99 96.32 $Oracle : 30.42$ BIC 113.77 94.61 72.98 95.56 $Oracle : 30.42$ CV.1se 0.3 0.23 0.11 7.81 0.41 $Oracle : 30.42$ AICc 6.04 0.46 51.2 14.45 $oracle : 37.66$ AIC 114.45 97.04 78.89 91.88 $Oracle : 27.66$  |
| AIC 115.07 98.4 77 96.2 $Oracle: 56.98$ BIC 113.5 96.83 74.87 95.46  CV.1se 0.51 0.45 0.31 7.67 0.61 $CV.min$ 7.71 4.6 1.2 27.5 5.56 $cont sin sin sin sin sin sin sin sin sin sin$  |
| BIC         113.5         96.83         74.87         95.46         Oracle : 56.98           CV.1se         0.51         0.45         0.31         7.67         0.61 $(0.61)$  |
| BIC         113.5         96.83         74.87         95.46           CV.1se         0.51         0.45         0.31         7.67         0.61           CV.min         7.71         4.6         1.2         27.5         5.56 $sd(\mu)/\sigma = 2$ AIC         7.44         0.88         25.08         14.94 $\rho = 0.9$ AIC         112.43         96.94         78.26         87.64         Oracle: 54.95           BIC         111.37         96.52         77.03         24.07         0.54           CV.1se         0.43         0.07         0.02         51.02         0.54           CV.min         10.48         0.92         0.29         84.44         10.15 $sd(\mu)/\sigma = 1$ AIC         114.66         92.06         69.78         96.07         0.7acle: 30.65           BIC         113.67         90.44         68.37         95.48         0.57           CV.1se         0.21         0.06         0.02         42.44         0.57           CV.min         5.87         1.18         0.21         76.85         6.16 $sd(\mu)/\sigma = 1$ AIC         115.47         96.49         74.99  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| AICc 7.44 0.88 25.08 14.94 $\rho = 0.9$ AIC 112.43 96.94 78.26 87.64 BIC 111.37 96.52 77.03 24.07 $\rho = 0.9$ CV.1se 0.43 0.07 0.02 51.02 0.54 CV.min 10.48 0.92 0.29 84.44 10.15 $\rho = 0$ AIC 114.66 92.06 69.78 96.07 AIC 113.67 90.44 68.37 95.48 $\rho = 0$ Oracle : 30.65 $\rho = 0$ CV.1se 0.21 0.06 0.02 42.44 0.57 $\rho = 0$ AIC 115.47 96.49 74.99 96.32 AIC 113.77 94.61 72.98 95.56 $\rho = 0$ Oracle : 30.42 $\rho = 0$ AIC 114.45 97.04 78.89 91.88 $\rho = 0.9$ Oracle : 27.66 $\rho = 0.9$ AIC 114.45 97.04 78.89 91.88   |
| AIC 112.43 96.94 78.26 87.64 $Oracle: 54.95$ BIC 111.37 96.52 77.03 24.07 $Oracle: 54.95$ CV.1se 0.43 0.07 0.02 51.02 0.54 CV.min 10.48 0.92 0.29 84.44 10.15 $sd(\mu)/\sigma=1$ AICc 6.5 26.93 57.5 21.65 $\rho=0$ AIC 114.66 92.06 69.78 96.07 $Oracle: 30.65$ BIC 113.67 90.44 68.37 95.48 $Oracle: 30.65$ CV.1se 0.21 0.06 0.02 42.44 0.57 $Oracle: 30.65$ AIC 115.47 96.49 74.99 96.32 AIC 115.47 96.49 74.99 96.32 $Oracle: 30.42$ BIC 113.77 94.61 72.98 95.56 $Oracle: 30.42$ CV.nin 5.86 3.2 0.67 28.37 5.21 $oracle: 30.42$ AIC 114.45 97.04 78.89 91.88 $Oracle: 27.66$   |
| BIC         111.37         96.52         77.03         24.07         Oracle: S4.95           CV.1se         0.43         0.07         0.02         51.02         0.54           CV.min         10.48         0.92         0.29         84.44         10.15 $sd(\mu)/\sigma = 1$ AICc         6.5         26.93         57.5         21.65 $\rho = 0$ AIC         114.66         92.06         69.78         96.07           BIC         113.67         90.44         68.37         95.48           CV.1se         0.21         0.06         0.02         42.44         0.57           CV.min         5.87         1.18         0.21         76.85         6.16 $sd(\mu)/\sigma = 1$ AIC         115.47         96.49         74.99         96.32 $\rho = 0.5$ BIC         113.77         94.61         72.98         95.56         Oracle: 30.42           CV.1se         0.3         0.23         0.11         7.81         0.41           CV.min         5.86         3.2         0.67         28.37         5.21 $sd(\mu)/\sigma = 1$ AIC         114.45         97.04         78.89         91.88  |
| BIC         111.37         96.52         77.03         24.07           CV.1se         0.43         0.07         0.02         51.02         0.54           CV.min         10.48         0.92         0.29         84.44         10.15 $sd(\mu)/\sigma = 1$ AICc         6.5         26.93         57.5         21.65 $\rho = 0$ AIC         114.66         92.06         69.78         96.07           BIC         113.67         90.44         68.37         95.48           CV.1se         0.21         0.06         0.02         42.44         0.57           CV.min         5.87         1.18         0.21         76.85         6.16 $sd(\mu)/\sigma = 1$ AICc         5.05         3.51         56.35         19.82 $\rho = 0.5$ AIC         115.47         96.49         74.99         96.32         Oracle : 30.42           EV.1se         0.3         0.23         0.11         7.81         0.41           CV.nin         5.86         3.2         0.67         28.37         5.21 $sd(\mu)/\sigma = 1$ AICc         6.04         0.46         51.2         14.45 $\rho = 0.9$   |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| AICc 6.5 26.93 57.5 21.65 $\rho = 0$ AIC 114.66 92.06 69.78 96.07 BIC 113.67 90.44 68.37 95.48  CV.1se 0.21 0.06 0.02 42.44 0.57  CV.min 5.87 1.18 0.21 76.85 6.16 $\operatorname{sd}(\mu)/\sigma = 1$ AICc 5.05 3.51 56.35 19.82 $\rho = 0.5$ AIC 115.47 96.49 74.99 96.32 BIC 113.77 94.61 72.98 95.56  CV.1se 0.3 0.23 0.11 7.81 0.41  CV.min 5.86 3.2 0.67 28.37 5.21 $\operatorname{sd}(\mu)/\sigma = 1$ AICc 6.04 0.46 51.2 14.45 $\rho = 0.9$ AIC 114.45 97.04 78.89 91.88  |
| AIC 114.66 92.06 69.78 96.07 $Oracle: 30.65$ $Oracle: 30.42$   |
| BIC         113.67         90.44         68.37         95.48         Oracle: 30.65           CV.1se         0.21         0.06         0.02         42.44         0.57           CV.min         5.87         1.18         0.21         76.85         6.16 $sd(\mu)/\sigma = 1$ AICc         5.05         3.51         56.35         19.82 $\rho = 0.5$ AIC         115.47         96.49         74.99         96.32         Oracle: 30.42           BIC         113.77         94.61         72.98         95.56         Oracle: 30.42           CV.1se         0.3         0.23         0.11         7.81         0.41           CV.min         5.86         3.2         0.67         28.37         5.21 $sd(\mu)/\sigma = 1$ AICc         6.04         0.46         51.2         14.45 $\rho = 0.9$ AIC         114.45         97.04         78.89         91.88  |
| BIC         113.67         90.44         68.37         95.48           CV.1se         0.21         0.06         0.02         42.44         0.57           CV.min         5.87         1.18         0.21         76.85         6.16 $sd(\mu)/\sigma = 1$ AIC         5.05         3.51         56.35         19.82 $\rho = 0.5$ AIC         115.47         96.49         74.99         96.32           BIC         113.77         94.61         72.98         95.56           CV.1se         0.3         0.23         0.11         7.81         0.41           CV.min         5.86         3.2         0.67         28.37         5.21 $sd(\mu)/\sigma = 1$ AIC         6.04         0.46         51.2         14.45 $\rho = 0.9$ AIC         114.45         97.04         78.89         91.88  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| AICc 5.05 3.51 56.35 19.82 $\rho = 0.5$ AIC 115.47 96.49 74.99 96.32 BIC 113.77 94.61 72.98 95.56 $\rho = 0.5$ CV.1se 0.3 0.23 0.11 7.81 0.41 CV.min 5.86 3.2 0.67 28.37 5.21 $\rho = 0.9$ AIC 114.45 97.04 78.89 91.88 $\rho = 0.5$ Oracle : 27.66  |
| AIC       115.47       96.49       74.99       96.32         BIC       113.77       94.61       72.98       95.56         CV.1se       0.3       0.23       0.11       7.81       0.41         CV.min       5.86       3.2       0.67       28.37       5.21       sd(μ)/σ = 1         AIC       6.04       0.46       51.2       14.45 $\rho = 0.9$ AIC       114.45       97.04       78.89       91.88  |
| BIC         113.77         94.61         72.98         95.56         Oracle: $30.42$ CV.1se         0.3         0.23         0.11         7.81         0.41           CV.min         5.86         3.2         0.67         28.37         5.21 $sd(\mu)/\sigma = 1$ AICc         6.04         0.46         51.2         14.45 $\rho = 0.9$ AIC         114.45         97.04         78.89         91.88         Oracle: 27.66   |
| BIC       113.77       94.61       72.98       95.56         CV.1se       0.3       0.23       0.11       7.81       0.41         CV.min       5.86       3.2       0.67       28.37       5.21 $sd(\mu)/\sigma = 1$ AIC       6.04       0.46       51.2       14.45 $\rho = 0.9$ AIC       114.45       97.04       78.89       91.88  |
| CV.min 5.86 3.2 0.67 28.37 5.21 $sd(\mu)/\sigma = 1$<br>AICc 6.04 0.46 51.2 14.45 $\rho = 0.9$<br>AIC 114.45 97.04 78.89 91.88   |
| AICc 6.04 0.46 51.2 14.45 $\rho = 0.9$<br>AIC 114.45 97.04 78.89 91.88   |
| AIC 114.45 97.04 78.89 91.88 Oracle: 27.66   |
| Uracle: 27 bb  |
| BIC 113.37 96.51 77.61 42.4  |
|  |
| CV.1se 0.3 0.04 0.03 48.78 0.43  |
| CV.min 6.8 0.38 0.17 83.46 6.23 $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc 5.14 46.46 59.19 20.55 $\rho = 0$   |
| AIC 115.51 88.58 66.99 96.71 Oracle: 8.65  |
| BIC 114.39 86./1 65.95 96.09   |
| CV.1se 0.22 0.03 0.02 39.8 0.37  |
| CV.min 5.6 0.6 0.19 74.69 5.09 $sd(\mu)/\sigma = 0.5$  |
| AICc 4.62 21.05 58.6 19.88 $\rho = 0.5$  |
| AIC 115.61 93 71.18 96.54 Oracle: 8.5  |
| BIC 114.2 91.07 69.67 95.76  |
| CV.1se 0.16 0.06 0.03 7.94 0.4   |
| CV.min 4.34 1.46 0.25 28.76 3.8 $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc 4.41 0.23 62.79 14.46 $\rho = 0.9$  |
| AIC 116.02 94.45 77.16 94.19 Oracle: 7.26  |
| BIC 114.99 93.78 75.88 58.47   |

Table 81: Nonzero coefficients at n=100, continuous design, dense covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ |       | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|-------|-------------|---------------|---------------------------------------|
| CV.1se | 0.67   | 0.06                           | 0.04  | 52.6        | 0.76          |                                       |
| CV.min | 13.65  | 0.82                           | 0.27  | 85.39       | 13.84         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 7.11   | 34.13                          | 57.96 | 22.79       |               | $\rho = 0$                            |
| AIC    | 114.54 | 90.7                           | 68.26 | 95.72       |               | Oracle: 77.53                         |
| BIC    | 113.41 | 88.92                          | 67.22 | 95.01       |               | Oracic . 11.55                        |
| CV.1se | 0.22   | 0.09                           | 0.02  | 41.74       | 0.41          |                                       |
| CV.min | 6.41   | 1.13                           | 0.19  | 75.51       | 6.44          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 4.88   | 5.81                           | 57.14 | 20.33       |               | $\rho = 0.5$                          |
| AIC    | 115.39 | 96.11                          | 73.86 | 96.26       |               | Oracle: 77.53                         |
| BIC    | 113.81 | 94.16                          | 71.99 | 95.3        |               | Oracie . 11.55                        |
| CV.1se | 0.26   | 0.15                           | 0.1   | 8.03        | 0.38          |                                       |
| CV.min | 5.95   | 2.79                           | 0.59  | 28.47       | 4.99          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.97   | 0.39                           | 55.53 | 15.36       |               | $\rho = 0.9$                          |
| AIC    | 114.85 | 96.86                          | 78.52 | 92.57       |               | Oma ala . 76 01                       |
| BIC    | 113.69 | 96.21                          | 77.41 | 45.46       |               | <i>Oracle</i> : 76.01                 |
| CV.1se | 0.3    | 0.05                           | 0.03  | 51.64       | 0.44          |                                       |
| CV.min | 8.77   | 0.44                           | 0.19  | 83.44       | 8.33          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.87   | 43.26                          | 58.6  | 20.88       |               | $\rho = 0$                            |
| AIC    | 115.09 | 89.05                          | 67.39 | 96.38       |               | 0 1 27 66                             |
| BIC    | 114    | 87.23                          | 66.38 | 95.79       |               | <i>Oracle</i> : 37.66                 |
| CV.1se | 0.23   | 0.05                           | 0.02  | 41.34       | 0.41          |                                       |
| CV.min | 6.02   | 0.75                           | 0.18  | 76.06       | 5.42          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 4.92   | 15.17                          | 58.29 | 19.95       |               | $\rho = 0.5$                          |
| AIC    | 115.57 | 94                             | 72.01 | 96.38       |               | ,                                     |
| BIC    | 113.99 | 92                             | 70.37 | 95.56       |               | <i>Oracle</i> : 37.21                 |
| CV.1se | 0.13   | 0.1                            | 0.03  | 7.66        | 0.35          |                                       |
| CV.min | 4.44   | 1.82                           | 0.34  | 29.36       | 4.55          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 4.79   | 0.18                           | 61.89 | 14.63       | .,,,,         | $\rho = 0.9$                          |
| AIC    | 115.68 | 95.57                          | 77.87 | 93.94       |               | ,                                     |
| BIC    | 114.84 | 94.91                          | 76.41 | 53.27       |               | <i>Oracle</i> : 34.56                 |
| CV.1se | 0.2    | 0.04                           | 0.02  | 48.56       | 0.42          |                                       |
| CV.min | 6.36   | 0.35                           | 0.18  | 82.92       | 5.52          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.9    | 50.95                          | 60.05 | 20.72       |               | $\rho = 0$                            |
| AIC    | 115.38 | 84.92                          | 65.25 | 96.58       |               | ,                                     |
| BIC    | 114.25 | 82.92                          | 64.42 | 95.97       |               | Oracle: 6.81                          |
| CV.1se | 0.19   | 0.02                           | 0.01  | 38.82       | 0.38          |                                       |
| CV.min | 5.61   | 0.41                           | 0.16  | 74.96       | 5.09          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.38   | 39.49                          | 59.56 | 19.93       | 3.07          | $\rho = 0.5$                          |
| AIC    | 115.44 | 89.9                           | 68.67 | 96.71       |               | ,                                     |
| BIC    | 113.88 | 87.92                          | 67.64 | 95.92       |               | Oracle: 6.7                           |
| CV.1se | 0.11   | 0.04                           | 0.02  | 7.47        | 0.35          |                                       |
| CV.13C | 3.86   | 0.96                           | 0.22  | 28.61       | 3.4           | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.23   | 0.47                           | 64.76 | 14.1        | J.T           | $\rho = 0.9$                          |
| AIC    | 116.35 | 91.88                          | 75.83 | 94.49       |               | ,                                     |
| BIC    | 115.4  | 91.00                          | 74.37 | 57.59       |               | Oracle: 6.45                          |
| ыс     | 113.4  | 71.01                          | 14.31 | 31.39       |               |                                       |

Table 82: Nonzero coefficients at n=100, continuous design, dense covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 0.39   | 0.05                           | 0.03                            | 52.15       | 0.57          |                                       |
| CV.min | 12.92  | 0.49                           | 0.2                             | 85.14       | 12.66         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 6.57   | 46.91                          | 58.63                           | 22.66       |               | $\rho = 0$                            |
| AIC    | 114.72 | 87.92                          | 66.31                           | 96.21       |               | <i>Oracle</i> : 91.12                 |
| BIC    | 113.53 | 85.95                          | 65.55                           | 95.64       |               | 074666.71.12                          |
| CV.1se | 0.13   | 0.03                           | 0.02                            | 40.77       | 0.45          |                                       |
| CV.min | 5.82   | 0.73                           | 0.16                            | 75.21       | 6.34          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.16   | 20.41                          | 58.08                           | 20.33       |               | $\rho = 0.5$                          |
| AIC    | 115.38 | 92.81                          | 70.86                           | 96.34       |               | Oracle : 91.12                        |
| BIC    | 113.65 | 90.95                          | 69.43                           | 95.54       |               | Oracle . 91.12                        |
| CV.1se | 0.1    | 0.09                           | 0.04                            | 7.82        | 0.36          |                                       |
| CV.min | 4.77   | 1.7                            | 0.32                            | 29          | 4.33          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 5.06   | 0.24                           | 62.47                           | 15.09       |               | $\rho = 0.9$                          |
| AIC    | 115.24 | 94.82                          | 77.08                           | 93.74       |               | 0100-40                               |
| BIC    | 114.18 | 94.19                          | 75.55                           | 54.71       |               | Oracle: 90.49                         |
| CV.1se | 0.32   | 0.05                           | 0.03                            | 50.59       | 0.45          |                                       |
| CV.min | 8.62   | 0.38                           | 0.2                             | 83.59       | 9.19          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 5.72   | 50.11                          | 59.32                           | 21.22       |               | $\rho = 0$                            |
| AIC    | 114.97 | 85.8                           | 65.3                            | 96.45       |               |                                       |
| BIC    | 113.95 | 83.48                          | 64.34                           | 95.88       |               | <i>Oracle</i> : 41.19                 |
| CV.1se | 0.19   | 0.03                           | 0.01                            | 40.32       | 0.36          |                                       |
| CV.min | 5.87   | 0.44                           | 0.16                            | 75.03       | 5.34          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 4.63   | 33.38                          | 59.49                           | 20.09       |               | $\rho = 0.5$                          |
| AIC    | 115.52 | 90.77                          | 69.29                           | 96.41       |               | '                                     |
| BIC    | 113.74 | 88.77                          | 68.06                           | 95.73       |               | <i>Oracle</i> : 41.33                 |
| CV.1se | 0.11   | 0.04                           | 0.02                            | 7.11        | 0.35          |                                       |
| CV.min | 3.8    | 1.17                           | 0.21                            | 28.46       | 3.72          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 4.36   | 0.19                           | 63.75                           | 14.38       |               | $\rho = 0.9$                          |
| AIC    | 115.83 | 92.95                          | 76.28                           | 94.55       |               | '                                     |
| BIC    | 114.57 | 92.2                           | 74.93                           | 58.59       |               | <i>Oracle</i> : 39.92                 |
| CV.1se | 0.17   | 0.04                           | 0.02                            | 48.98       | 0.41          |                                       |
| CV.min | 6.19   | 0.27                           | 0.17                            | 83.35       | 5.93          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.79   | 53.01                          | 60.14                           | 20.33       |               | $\rho = 0$                            |
| AIC    | 115.2  | 81.51                          | 64.03                           | 96.69       |               | ,                                     |
| BIC    | 114.26 | 79.22                          | 63.24                           | 96.1        |               | Oracle: 5.4                           |
| CV.1se | 0.13   | 0.03                           | 0.01                            | 38.83       | 0.35          |                                       |
| CV.min | 5.75   | 0.3                            | 0.13                            | 74.26       | 5.07          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.8    | 48.9                           | 60.57                           | 19.92       | 3.07          | $\rho = 0.5$                          |
| AIC    | 115.71 | 86.57                          | 66.78                           | 96.49       |               |                                       |
| BIC    | 113.99 | 84.52                          | 65.89                           | 95.65       |               | Oracle: 5.46                          |
| CV.1se | 0.09   | 0.02                           | 0.01                            | 7.04        | 0.35          |                                       |
| CV.13c | 3.32   | 0.77                           | 0.18                            | 28.68       | 3.24          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.08   | 2.02                           | 65.28                           | 14.17       | J.2T          | $\rho = 0.9$                          |
| AICC   | 116.06 | 89.46                          | 74.33                           | 94.64       |               |                                       |
| BIC    |        | 88.47                          |                                 |             |               | Oracle: 5.28                          |
| DIC    | 115.1  | 00.47                          | 72.94                           | 58.05       |               |                                       |

Table 83: Nonzero coefficients at n=100, binary design, sparse covariates, and decay 10.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 15.26  | 10.62                          | 4.77                     | 34.95       | 9.61          |                                       |
| CV.min | 51.8   | 31.21                          | 10.08                    | 63.72       | 26.46         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 23.67  | 17.33                          | 47.63                    | 27.06       |               | $\rho = 0$                            |
| AIC    | 107.57 | 95.72                          | 73.55                    | 83.28       |               | Oracle: 10                            |
| BIC    | 105.8  | 94.27                          | 72.36                    | 70.2        |               | Oracie. 10                            |
| CV.1se | 13.29  | 9.46                           | 3.97                     | 37.88       | 9.27          |                                       |
| CV.min | 49.64  | 31.3                           | 9.03                     | 66.79       | 25.74         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 22.91  | 17.68                          | 48.1                     | 27.48       |               | $\rho = 0.5$                          |
| AIC    | 108.01 | 96.82                          | 74.63                    | 84.59       |               | Oracle:10                             |
| BIC    | 106.54 | 95.38                          | 73.26                    | 75.65       |               | Oracie: 10                            |
| CV.1se | 12.9   | 9.51                           | 3.65                     | 37.95       | 9.13          |                                       |
| CV.min | 49.97  | 31.29                          | 8.63                     | 66.12       | 25.43         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 22.52  | 17.48                          | 47.23                    | 27.33       |               | $\rho = 0.9$                          |
| AIC    | 108.2  | 97.07                          | 75.19                    | 84.9        |               | Oracle: 10                            |
| BIC    | 106.67 | 95.7                           | 73.7                     | 74.68       |               | Oracie: 10                            |
| CV.1se | 2.24   | 1.32                           | 0.37                     | 44.25       | 1.8           |                                       |
| CV.min | 22.92  | 8.52                           | 1.58                     | 76.86       | 20.44         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 12.31  | 10.3                           | 52.27                    | 23.99       |               | $\rho = 0$                            |
| AIC    | 112.3  | 97.2                           | 75.73                    | 92.06       |               | ,                                     |
| BIC    | 110.82 | 95.77                          | 74.01                    | 90.62       |               | Oracle: 10                            |
| CV.1se | 1.87   | 0.97                           | 0.4                      | 45.65       | 1.34          |                                       |
| CV.min | 20.75  | 8.04                           | 1.29                     | 78.54       | 17.03         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 11.25  | 9.71                           | 51.62                    | 23.01       |               | $\rho = 0.5$                          |
| AIC    | 112.86 | 98.02                          | 76.29                    | 92.45       |               | ,                                     |
| BIC    | 111.36 | 96.45                          | 74.48                    | 90.71       |               | Oracle: 10                            |
| CV.1se | 2.07   | 0.91                           | 0.36                     | 43.34       | 1.56          |                                       |
| CV.min | 20.36  | 8.18                           | 1.35                     | 75.11       | 17.3          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 11.44  | 9.29                           | 51.97                    | 23.82       |               | $\rho = 0.9$                          |
| AIC    | 112.43 | 98.3                           | 76.93                    | 92.28       |               | ,                                     |
| BIC    | 110.79 | 96.77                          | 75.18                    | 90.7        |               | Oracle: 10                            |
| CV.1se | 0.3    | 0.05                           | 0.03                     | 48.68       | 0.51          |                                       |
| CV.min | 7.54   | 1.43                           | 0.26                     | 81.23       | 7.13          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 5.83   | 26.06                          | 54.48                    | 21.04       |               | $\rho = 0$                            |
| AIC    | 114.97 | 96.18                          | 74.3                     | 96.04       |               | ,                                     |
| BIC    | 113.74 | 94.86                          | 72.14                    | 95.37       |               | Oracle: 10                            |
| CV.1se | 0.18   | 0.07                           | 0.03                     | 48.41       | 0.53          |                                       |
| CV.min | 7.54   | 1.3                            | 0.27                     | 82.65       | 6.92          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.72   | 23.47                          | 54.59                    | 21.12       |               | $\rho = 0.5$                          |
| AIC    | 114.94 | 96.9                           | 74.9                     | 96.2        |               | ,                                     |
| BIC    | 113.77 | 95.4                           | 72.7                     | 95.47       |               | Oracle:10                             |
| CV.1se | 0.46   | 0.08                           | 0.05                     | 46.13       | 0.56          |                                       |
| CV.13C | 7.85   | 1.39                           | 0.33                     | 80.29       | 7.45          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.61   | 21.6                           | 54.19                    | 21.05       | 7.73          | $\rho = 0.9$                          |
| AIC    | 115.04 | 96.82                          | 74.9                     | 96.08       |               | ,                                     |
| BIC    | 113.73 | 95.31                          | 72.73                    | 95.3        |               | Oracle:10                             |
| БІС    | 113.73 | 95.51                          | 14.13                    | 93.3        |               |                                       |

Table 84: Nonzero coefficients at n=100, binary design, sparse covariates, and decay 50.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}~\gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|-------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 16.13  | 10.09                          | 2.67                    | 40.53       | 14.08         |                                       |
| CV.min | 56.2   | 31.18                          | 8.11                    | 68.24       | 43.57         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 25.81  | 19.81                          | 50.58                   | 29.52       |               | $\rho = 0$                            |
| AIC    | 109.45 | 94.74                          | 71.57                   | 86.29       |               | Oracle: 10                            |
| BIC    | 107.59 | 93.14                          | 70.12                   | 81.32       |               | Oracic . 10                           |
| CV.1se | 12.85  | 8.14                           | 2.13                    | 42.89       | 12.2          |                                       |
| CV.min | 52.22  | 29.99                          | 6.41                    | 72.28       | 42.91         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 23.98  | 21.35                          | 50.61                   | 30.33       |               | $\rho = 0.5$                          |
| AIC    | 110    | 95.56                          | 72.79                   | 88.07       |               | Oracle: 10                            |
| BIC    | 108.16 | 93.96                          | 71.14                   | 85.1        |               | Oracic . 10                           |
| CV.1se | 12.45  | 7.88                           | 1.6                     | 43.29       | 11.43         |                                       |
| CV.min | 51.72  | 28.89                          | 5.45                    | 72.13       | 41.13         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 23.49  | 21.43                          | 50.1                    | 29.47       |               | $\rho = 0.9$                          |
| AIC    | 109.97 | 95.94                          | 73.2                    | 88.1        |               | Oracle:10                             |
| BIC    | 108.29 | 94.27                          | 71.58                   | 84.75       |               | Oracie . 10                           |
| CV.1se | 1.71   | 0.53                           | 0.18                    | 46.33       | 1.54          |                                       |
| CV.min | 21.83  | 4.96                           | 0.88                    | 79.69       | 19.74         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 11.04  | 21.93                          | 53.84                   | 24.64       |               | $\rho = 0$                            |
| AIC    | 113.3  | 95.24                          | 72.79                   | 93.32       |               | 0 1 10                                |
| BIC    | 111.88 | 93.85                          | 71.27                   | 92.44       |               | Oracle: 10                            |
| CV.1se | 1.35   | 0.49                           | 0.15                    | 48.46       | 1.05          |                                       |
| CV.min | 18.23  | 4.31                           | 0.76                    | 80.96       | 17.35         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 10.07  | 19.99                          | 54.25                   | 23.47       |               | $\rho = 0.5$                          |
| AIC    | 113.55 | 96.07                          | 74.08                   | 93.89       |               | 0 1 10                                |
| BIC    | 112.04 | 94.68                          | 72.11                   | 93.01       |               | Oracle: 10                            |
| CV.1se | 1.48   | 0.45                           | 0.15                    | 46.58       | 1.43          |                                       |
| CV.min | 18.38  | 4.3                            | 0.72                    | 78.04       | 16.64         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 9.91   | 18.8                           | 53.45                   | 23.86       |               | $\rho = 0.9$                          |
| AIC    | 113.5  | 96.56                          | 74.22                   | 93.69       |               | ,                                     |
| BIC    | 112.07 | 94.87                          | 72.43                   | 92.51       |               | Oracle: 10                            |
| CV.1se | 0.19   | 0.05                           | 0.03                    | 48.89       | 0.49          |                                       |
| CV.min | 7.2    | 0.78                           | 0.22                    | 82.38       | 7.36          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.69   | 41.34                          | 56.18                   | 20.81       |               | $\rho = 0$                            |
| AIC    | 115.05 | 93.33                          | 71.05                   | 96.19       |               | ,                                     |
| BIC    | 113.79 | 91.61                          | 69.48                   | 95.57       |               | Oracle: 10                            |
| CV.1se | 0.15   | 0.09                           | 0.03                    | 48.92       | 0.51          |                                       |
| CV.min | 6.87   | 0.75                           | 0.22                    | 83.16       | 6.76          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.32   | 39.19                          | 56.2                    | 20.6        |               | $\rho = 0.5$                          |
| AIC    | 115.1  | 93.86                          | 71.59                   | 96.49       |               | ,                                     |
| BIC    | 113.89 | 92.23                          | 69.58                   | 95.72       |               | Oracle: 10                            |
| CV.1se | 0.35   | 0.08                           | 0.03                    | 47.2        | 0.51          |                                       |
| CV.min | 7.52   | 0.85                           | 0.23                    | 81.11       | 7.4           | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.54   | 39.18                          | 55.9                    | 21.08       | . • •         | $\rho = 0.9$                          |
| AIC    | 115.04 | 94.12                          | 71.57                   | 96.28       |               | ,                                     |
| BIC    | 113.72 | 92.32                          | 70.03                   | 95.6        |               | Oracle: 10                            |
|        | 110.12 | 72.52                          | , 0.03                  | 75.0        |               |                                       |

Table 85: Nonzero coefficients at n=100, binary design, sparse covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 16.25  | 9.9                            | 2.56                     | 40.8        | 13.89         |                                       |
| CV.min | 56.12  | 30.29                          | 7.09                     | 68.19       | 43.91         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 25.92  | 20.1                           | 50.87                    | 29.8        |               | $\rho = 0$                            |
| AIC    | 109.5  | 94.17                          | 71.06                    | 86.42       |               | Oracle:10                             |
| BIC    | 107.71 | 92.58                          | 69.35                    | 81.31       |               | Oracle . 10                           |
| CV.1se | 12.66  | 7.82                           | 1.83                     | 43.08       | 12.63         |                                       |
| CV.min | 51.74  | 29.5                           | 5.79                     | 72.42       | 45.16         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 23.93  | 21.36                          | 51.14                    | 30.35       |               | $\rho = 0.5$                          |
| AIC    | 110.06 | 95.36                          | 72.61                    | 88.21       |               | Oracle:10                             |
| BIC    | 108.22 | 93.81                          | 71.01                    | 85.14       |               | Oracle . 10                           |
| CV.1se | 12.13  | 7.54                           | 1.57                     | 43.65       | 11.08         |                                       |
| CV.min | 51.24  | 27.8                           | 5.46                     | 72.44       | 42.37         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 23.51  | 22.16                          | 50.82                    | 29.91       |               | $\rho = 0.9$                          |
| AIC    | 109.96 | 95.43                          | 72.92                    | 88.15       |               | Oma ala . 10                          |
| BIC    | 108.27 | 93.79                          | 71.36                    | 84.83       |               | Oracle:10                             |
| CV.1se | 1.67   | 0.54                           | 0.17                     | 46.44       | 1.52          |                                       |
| CV.min | 21.94  | 4.62                           | 0.85                     | 79.58       | 19.81         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 11.21  | 25.15                          | 54.4                     | 24.47       |               | $\rho = 0$                            |
| AIC    | 113.21 | 94.98                          | 72.58                    | 93.3        |               | ·                                     |
| BIC    | 111.84 | 93.46                          | 70.87                    | 92.48       |               | Oracle: 10                            |
| CV.1se | 1.31   | 0.46                           | 0.16                     | 48.53       | 1.11          |                                       |
| CV.min | 17.75  | 3.93                           | 0.74                     | 81.02       | 17.72         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 9.99   | 22.08                          | 53.71                    | 23.21       |               | $\rho = 0.5$                          |
| AIC    | 113.45 | 95.41                          | 73.3                     | 93.87       |               | ,                                     |
| BIC    | 112.21 | 93.9                           | 71.58                    | 93.07       |               | Oracle: 10                            |
| CV.1se | 1.48   | 0.44                           | 0.15                     | 46.94       | 1.36          |                                       |
| CV.min | 18.39  | 4.36                           | 0.68                     | 78.06       | 16.65         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 9.9    | 20.73                          | 54.31                    | 23.77       |               | $\rho = 0.9$                          |
| AIC    | 113.62 | 95.86                          | 73.83                    | 93.83       |               |                                       |
| BIC    | 111.78 | 94.25                          | 72.08                    | 92.75       |               | Oracle: 10                            |
| CV.1se | 0.2    | 0.05                           | 0.03                     | 48.94       | 0.51          |                                       |
| CV.min | 7.25   | 0.85                           | 0.24                     | 82.54       | 7.42          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.58   | 42.66                          | 56.7                     | 20.93       |               | $\rho = 0$                            |
| AIC    | 115.13 | 92.77                          | 70.27                    | 96.11       |               |                                       |
| BIC    | 113.8  | 91.17                          | 68.87                    | 95.44       |               | Oracle: 10                            |
| CV.1se | 0.13   | 0.06                           | 0.03                     | 48.89       | 0.47          |                                       |
| CV.min | 7.36   | 0.71                           | 0.23                     | 82.88       | 6.72          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 5.47   | 40.99                          | 56.27                    | 20.73       | ***-          | $\rho = 0.5$                          |
| AIC    | 115.14 | 93.36                          | 71.01                    | 96.47       |               |                                       |
| BIC    | 114.08 | 91.68                          | 69.34                    | 95.79       |               | Oracle: 10                            |
| CV.1se | 0.31   | 0.06                           | 0.03                     | 46.93       | 0.54          |                                       |
| CV.nsc | 7.5    | 0.77                           | 0.22                     | 80.97       | 7.4           | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.59   | 40.25                          | 56.13                    | 21.02       |               | $\rho = 0.9$                          |
| AIC    | 115.22 | 93.28                          | 71.09                    | 96.18       |               |                                       |
| BIC    | 113.78 | 91.46                          | 69.58                    | 95.53       |               | Oracle:10                             |
| DIC    | 113.70 | 71. <del>4</del> 0             | 07.30                    | 75.55       |               |                                       |

Table 86: Nonzero coefficients at n=100, binary design, sparse covariates, and decay 200.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | marginal AL | sparsenet MCP |  |
|---|--------|--------|--------------------------------|------------------------------|-------------|---------------|--|
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             |               |  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             | 44.62         |  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        | 25.96  |                                |                              | 30.09       |               | $\rho = 0$                                 |
| BIC   101.7   92.34   89.24   81.5   CV.lse   12.64   7.58   1.76   43.12   12.52   $\rho = 0.5$   AIC   24.19   21.69   51.09   30.58   $\rho = 0.5$   AIC   109.97   95.16   72.22   88.27   BIC   108.2   93.63   70.63   85.32   CV.lse   12.47   7.56   1.56   43.72   11.49   $\rho = 0.9$   AIC   110.06   95.27   72.43   88.19   Oracle : 10   AIC   11.19   26.01   54.39   24.47   $\rho = 0.9$   AIC   113.26   94.75   72.32   93.32   AIC   113.26   94.75   72.32   93.32   AIC   113.26   94.75   72.32   93.32   Oracle : 10   AIC   111.88   92.98   70.66   92.52   Oracle : 10   Oracle : 10   AIC   113.55   95.31   73.21   93.9   BIC   112.09   93.71   71.35   93.02   Oracle : 10   Oracle : 10   AIC   112.09   93.71   71.35   93.02   Oracle : 10   Oracle :  |        |        |                                |                              |             |               | $Oracle \cdot 10$                          |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    |        |                                |                              |             |               | Oracic . 10                                |
| AICc 24.19 21.69 51.09 30.58 $\rho = 0.5$ AIC 109.97 95.16 72.22 88.27 $\rho = 0.5$ AIC 109.97 95.16 72.22 88.27 $\rho = 0.5$ AIC 108.2 93.63 70.63 85.32 $\rho = 0.5$ AIC 108.2 93.63 70.63 85.32 $\rho = 0.5$ AIC 108.2 93.63 5.1 72.34 43.41 $\rho = 0.5$ AICc 23.59 22.25 51.31 29.76 $\rho = 0.9$ AIC 110.06 95.27 72.43 88.19 $\rho = 0.9$ AIC 110.06 95.27 72.43 88.19 $\rho = 0.9$ AIC 110.08.38 93.75 70.8 85.2 $\rho = 0.9$ AIC 110.06 95.27 72.43 88.19 $\rho = 0.9$ AIC 110.06 95.27 72.43 88.19 $\rho = 0.9$ AIC 111.19 26.01 54.39 24.47 $\rho = 0.0$ AIC 113.26 94.75 72.32 93.32 $\rho = 0.0$ AIC 113.26 94.75 72.32 93.32 $\rho = 0.0$ AIC 113.88 92.98 70.66 92.52 $\rho = 0.0$ AIC 113.89 0.49 0.14 48.48 1.08 $\rho = 0.0$ AIC 113.55 95.31 73.21 93.9 $\rho = 0.0$ AIC 113.55 95.31 73.21 93.9 $\rho = 0.0$ AIC 113.55 95.31 73.21 93.9 $\rho = 0.0$ AIC 113.62 94.7 0.17 47.01 1.38 $\rho = 0.0$ AIC 113.62 95.64 73.58 93.83 BIC 112.09 93.71 71.35 93.02 $\rho = 0.0$ AIC 113.62 95.64 73.58 93.83 BIC 112.03 93.96 72.05 92.8 $\rho = 0.0$ AIC 113.64 95.64 73.58 93.83 BIC 112.03 93.96 72.05 92.8 $\rho = 0.0$ AIC 113.65 95.44 73.58 93.83 BIC 112.03 93.96 72.05 92.8 $\rho = 0.0$ AIC 113.64 90.86 $\rho = 0.0$ AIC 113.65 95.44 73.58 93.83 BIC 112.03 93.96 72.05 92.8 $\rho = 0.0$ AIC 113.84 90.98 68.77 95.54 $\rho = 0.0$ AIC 113.85 93.90 $\rho = 0.0$ AIC 113.84 90.98 68.77 95.54 $\rho = 0.0$ AIC 113.87 90.88 $\rho = 0.0$ AIC 115.05 92.49 70.28 96.17 $\rho = 0.0$ AIC 115.05 92.49 70.28 96.17 $\rho = 0.0$ AIC 115.05 92.49 70.28 96.17 $\rho = 0.0$ AIC 115.25 93.32 70.79 96.45 $\rho = 0.0$ AIC 115.32 93.22 70.99 96.26 $\rho = 0.0$ AIC 115.32 93.22 70.99 96.26 $\rho = 0.0$ AIC 115.32 93.22 70.99 96.26  |        | 12.64  | 7.58                           | 1.76                         | 43.12       | 12.52         |  |
| AIC 109.97 95.16 72.22 88.27 $Oracle: 10$ BIC 108.2 93.63 70.63 85.32 $Oracle: 10$ CV.1se 12.47 7.56 1.56 43.72 11.49 $Oracle: 10$ AIC 110.06 95.27 72.43 88.19 $Oracle: 10$ BIC 108.38 93.75 70.8 85.2 $Oracle: 10$ BIC 108.38 93.75 70.8 85.2 $Oracle: 10$ CV.min 21.53 4.46 0.88 79.52 19.68 $oracle: 10$ AIC 11.19 26.01 54.39 24.47 $oracle: 10$ AIC 11.18 29.98 70.66 92.52 $Oracle: 10$ BIC 111.88 29.98 70.66 92.52 $Oracle: 10$ CV.1se 1.39 0.49 0.14 48.48 1.08 $oracle: 10$ CV.1se 1.39 0.49 0.14 48.48 1.08 $oracle: 10$ AIC 113.55 95.31 73.21 93.9 $oracle: 10$ BIC 112.09 93.71 71.35 93.02 $oracle: 10$ CV.1se 1.49 0.47 0.17 47.01 1.38 $oracle: 10$ CV.1se 1.49 0.47 0.17 47.01 1.38 $oracle: 10$ AIC 113.62 95.64 73.58 93.83 $oracle: 10$ AIC 113.62 95.64 73.58 93.83 $oracle: 10$ CV.1se 1.39 0.49 0.44 49.01 0.5 $oracle: 10$ CV.1se 1.39 0.49 0.49 0.49 0.49 0.40 0.70 0.70 0.70 0.70 0.70 0.70 0.70  | CV.min | 51.72  | 28.7                           | 5.71                         |             | 45.49         | $\operatorname{sd}(\mu)/\sigma = 2$        |
| BIC         108.2         93.63         70.63         85.32         Oracle : 10           CV.Ise         12.47         7.56         1.56         43.72         11.49         c/// (μ)/σ = 2           CV.min         52.07         28.03         5.1         72.34         43.41         sd(μ)/σ = 2           AIC         23.59         22.25         51.31         29.76         ρ = 0.9           AIC         110.06         95.27         72.43         88.19         Oracle : 10           CV.Ise         1.67         0.58         0.17         46.52         1.53           CV.Ise         1.67         0.58         0.17         46.52         1.53           CV.min         21.53         4.46         0.88         79.52         19.68         sd(μ)/σ = 1           AIC         11.19         26.01         54.39         24.47         ρ = 0         0           AIC         113.26         94.75         72.32         93.32         Oracle : 10           CV.Ise         1.39         0.49         0.14         48.48         1.08           CV.min         17.82         3.67         0.7         80.79         16.98         sd(μ)/σ = 0.5 <td< td=""><td>AICc</td><td>24.19</td><td>21.69</td><td>51.09</td><td>30.58</td><td></td><td><math>\rho = 0.5</math></td></td<>  | AICc   | 24.19  | 21.69                          | 51.09                        | 30.58       |               | $\rho = 0.5$                               |
| RIC   108.2   93.63   70.63   85.32   CV.lse   12.47   7.56   1.56   43.72   11.49   CV.min   52.07   28.03   5.1   72.34   43.41   sd( $\mu$ )/ $\sigma$ = 2   AICc   23.59   22.25   51.31   29.76   $\rho$ = 0.9   AIC   110.06   95.27   72.43   88.19   Oracle : 10   CV.lse   1.67   0.58   0.17   46.52   1.53   CV.min   21.53   4.46   0.88   79.52   19.68   sd( $\mu$ )/ $\sigma$ = 1   AICc   11.19   26.01   54.39   24.47   $\rho$ = 0   AIC   111.88   92.98   70.66   92.52   Oracle : 10   CV.lse   1.39   0.49   0.14   48.48   1.08   CV.min   17.82   3.67   0.7   80.79   16.98   sd( $\mu$ )/ $\sigma$ = 1   AICc   13.55   95.31   73.21   93.9   Oracle : 10   CV.lse   1.49   0.47   0.17   47.01   1.38   CV.min   18.57   3.81   0.71   78.45   16.48   sd( $\mu$ )/ $\sigma$ = 1   AICc   9.44   22.28   54.36   24.04   $\rho$ = 0.9   AICc   113.62   95.64   73.58   93.83   Oracle : 10   CV.lse   0.18   0.05   0.04   49.01   0.5   CV.lse   0.13   0.06   0.02   49.06   0.49   CV.lse   0.32   0.09   0.02   47.14   0.5   CV.lse   0.55   0.04   0.09   0.02   47.14   0.5   CV.lse   0.55   0.09   0.02   47.14   0.5   | AIC    | 109.97 | 95.16                          | 72.22                        | 88.27       |               | Omagle , 10                                |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 108.2  | 93.63                          | 70.63                        | 85.32       |               | Oracie . 10                                |
| AICc 23.59 22.25 51.31 29.76 $\rho = 0.9$ AIC 110.06 95.27 72.43 88.19 $\rho = 0.9$ BIC 108.38 93.75 70.8 85.2 $\rho = 0.9$ CV.1se 1.67 0.58 0.17 46.52 1.53 $\rho = 0.9$ AIC 11.19 26.01 54.39 24.47 $\rho = 0.9$ AIC 113.26 94.75 72.32 93.32 $\rho = 0.9$ AIC 113.26 94.75 72.32 93.32 $\rho = 0.9$ CV.lse 1.39 0.49 0.14 48.48 1.08 $\rho = 0.9$ AIC 113.55 95.31 73.21 93.9 $\rho = 0.9$ AIC 113.55 95.31 73.21 93.9 $\rho = 0.9$ AIC 112.09 93.71 71.35 93.02 $\rho = 0.9$ AIC 113.62 94.77 0.17 47.01 1.38 $\rho = 0.9$ AIC 113.62 95.64 73.58 93.83 $\rho = 0.9$ AIC 113.84 90.98 68.77 95.54 $\rho = 0.9$ AIC 115.05 92.49 70.28 96.17 $\rho = 0.9$ AIC 115.05 92.49 70.28 96.17 $\rho = 0.9$ AIC 115.25 93.32 70.79 96.45 $\rho = 0.9$ AIC 15.32 93.92 70.92 96.26 $\rho = 0.9$ AIC 15.32 93.22 70.99 96.45 $\rho = 0.9$ AIC 15.32 93.22 70.99 96.45 $\rho = 0.9$ AIC 15.32 93.22 70.99 96.26   | CV.1se | 12.47  | 7.56                           | 1.56                         | 43.72       | 11.49         |  |
| AIC 110.06 95.27 72.43 88.19 $Oracle: 10$ BIC 108.38 93.75 70.8 85.2 $Oracle: 10$ CV.lse 1.67 0.58 0.17 46.52 1.53 $Oracle: 10$ CV.min 21.53 4.46 0.88 79.52 19.68 $oracle: 10$ AICc 11.19 26.01 54.39 24.47 $oracle: 10$ AIC 113.26 94.75 72.32 93.32 $Oracle: 10$ BIC 111.88 92.98 70.66 92.52 $Oracle: 10$ CV.lse 1.39 0.49 0.14 48.48 1.08 $Oracle: 10$ CV.min 17.82 3.67 0.7 80.79 16.98 $oracle: 10$ AICc 9.77 23.42 53.92 23.32 $oracle: 10$ AIC 113.55 95.31 73.21 93.9 $oracle: 10$ BIC 112.09 93.71 71.35 93.02 $oracle: 10$ CV.lse 1.49 0.47 0.17 47.01 1.38 $oracle: 10$ CV.min 18.57 3.81 0.71 78.45 16.48 $oracle: 10$ AICc 9.44 22.28 54.36 24.04 $oracle: 10$ AIC 113.62 95.64 73.58 93.83 $oracle: 10$ AIC 113.62 95.64 73.58 93.83 $oracle: 10$ CV.lse 0.18 0.05 0.04 49.01 0.5 $oracle: 10$ CV.lse 0.18 0.05 0.04 49.01 0.5 $oracle: 10$ AIC 115.05 92.49 70.28 96.17 $oracle: 10$ AIC 115.25 93.32 70.79 96.45 $oracle: 10$ CV.lse 0.32 0.09 0.02 47.14 0.5 $oracle: 10$ AIC 15.32 93.22 70.99 96.26 $oracle: 10$ AIC 15.32 93.22 70.99 96.26   | CV.min | 52.07  | 28.03                          | 5.1                          | 72.34       | 43.41         | $\operatorname{sd}(\mu)/\sigma = 2$        |
| BIC 108.38 93.75 70.8 85.2 Oracle: 10 CV.1se 1.67 0.58 0.17 46.52 1.53 $CV.min$ 21.53 4.46 0.88 79.52 19.68 $sd(\mu)/\sigma = 1$ AICc 11.19 26.01 54.39 24.47 $\rho = 0$ AIC 113.26 94.75 72.32 93.32 BIC 111.88 92.98 70.66 92.52 Oracle: 10 CV.1se 1.39 0.49 0.14 48.48 1.08 CV.min 17.82 3.67 0.7 80.79 16.98 $sd(\mu)/\sigma = 1$ AICc 9.77 23.42 53.92 23.32 $\rho = 0.5$ AIC 113.55 95.31 73.21 93.9 BIC 112.09 93.71 71.35 93.02 Oracle: 10 CV.1se 1.49 0.47 0.17 47.01 1.38 CV.min 18.57 3.81 0.71 78.45 16.48 $sd(\mu)/\sigma = 1$ AICc 9.44 22.28 54.36 24.04 $\rho = 0.9$ AIC 113.62 95.64 73.58 93.83 BIC 112.03 93.96 72.05 92.8 Oracle: 10 CV.1se 0.18 0.05 0.04 49.01 0.5 CV.min 7.3 0.76 0.22 82.27 7.55 $sd(\mu)/\sigma = 0.5$ AICc 5.68 42.76 56.51 20.96 $\rho = 0$ AIC 115.05 92.49 70.28 96.17 Oracle: 10 CV.1se 0.13 0.06 0.02 49.06 0.49 CV.min 7.18 0.72 0.22 82.87 6.86 $sd(\mu)/\sigma = 0.5$ AICc 5.32 41.42 56.52 20.47 $\rho = 0.5$ AIC 113.97 91.47 69.17 95.78 Oracle: 10 CV.1se 0.13 0.06 0.02 49.06 0.49 CV.min 7.18 0.72 0.22 82.87 6.86 $sd(\mu)/\sigma = 0.5$ AIC 115.25 93.32 70.79 96.45 BIC 113.97 91.47 69.17 95.78 Oracle: 10 CV.1se 0.32 0.09 0.02 47.14 0.5 CV.min 7.87 0.81 0.21 81.23 7.48 $sd(\mu)/\sigma = 0.5$ AICc 5.56 41.04 56.52 21.18 $\rho = 0.5$ AICc 5.56 41.04 56. | AICc   | 23.59  | 22.25                          | 51.31                        | 29.76       |               | $\rho = 0.9$                               |
| BIC         108.38         93.75 $\sqrt{0.8}$ 85.2           CV.Ise         1.67         0.58         0.17         46.52         1.53           CV.min         21.53         4.46         0.88         79.52         19.68 $sd(\mu)/\sigma = 1$ AIC         11.19         26.01         54.39         24.47 $\rho = 0$ AIC         113.26         94.75         72.32         93.32         Oracle : 10           CV.Ise         1.39         0.49         0.14         48.48         1.08           CV.min         17.82         3.67         0.7         80.79         16.98 $sd(\mu)/\sigma = 1$ AIC         9.77         23.42         53.92         23.32 $\rho = 0.5$ AIC         113.55         95.31         73.21         93.9         Oracle : 10           CV.Ise         1.49         0.47         0.17         47.01         1.38 $sd(\mu)/\sigma = 1$ AIC         1.49         0.47         0.17         47.01         1.38 $sd(\mu)/\sigma = 1$ AIC         113.62         95.64         73.58         93.83         Oracle : 10           CV.Ise         0.18   | AIC    | 110.06 | 95.27                          | 72.43                        | 88.19       |               | Ongolo , 10                                |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 108.38 | 93.75                          | 70.8                         | 85.2        |               | Oracie: 10                                 |
| AICc 11.19 26.01 54.39 24.47 $\rho = 0$ AIC 113.26 94.75 72.32 93.32 BIC 111.88 92.98 70.66 92.52  CV.1se 1.39 0.49 0.14 48.48 1.08 CV.min 17.82 3.67 0.7 80.79 16.98 $sd(\mu)/\sigma = 1$ AICc 9.77 23.42 53.92 23.32 $\rho = 0.5$ AIC 113.55 95.31 73.21 93.9 BIC 112.09 93.71 71.35 93.02  CV.1se 1.49 0.47 0.17 47.01 1.38 CV.min 18.57 3.81 0.71 78.45 16.48 $sd(\mu)/\sigma = 1$ AICc 9.44 22.28 54.36 24.04 $\rho = 0.9$ AIC 113.62 95.64 73.58 93.83 BIC 112.03 93.96 72.05 92.8  CV.1se 0.18 0.05 0.04 49.01 0.5 CV.min 7.3 0.76 0.22 82.27 7.55 $sd(\mu)/\sigma = 0.5$ AIC 15.05 92.49 70.28 96.17 BIC 113.84 90.98 68.77 95.54  CV.1se 0.13 0.06 0.02 49.06 0.49 CV.1se 0.13 0.06 0.00 0.02 49.06 0.49 CV.1se 0.32 0.09 0.02 47.14 0.5 CV.1se 0.32 0.09 0.02 47.14 CV.1se 0.5 CV.1se 0.56 41.04 56.52 21.18 AICc 5.56 41.04 56.52 21.18 AICc 115.32 93.22 70.99 96.26   | CV.1se | 1.67   | 0.58                           | 0.17                         | 46.52       | 1.53          |  |
| AICc 11.19 26.01 54.39 24.47 $\rho = 0$ AIC 113.26 94.75 72.32 93.32 BIC 111.88 92.98 70.66 92.52  CV.1se 1.39 0.49 0.14 48.48 1.08 CV.min 17.82 3.67 0.7 80.79 16.98 $sd(\mu)/\sigma = 1$ AICc 9.77 23.42 53.92 23.32 $\rho = 0.5$ AIC 113.55 95.31 73.21 93.9 BIC 112.09 93.71 71.35 93.02  CV.1se 1.49 0.47 0.17 47.01 1.38 CV.min 18.57 3.81 0.71 78.45 16.48 $sd(\mu)/\sigma = 1$ AICc 9.44 22.28 54.36 24.04 $\rho = 0.9$ AIC 113.62 95.64 73.58 93.83 BIC 112.03 93.96 72.05 92.8  CV.1se 0.18 0.05 0.04 49.01 0.5 CV.min 7.3 0.76 0.22 82.27 7.55 $sd(\mu)/\sigma = 0.5$ AIC 15.05 92.49 70.28 96.17 BIC 113.84 90.98 68.77 95.54  CV.1se 0.13 0.06 0.02 49.06 0.49 CV.1se 0.32 0.09 0.02 47.14 0.5 CV.1se 0.32 0.09 0.02 47.14 CV.1se 0.5 CV.1se 0.56 41.04 56.52 21.18 AICc 5.56 41.04 56.52 21.18 AICc 115.32 93.22 70.99 96.26  | CV.min | 21.53  | 4.46                           | 0.88                         | 79.52       | 19.68         | $\operatorname{sd}(\mu)/\sigma = 1$        |
| BIC         111.88         92.98         70.66         92.52         Oracle: 10           CV.1se         1.39         0.49         0.14         48.48         1.08           CV.min         17.82         3.67         0.7         80.79         16.98 $sd(\mu)/\sigma = 1$ AICc         9.77         23.42         53.92         23.32 $\rho = 0.5$ AIC         113.55         95.31         73.21         93.9         Oracle: 10           CV.1se         1.49         0.47         0.17         47.01         1.38 $cccccccccccccccccccccccccccccccccccc$   | AICc   | 11.19  | 26.01                          | 54.39                        | 24.47       |               |  |
| BIC         111.88         92.98         70.66         92.52         Oracle: 10           CV.1se         1.39         0.49         0.14         48.48         1.08           CV.min         17.82         3.67         0.7         80.79         16.98 $sd(\mu)/\sigma = 1$ AICc         9.77         23.42         53.92         23.32 $\rho = 0.5$ AIC         113.55         95.31         73.21         93.9         Oracle: 10           CV.1se         1.49         0.47         0.17         47.01         1.38 $sd(\mu)/\sigma = 1$ CV.min         18.57         3.81         0.71         78.45         16.48 $sd(\mu)/\sigma = 1$ AICc         9.44         22.28         54.36         24.04 $\rho = 0.9$ AIC         113.62         95.64         73.58         93.83         Oracle: 10           CV.1se         0.18         0.05         0.04         49.01         0.5           CV.min         7.3         0.76         0.22         82.27         7.55 $sd(\mu)/\sigma = 0.5$ AIC         115.05         92.49         70.28         96.17         Oracle: 10           CV.1se <td>AIC</td> <td>113.26</td> <td>94.75</td> <td>72.32</td> <td>93.32</td> <td></td> <td>0 1 10</td>  | AIC    | 113.26 | 94.75                          | 72.32                        | 93.32       |               | 0 1 10                                     |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 111.88 |                                | 70.66                        | 92.52       |               | Oracle: 10                                 |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.1se | 1.39   | 0.49                           | 0.14                         | 48.48       | 1.08          |  |
| AICc 9.77 23.42 53.92 23.32 $ρ = 0.5$ AIC 113.55 95.31 73.21 93.9 BIC 112.09 93.71 71.35 93.02 $Oracle : 10$ CV.1se 1.49 0.47 0.17 47.01 1.38 $CV.min$ 18.57 3.81 0.71 78.45 16.48 $sd(μ)/σ = 1$ AICc 9.44 22.28 54.36 24.04 $ρ = 0.9$ AIC 113.62 95.64 73.58 93.83 $Oracle : 10$ CV.1se 0.18 0.05 0.04 49.01 0.5 $CV.min$ 7.3 0.76 0.22 82.27 7.55 $sd(μ)/σ = 0.5$ AICc 5.68 42.76 56.51 20.96 $ρ = 0$ AIC 113.84 90.98 68.77 95.54 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $CV.min$ 7.18 0.72 0.22 82.87 6.86 $sd(μ)/σ = 0.5$ AICc 5.32 41.42 56.52 20.47 $ρ = 0.5$ AIC 115.25 93.32 70.79 96.45 $Oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $Oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $Oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $Oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $Oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $Oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $Oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $Oracle : 10$ AIC 115.32 93.22 70.92 96.26 $Oracle : 10$  |        | 17.82  |                                |                              |             |               | $\operatorname{sd}(\mu)/\sigma = 1$        |
| BIC 112.09 93.71 71.35 93.02 $Oracle : 10$ CV.1se 1.49 0.47 0.17 47.01 1.38 $CV.min$ 18.57 3.81 0.71 78.45 16.48 $sd(\mu)/\sigma = 1$ AICc 9.44 22.28 54.36 24.04 $\rho = 0.9$ AIC 113.62 95.64 73.58 93.83 $Oracle : 10$ CV.1se 0.18 0.05 0.04 49.01 0.5 $CV.min$ 7.3 0.76 0.22 82.27 7.55 $sd(\mu)/\sigma = 0.5$ AICc 5.68 42.76 56.51 20.96 $\rho = 0$ AIC 115.05 92.49 70.28 96.17 $Oracle : 10$ BIC 113.84 90.98 68.77 95.54 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.72 0.22 82.87 6.86 $oracle : 10$ AIC 115.25 93.32 70.79 96.45 $oracle : 10$ BIC 113.97 91.47 69.17 95.78 $oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $oracle : 10$ AIC 15.32 93.22 70.92 96.26 $oracle : 10$ AIC 115.32 93.22 70.99 96.26  | AICc   | 9.77   | 23.42                          | 53.92                        | 23.32       |               | $\rho = 0.5$                               |
| BIC 112.09 93.71 71.35 93.02 $Oracle : 10$ CV.1se 1.49 0.47 0.17 47.01 1.38 $CV.min$ 18.57 3.81 0.71 78.45 16.48 $sd(\mu)/\sigma = 1$ AICc 9.44 22.28 54.36 24.04 $\rho = 0.9$ AIC 113.62 95.64 73.58 93.83 $Oracle : 10$ CV.1se 0.18 0.05 0.04 49.01 0.5 $CV.min$ 7.3 0.76 0.22 82.27 7.55 $sd(\mu)/\sigma = 0.5$ AICc 5.68 42.76 56.51 20.96 $\rho = 0$ AIC 115.05 92.49 70.28 96.17 $Oracle : 10$ BIC 113.84 90.98 68.77 95.54 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.06 0.02 49.06 0.49 $Oracle : 10$ CV.1se 0.13 0.72 0.22 82.87 6.86 $oracle : 10$ AIC 115.25 93.32 70.79 96.45 $oracle : 10$ BIC 113.97 91.47 69.17 95.78 $oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $oracle : 10$ CV.1se 0.32 0.09 0.02 47.14 0.5 $oracle : 10$ AIC 15.32 93.22 70.92 96.26 $oracle : 10$ AIC 115.32 93.22 70.99 96.26  | AIC    | 113.55 | 95.31                          | 73.21                        | 93.9        |               | ,  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 112.09 | 93.71                          | 71.35                        | 93.02       |               | Oracle: 10                                 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se | 1.49   | 0.47                           | 0.17                         |             | 1.38          |  |
| AICc 9.44 22.28 54.36 24.04 $\rho = 0.9$ AIC 113.62 95.64 73.58 93.83 $\rho = 0.9$ BIC 112.03 93.96 72.05 92.8 $\rho = 0.9$ CV.1se 0.18 0.05 0.04 49.01 0.5 CV.min 7.3 0.76 0.22 82.27 7.55 $\rho = 0.5$ AICc 5.68 42.76 56.51 20.96 $\rho = 0.5$ AIC 115.05 92.49 70.28 96.17 $\rho = 0.5$ BIC 113.84 90.98 68.77 95.54 $\rho = 0.5$ CV.1se 0.13 0.06 0.02 49.06 0.49 CV.min 7.18 0.72 0.22 82.87 6.86 $\rho = 0.5$ AICc 5.32 41.42 56.52 20.47 $\rho = 0.5$ AIC 115.25 93.32 70.79 96.45 BIC 113.97 91.47 69.17 95.78 $\rho = 0.5$ CV.1se 0.32 0.09 0.02 47.14 0.5 CV.min 7.87 0.81 0.21 81.23 7.48 $\rho = 0.5$ AICc 5.56 41.04 56.52 21.18 $\rho = 0.9$ AIC 115.32 93.22 70.92 96.26 $\rho = 0.9$ AIC 115.32 93.22 70.92 96.26  |        |        |                                | 0.71                         |             |               | $\operatorname{sd}(\mu)/\sigma = 1$        |
| AIC 113.62 95.64 73.58 93.83 $Oracle: 10$   |        |        |                                |                              |             |               |  |
| BIC         112.03         93.96         72.05         92.8           CV.1se         0.18         0.05         0.04         49.01         0.5           CV.min         7.3         0.76         0.22         82.27         7.55 $sd(\mu)/\sigma = 0.5$ AICc         5.68         42.76         56.51         20.96 $\rho = 0$ AIC         115.05         92.49         70.28         96.17           BIC         113.84         90.98         68.77         95.54           CV.1se         0.13         0.06         0.02         49.06         0.49           CV.min         7.18         0.72         0.22         82.87         6.86 $sd(\mu)/\sigma = 0.5$ AICc         5.32         41.42         56.52         20.47 $\rho = 0.5$ AIC         115.25         93.32         70.79         96.45         0racle: 10           CV.1se         0.32         0.09         0.02         47.14         0.5           CV.min         7.87         0.81         0.21         81.23         7.48 $sd(\mu)/\sigma = 0.5$ AIC         5.56         41.04         56.52         21.18 $\rho = 0.9$   |        |        |                                |                              |             |               | ,  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             |               | Oracle: 10                                 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             | 0.5           |  |
| AICc 5.68 42.76 56.51 20.96 $\rho = 0$ AIC 115.05 92.49 70.28 96.17 BIC 113.84 90.98 68.77 95.54 $\rho = 0$ CV.1se 0.13 0.06 0.02 49.06 0.49  CV.min 7.18 0.72 0.22 82.87 6.86 $sd(\mu)/\sigma = 0.5$ AICc 5.32 41.42 56.52 20.47 $\rho = 0.5$ AIC 115.25 93.32 70.79 96.45  BIC 113.97 91.47 69.17 95.78 $\rho = 0.5$ CV.1se 0.32 0.09 0.02 47.14 0.5  CV.min 7.87 0.81 0.21 81.23 7.48 $sd(\mu)/\sigma = 0.5$ AICc 5.56 41.04 56.52 21.18 $\rho = 0.9$ AIC 115.32 93.22 70.92 96.26   |        |        |                                |                              |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$      |
| AIC 115.05 92.49 70.28 96.17 $Oracle: 10$   |        |        |                                |                              |             |               | . , , ,                                    |
| BIC         113.84         90.98         68.77         95.54         Oracle: 10           CV.1se         0.13         0.06         0.02         49.06         0.49           CV.min         7.18         0.72         0.22         82.87         6.86 $sd(\mu)/\sigma = 0.5$ AICc         5.32         41.42         56.52         20.47 $\rho = 0.5$ AIC         115.25         93.32         70.79         96.45         Oracle: 10           BIC         113.97         91.47         69.17         95.78         Oracle: 10           CV.1se         0.32         0.09         0.02         47.14         0.5           CV.min         7.87         0.81         0.21         81.23         7.48 $sd(\mu)/\sigma = 0.5$ AICc         5.56         41.04         56.52         21.18 $\rho = 0.9$ AIC         115.32         93.22         70.92         96.26         Oracle: 10  |        |        |                                |                              |             |               | ,  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             |               | Oracle: 10                                 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             | 0.49          |  |
| AICc 5.32 41.42 56.52 20.47 $\rho = 0.5$ AIC 115.25 93.32 70.79 96.45 BIC 113.97 91.47 69.17 95.78  CV.1se 0.32 0.09 0.02 47.14 0.5  CV.min 7.87 0.81 0.21 81.23 7.48 $sd(\mu)/\sigma = 0.5$ AICc 5.56 41.04 56.52 21.18 $\rho = 0.9$ AIC 115.32 93.22 70.92 96.26  |        |        |                                |                              |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$      |
| AIC       115.25       93.32       70.79       96.45         BIC       113.97       91.47       69.17       95.78         CV.1se       0.32       0.09       0.02       47.14       0.5         CV.min       7.87       0.81       0.21       81.23       7.48 $sd(\mu)/\sigma = 0.5$ AICc       5.56       41.04       56.52       21.18 $\rho = 0.9$ AIC       115.32       93.22       70.92       96.26   |        |        |                                |                              |             |               | \' / /                                     |
| BIC         113.97         91.47         69.17         95.78         Oracle: 10           CV.1se         0.32         0.09         0.02         47.14         0.5           CV.min         7.87         0.81         0.21         81.23         7.48 $sd(\mu)/\sigma = 0.5$ AICc         5.56         41.04         56.52         21.18 $\rho = 0.9$ AIC         115.32         93.22         70.92         96.26         Oracle: 10  |        |        |                                |                              |             |               | ,  |
| CV.1se     0.32     0.09     0.02     47.14     0.5       CV.min     7.87     0.81     0.21     81.23     7.48 $sd(\mu)/\sigma = 0.5$ AICc     5.56     41.04     56.52     21.18 $\rho = 0.9$ AIC     115.32     93.22     70.92     96.26   |        |        |                                |                              |             |               | Oracle: 10                                 |
| CV.min 7.87 0.81 0.21 81.23 7.48 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 5.56 41.04 56.52 21.18 $\rho = 0.9$ AIC 115.32 93.22 70.92 96.26  |        |        |                                |                              |             | 0.5           |  |
| AICc 5.56 41.04 56.52 21.18 $\rho = 0.9$<br>AIC 115.32 93.22 70.92 96.26  |        |        |                                |                              |             |               | $\int \operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC 115.32 93.22 70.92 96.26  |        |        |                                |                              |             |               | (1 / /                                     |
| $\perp$ $IIracle: 111$  |        |        |                                |                              |             |               | -  |
|   |        |        |                                |                              |             |               | Oracle: 10                                 |

Table 87: Nonzero coefficients at n=100, continuous design, sparse covariates, and decay 10.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 14.5   | 10.37                          | 4.59                            | 34.35       | 9.08          |                                       |
| CV.min | 48.76  | 30.49                          | 9.09                            | 62.24       | 25.12         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 23.63  | 12.69                          | 40.4                            | 27.3        |               | $\rho = 0$                            |
| AIC    | 107.21 | 95.86                          | 73.11                           | 82.84       |               | Oracle: 10                            |
| BIC    | 105.59 | 94.62                          | 71.98                           | 68.72       |               | Oracic : 10                           |
| CV.1se | 1.85   | 2.03                           | 0.98                            | 34.6        | 2.43          |                                       |
| CV.min | 18.64  | 13.43                          | 2.57                            | 67.88       | 10.97         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 11.48  | 3.33                           | 32.98                           | 21.77       |               | $\rho = 0.5$                          |
| AIC    | 108.62 | 99.01                          | 78.58                           | 86.94       |               | Oracle: 10                            |
| BIC    | 107.48 | 98.11                          | 77.47                           | 69.36       |               | Oracic . 10                           |
| CV.1se | 1.87   | 1.57                           | 1.21                            | 14.26       | 1.38          |                                       |
| CV.min | 12.42  | 8.94                           | 2.65                            | 35.64       | 4.83          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 9.63   | 2.13                           | 1.09                            | 20.56       |               | $\rho = 0.9$                          |
| AIC    | 103.72 | 94.2                           | 74.92                           | 59.68       |               | Oracle: 10                            |
| BIC    | 96.42  | 91.4                           | 74.17                           | 4.16        |               | Oracie: 10                            |
| CV.1se | 2.32   | 1.23                           | 0.47                            | 42.95       | 1.56          |                                       |
| CV.min | 21.01  | 7.68                           | 1.51                            | 75.87       | 17.68         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 12.34  | 2.64                           | 52.92                           | 22.95       |               | $\rho = 0$                            |
| AIC    | 112.42 | 97.36                          | 75.51                           | 91.96       |               | 0 1 10                                |
| BIC    | 110.69 | 96.1                           | 73.51                           | 89.39       |               | Oracle:10                             |
| CV.1se | 0.65   | 0.47                           | 0.24                            | 37.69       | 0.66          |                                       |
| CV.min | 10.16  | 4.68                           | 1                               | 71.7        | 7.12          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 7.91   | 1.19                           | 49.4                            | 20.47       |               | $\rho = 0.5$                          |
| AIC    | 112.63 | 100.66                         | 80.45                           | 92.43       |               | , , , , ,                             |
| BIC    | 110.97 | 99.28                          | 79.02                           | 88.18       |               | Oracle: 10                            |
| CV.1se | 1.08   | 1.02                           | 0.88                            | 8.06        | 0.92          |                                       |
| CV.min | 9.12   | 6.35                           | 1.86                            | 27.66       | 4.02          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 8.21   | 1.51                           | 1.5                             | 14.76       |               | $\rho = 0.9$                          |
| AIC    | 108.8  | 96.79                          | 77.68                           | 77.15       |               | ,                                     |
| BIC    | 107.12 | 96.28                          | 76.8                            | 6.57        |               | Oracle:10                             |
| CV.1se | 0.43   | 0.1                            | 0.04                            | 47.17       | 0.53          |                                       |
| CV.min | 7.26   | 1.51                           | 0.35                            | 81.57       | 7.12          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 6.04   | 5.46                           | 56.14                           | 20.48       |               | $\rho = 0$                            |
| AIC    | 114.91 | 96.23                          | 74.15                           | 96.17       |               | ,                                     |
| BIC    | 113.8  | 95.08                          | 71.87                           | 95.47       |               | Oracle:10                             |
| CV.1se | 0.19   | 0.1                            | 0.03                            | 40.1        | 0.4           |                                       |
| CV.min | 6.2    | 1.96                           | 0.33                            | 73.69       | 5.92          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 5.5    | 0.51                           | 54.56                           | 19.49       | 3.72          | $\rho = 0.5$                          |
| AIC    | 115.31 | 99.61                          | 78.56                           | 95.89       |               |                                       |
| BIC    | 113.74 | 98.17                          | 76.53                           | 94.87       |               | Oracle:10                             |
| CV.1se | 0.27   | 0.21                           | 0.13                            | 8.65        | 0.47          |                                       |
| CV.13C | 6.07   | 3.78                           | 0.76                            | 29.34       | 4.84          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 6.02   | 0.53                           | 39.04                           | 15.1        | 1.07          | $\rho = 0.9$                          |
| AIC    | 114.26 | 98.77                          | 79.84                           | 91.25       |               |                                       |
| BIC    | 113.21 | 98.77                          | 78.81                           | 40.59       |               | Oracle: 10                            |
| БІС    | 113.41 | 70.20                          | /0.01                           | 40.33       |               |                                       |

Table 88: Nonzero coefficients at n=100, continuous design, sparse covariates, and decay 50.

|                  | lasso  | $\operatorname{GL} \gamma = 1$ | ,     | marginal AL    | sparsenet MCP |  |
|------------------|--------|--------------------------------|-------|----------------|---------------|--|
| CV.1se           | 15.25  | 9.84                           | 2.94  | 38.53          | 12.86         |  |
| CV.min           | 52.29  | 29.7                           | 7.84  | 65.99          | 41.23         | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc             | 25.49  | 14.18                          | 48.45 | 29.4           |               | $\rho = 0$   |
| AIC              | 108.91 | 94.44                          | 71.11 | 85.89          |               | Oracle: 10   |
| BIC              | 107.15 | 93.03                          | 69.96 | 79.75          |               | Oracic . 10  |
| CV.1se           | 1.13   | 0.83                           | 0.32  | 38.6           | 1.18          |  |
| CV.min           | 15.96  | 7.85                           | 1.36  | 71.45          | 12.66         | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc             | 10.31  | 2.05                           | 51.43 | 22.39          |               | $\rho = 0.5$   |
| AIC              | 111.75 | 99.46                          | 78.84 | 91.86          |               | Oracle: 10   |
| BIC              | 110.21 | 98.12                          | 77.3  | 88.77          |               | Oracie . 10  |
| CV.1se           | 2.94   | 2.39                           | 1.55  | 11.52          | 1.8           |  |
| CV.min           | 17.32  | 11.96                          | 3.39  | 31.45          | 5.82          | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc             | 12.15  | 2.92                           | 4.24  | 17.22          |               | $\rho = 0.9$   |
| AIC              | 110.52 | 98.92                          | 79.39 | 82.52          |               | 0 1 10   |
| BIC              | 109.06 | 98.51                          | 78.52 | 16.99          |               | Oracle: 10   |
| CV.1se           | 1.89   | 0.68                           | 0.22  | 45.26          | 1.47          |  |
| CV.min           | 20.44  | 4.87                           | 1     | 77.64          | 19.27         | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc             | 11.4   | 3.98                           | 55.05 | 23.7           |               | $\rho = 0$   |
| AIC              | 112.93 | 95.4                           | 72.56 | 93.21          |               | ,  |
| BIC              | 111.49 | 93.86                          | 71.14 | 92.01          |               | Oracle:10  |
| CV.1se           | 0.47   | 0.15                           | 0.09  | 40.29          | 0.5           |  |
| CV.min           | 8.63   | 3.06                           | 0.5   | 73.88          | 8.11          | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc             | 6.57   | 1.17                           | 53.49 | 20.6           | 0.11          | $\rho = 0.5$   |
| AIC              | 114.17 | 99.81                          | 78.69 | 94.66          |               | ,  |
| BIC              | 112.51 | 98.2                           | 76.7  | 92.95          |               | Oracle:10  |
| CV.1se           | 0.92   | 0.75                           | 0.43  | 10.91          | 0.9           |  |
| CV.13c           | 10.64  | 7.1                            | 1.62  | 31.65          | 6.78          | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc             | 8.71   | 1.03                           | 22.63 | 16.97          | 0.76          | $\rho = 0.9$   |
| AIC              | 113.45 | 99.75                          | 80.37 | 89.73          |               | ,  |
| BIC              | 112.3  | 99.73                          | 79.27 | 36.91          |               | Oracle:10  |
| CV.1se           | 0.45   | 0.08                           | 0.04  | 47.64          | 0.51          |  |
| CV.1se<br>CV.min | 7.27   | 1.09                           | 0.04  | 83.01          | 6.88          | $sd(\mu)/\sigma = 0.5$   |
| AICc             | 5.88   | 21.4                           | 57.22 | 20.57          | 0.66          | $\begin{array}{c c} \operatorname{sd}(\mu)/\sigma = 0.3 \\ \rho = 0 \end{array}$ |
| AICC             | 115.22 | 93.22                          | 70.71 | 96.37          |               | $\rho = 0$   |
| BIC              |        |                                | 69.19 | 96.37<br>95.75 |               | Oracle:10  |
| CV.1se           | 113.89 | 91.61                          |       |                | 0.38          |  |
|                  | 0.16   |                                | 0.01  | 40.62          |               | -1()/- 0.5   |
| CV.min           | 5.75   | 1.27                           | 0.24  | 74.63          | 5.47          | $sd(\mu)/\sigma = 0.5$   |
| AICc             | 4.8    | 2.44                           | 56.44 | 19.2           |               | $\rho = 0.5$   |
| AIC              | 115.48 | 97.16                          | 75.46 | 96.22          |               | Oracle:10  |
| BIC              | 113.75 | 95.41                          | 73.34 | 95.56          | 0.41          |  |
| CV.1se           | 0.23   | 0.1                            | 0.04  | 9.17           | 0.41          | 1/ )/ 0.7  |
| CV.min           | 5.11   | 2.47                           | 0.36  | 30.21          | 4.47          | $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc             | 4.77   | 0.2                            | 59.58 | 14.71          |               | $\rho = 0.9$   |
| AIC              | 115.51 | 97.78                          | 79.39 | 93.86          |               | Oracle: 10   |
| BIC              | 114.51 | 97.09                          | 77.93 | 56.05          |               |  |

Table 89: Nonzero coefficients at n=100, continuous design, sparse covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$          | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|---|--------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 15.3   | 9.46                                    | 2.79                     | 38.84       | 13.15         |                                       |
| CV.min | 52.74  | 28.67                                   | 7.57                     | 66.14       | 40.88         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 25.79  | 14.25                                   | 49.58                    | 29.74       |               | $\rho = 0$                            |
| AIC    | 109.07 | 94.06                                   | 70.86                    | 85.87       |               | Oracle: 10                            |
| BIC    | 107.23 | 92.67                                   | 69.57                    | 80.39       |               | Oracie. 10                            |
| CV.1se | 1.15   | 0.8                                     | 0.29                     | 38.82       | 1.13          |                                       |
| CV.min | 15.67  | 7.55                                    | 1.3                      | 71.88       | 12.83         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 9.99   | 2.09                                    | 51.75                    | 22.65       |               | $\rho = 0.5$                          |
| AIC    | 111.92 | 99.41                                   | 78.36                    | 92.07       |               | Oracle: 10                            |
| BIC    | 110.3  | 97.87                                   | 76.79                    | 88.34       |               | Oracie: 10                            |
| CV.1se | 3.02   | 2.37                                    | 1.53                     | 11.41       | 1.84          |                                       |
| CV.min | 17.58  | 11.65                                   | 3.21                     | 30.64       | 6.05          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 12.44  | 2.96                                    | 4.2                      | 17.48       |               | $\rho = 0.9$                          |
| AIC    | 111.28 | 99.27                                   | 79.3                     | 84.13       |               | Oracle: 10                            |
| BIC    | 110.01 | 98.5                                    | 78.44                    | 19.56       |               | Oracie: 10                            |
| CV.1se | 1.85   | 0.68                                    | 0.25                     | 45.32       | 1.5           |                                       |
| CV.min | 20.34  | 4.69                                    | 0.94                     | 77.91       | 19.42         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 11.35  | 4.96                                    | 55.5                     | 23.71       |               | $\rho = 0$                            |
| AIC    | 112.88 | 94.53                                   | 72.26                    | 93.26       |               | 0 1 10                                |
| BIC    | 111.39 | 93.22                                   | 70.86                    | 92.15       |               | Oracle: 10                            |
| CV.1se | 0.49   | 0.15                                    | 0.09                     | 40.63       | 0.55          |                                       |
| CV.min | 8.72   | 2.83                                    | 0.49                     | 74.05       | 7.92          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 6.7    | 1.08                                    | 54.75                    | 20.91       |               | $\rho = 0.5$                          |
| AIC    | 114.18 | 99.19                                   | 78.32                    | 94.66       |               | 0 1 10                                |
| BIC    | 112.37 | 97.6                                    | 76.47                    | 93.35       |               | Oracle: 10                            |
| CV.1se | 0.93   | 0.75                                    | 0.41                     | 11.31       | 0.92          |                                       |
| CV.min | 10.6   | 6.93                                    | 1.59                     | 31.92       | 6.93          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 8.87   | 1                                       | 28.15                    | 17.33       |               | $\rho = 0.9$                          |
| AIC    | 113.67 | 99.58                                   | 80.42                    | 90.31       |               |                                       |
| BIC    | 112.6  | 98.96                                   | 79.3                     | 38.44       |               | Oracle: 10                            |
| CV.1se | 0.39   | 0.09                                    | 0.03                     | 47.88       | 0.51          |                                       |
| CV.min | 7.02   | 0.94                                    | 0.22                     | 83.05       | 6.92          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 6.03   | 23.93                                   | 58.01                    | 20.39       |               | $\rho = 0$                            |
| AIC    | 115.14 | 92.72                                   | 70.33                    | 96.45       |               |                                       |
| BIC    | 113.9  | 91.32                                   | 68.77                    | 95.84       |               | Oracle: 10                            |
| CV.1se | 0.15   | 0.05                                    | 0.01                     | 40.56       | 0.39          |                                       |
| CV.min | 5.64   | 1.13                                    | 0.24                     | 74.59       | 5.6           | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.77   | 3.34                                    | 56.58                    | 18.98       |               | $\rho = 0.5$                          |
| AIC    | 115.38 | 96.69                                   | 74.79                    | 96.22       |               |                                       |
| BIC    | 113.88 | 95.01                                   | 72.91                    | 95.49       |               | Oracle: 10                            |
| CV.1se | 0.22   | 0.09                                    | 0.05                     | 9.07        | 0.39          |                                       |
| CV.min | 4.92   | 2.39                                    | 0.35                     | 30.14       | 4.48          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 4.99   | 0.18                                    | 60.35                    | 14.89       |               | $\rho = 0.9$                          |
| AIC    | 115.45 | 97.52                                   | 79.08                    | 94.04       |               |                                       |
| BIC    | 114.32 | 96.92                                   | 77.76                    | 56.09       |               | Oracle:10                             |
|        | 111102 | , ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, |                          |             |               |                                       |

Table 90: Nonzero coefficients at n=100, continuous design, sparse covariates, and decay 200.

|                   | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | marginal AL | sparsenet MCP |                                       |
|-------------------|--------|--------------------------------|------------------------------|-------------|---------------|---------------------------------------|
| CV.1se            | 15.21  | 9.35                           | 2.77                         | 38.82       | 13.47         |                                       |
| CV.min            | 52.82  | 28.65                          | 7.41                         | 66.02       | 41.77         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 25.42  | 14.14                          | 50.04                        | 29.98       |               | $\rho = 0$                            |
| AIC               | 109.08 | 93.8                           | 70.69                        | 85.97       |               | Oracle: 10                            |
| BIC               | 107.32 | 92.37                          | 69.39                        | 80.36       |               | Oracie. 10                            |
| CV.1se            | 1.17   | 0.96                           | 0.3                          | 38.95       | 1.11          |                                       |
| CV.min            | 15.91  | 7.53                           | 1.25                         | 71.91       | 12.68         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 10.01  | 1.97                           | 50.99                        | 22.59       |               | $\rho = 0.5$                          |
| AIC               | 111.92 | 99.13                          | 78.16                        | 92.24       |               | Oracle: 10                            |
| BIC               | 110.31 | 97.63                          | 76.44                        | 88.11       |               | Oracle: 10                            |
| CV.1se            | 3.06   | 2.36                           | 1.54                         | 11.34       | 1.82          |                                       |
| CV.min            | 17.76  | 11.56                          | 3.37                         | 30.47       | 6.11          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 12.36  | 2.97                           | 5.95                         | 17.28       |               | $\rho = 0.9$                          |
| AIC               | 111.5  | 99.3                           | 79.39                        | 84.64       |               | Omasla . 10                           |
| BIC               | 110.17 | 98.8                           | 78.55                        | 21.46       |               | Oracle: 10                            |
| CV.1se            | 1.82   | 0.61                           | 0.24                         | 45.25       | 1.42          |                                       |
| CV.min            | 20.17  | 4.57                           | 1.05                         | 77.66       | 19.06         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 11.37  | 5.38                           | 55.83                        | 23.62       |               | $\rho = 0$                            |
| AIC               | 112.97 | 94.51                          | 71.98                        | 93.3        |               | ,                                     |
| BIC               | 111.61 | 93.11                          | 70.39                        | 91.94       |               | Oracle: 10                            |
| CV.1se            | 0.45   | 0.14                           | 0.09                         | 40.74       | 0.56          |                                       |
| CV.min            | 8.58   | 2.68                           | 0.51                         | 74.03       | 7.9           | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 6.68   | 1.07                           | 54.68                        | 20.64       |               | $\rho = 0.5$                          |
| AIC               | 114.12 | 99.09                          | 78                           | 94.62       |               | ,                                     |
| BIC               | 112.63 | 97.48                          | 75.92                        | 93.32       |               | Oracle: 10                            |
| CV.1se            | 0.95   | 0.75                           | 0.38                         | 11.42       | 0.88          |                                       |
| CV.min            | 10.38  | 6.89                           | 1.56                         | 31.8        | 6.94          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 8.91   | 0.97                           | 29.77                        | 17.51       |               | $\rho = 0.9$                          |
| AIC               | 113.75 | 99.3                           | 80.23                        | 90.54       |               | ,                                     |
| BIC               | 112.62 | 98.61                          | 78.95                        | 40.24       |               | Oracle: 10                            |
| CV.1se            | 0.4    | 0.09                           | 0.03                         | 47.72       | 0.52          |                                       |
| CV.min            | 7.16   | 0.87                           | 0.23                         | 83.11       | 6.8           | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 5.98   | 25.61                          | 57.58                        | 20.44       |               | $\rho = 0$                            |
| AIC               | 115.19 | 92.21                          | 69.93                        | 96.41       |               | ,                                     |
| BIC               | 114    | 90.72                          | 68.56                        | 95.8        |               | Oracle: 10                            |
| CV.1se            | 0.14   | 0.05                           | 0.02                         | 40.55       | 0.38          |                                       |
| CV.min            | 5.73   | 1.12                           | 0.24                         | 74.35       | 5.55          | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 4.63   | 3.95                           | 56.76                        | 19.17       |               | $\rho = 0.5$                          |
| AIC               | 115.4  | 96.71                          | 74.93                        | 96.33       |               | ,                                     |
| BIC               | 113.69 | 95.06                          | 72.93                        | 95.62       |               | Oracle:10                             |
| CV.1se            | 0.23   | 0.09                           | 0.04                         | 9.02        | 0.38          |                                       |
| CV.rise<br>CV.min | 4.93   | 2.29                           | 0.36                         | 30.16       | 4.45          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 4.92   | 0.19                           | 60.41                        | 14.85       |               | $\rho = 0.9$                          |
| AIC               | 115.49 | 97.2                           | 79.11                        | 94.12       |               |                                       |
| BIC               | 113.49 | 96.64                          | 77.64                        | 54.99       |               | Oracle:10                             |
|                   | 117,77 | 70.04                          | 77.04                        | 27.22       |               |                                       |

Table 91: Nonzero coefficients at n=1000, binary design, dense covariates, and decay 10.

|        | lasso  | $\operatorname{GL} \gamma = 1$ |        | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------|-------------|---------------|---------------------------------------|
| CV.1se | 40.29  | 30.26                          | 20.06  | 28.88       | 18.91         |                                       |
| CV.min | 103.86 | 78.52                          | 31.82  | 53.4        | 32.61         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 98.7   | 77.59                          | 49.32  | 50.55       |               | $\rho = 0$                            |
| AIC    | 610.28 | 607.78                         | 579.95 | 51.89       |               | <i>Oracle</i> : 33.33                 |
| BIC    | 30.26  | 26.24                          | 20.04  | 25.37       |               | Oracie . 33.33                        |
| CV.1se | 44.17  | 32.54                          | 20.14  | 30.83       | 18.92         |                                       |
| CV.min | 111.63 | 84.28                          | 33.09  | 55.46       | 32.41         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 104.35 | 81.41                          | 52.45  | 52.7        |               | $\rho = 0.5$                          |
| AIC    | 610.41 | 607.82                         | 581.21 | 53.96       |               | Oracle: 33.31                         |
| BIC    | 30.89  | 26.5                           | 20     | 25.76       |               | Oracie . 55.51                        |
| CV.1se | 46.46  | 33.38                          | 20.35  | 31.05       | 18.88         |                                       |
| CV.min | 114.78 | 86.83                          | 34.4   | 55.02       | 33.29         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 106.32 | 82.36                          | 52.01  | 52.52       |               | $\rho = 0.9$                          |
| AIC    | 603.04 | 600.74                         | 573.89 | 53.5        |               | Oracle: 33.07                         |
| BIC    | 31.48  | 26.8                           | 19.88  | 26.37       |               | Oracie: 33.07                         |
| CV.1se | 24.04  | 17.97                          | 12.28  | 37.57       | 11.93         |                                       |
| CV.min | 77.63  | 53.9                           | 19.1   | 115.49      | 26.51         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 79.62  | 59.8                           | 48.82  | 98.15       |               | $\rho = 0$                            |
| AIC    | 741.05 | 735.09                         | 706.78 | 151.85      |               | 0 1 2624                              |
| BIC    | 19.81  | 16.69                          | 11.64  | 18.04       |               | <i>Oracle</i> : 26.34                 |
| CV.1se | 25.49  | 18.63                          | 12.2   | 40.99       | 11.94         |                                       |
| CV.min | 82.84  | 57.87                          | 18.8   | 119.47      | 24.93         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 83.24  | 62.61                          | 48.16  | 98.94       |               | $\rho = 0.5$                          |
| AIC    | 742.59 | 736.48                         | 708.61 | 158.24      |               | ,                                     |
| BIC    | 19.78  | 16.56                          | 11.67  | 18.13       |               | <i>Oracle</i> : 26.43                 |
| CV.1se | 27.1   | 19.2                           | 12.26  | 40.54       | 11.86         |                                       |
| CV.min | 85.99  | 60.35                          | 19.91  | 114.82      | 25.63         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 85.41  | 64.03                          | 48.92  | 100.32      |               | $\rho = 0.9$                          |
| AIC    | 736.9  | 730.77                         | 702.45 | 151.49      |               | ,                                     |
| BIC    | 19.93  | 16.69                          | 11.48  | 18.45       |               | <i>Oracle</i> : 26.14                 |
| CV.1se | 8.77   | 6.95                           | 4.92   | 41.55       | 5.06          |                                       |
| CV.min | 47.87  | 28.53                          | 9.83   | 139.79      | 22.76         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 57.57  | 39.53                          | 39.22  | 105.73      |               | $\rho = 0$                            |
| AIC    | 829.32 | 820.64                         | 811.42 | 314.03      |               | ,                                     |
| BIC    | 8.92   | 7.28                           | 3.28   | 10.28       |               | <i>Oracle</i> : 19.71                 |
| CV.1se | 8.77   | 7                              | 4.8    | 45.41       | 4.88          |                                       |
| CV.min | 50.91  | 31.32                          | 9.68   | 143.08      | 20.9          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 59.87  | 43.09                          | 41.37  | 105.96      |               | $\rho = 0.5$                          |
| AIC    | 831.55 | 823.04                         | 812.95 | 319.27      |               | ,                                     |
| BIC    | 8.23   | 6.88                           | 3.21   | 9.9         |               | <i>Oracle</i> : 19.37                 |
| CV.1se | 9.12   | 7.02                           | 4.69   | 43.14       | 4.97          |                                       |
| CV.min | 53.04  | 33.09                          | 9.76   | 136.65      | 20.59         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 60.92  | 42.57                          | 42.85  | 105.45      |               | $\rho = 0.9$                          |
| AIC    | 827.65 | 819.44                         | 809.05 | 303.68      |               | ,                                     |
| BIC    | 8.01   | 6.63                           | 3.13   | 9.99        |               | <i>Oracle</i> : 19.73                 |
|        | 5.01   | 0.05                           | 5.15   | 7.77        |               |                                       |

Table 92: Nonzero coefficients at n=1000, binary design, dense covariates, and decay 50.

| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |
|---|
| AICc 219.14 186.37 173.07 187.93 $\rho = 0$ AIC 746.18 738.06 708.24 255.23 BIC 93.41 79.6 59.12 85.74  CV.1se 198.73 146.75 74.36 154.43 88.12 CV.min 305.62 236.71 102.89 223.18 151.13 $\operatorname{sd}(\mu)/\sigma = 2$ AICc 225.69 192.07 173.83 196.54 $\rho = 0.5$ AIC 751.72 743.47 714.42 268.57 BIC 91.97 79.48 58.92 86.63  CV.1se 205.35 151.83 76.5 155.42 90.38   |
| AIC       746.18       738.06       708.24       255.23       Oracle: 124.19         BIC       93.41       79.6       59.12       85.74       Oracle: 124.19         CV.1se       198.73       146.75       74.36       154.43       88.12         CV.min       305.62       236.71       102.89       223.18       151.13       sd(μ)/σ = 2         AICc       225.69       192.07       173.83       196.54 $\rho = 0.5$ AIC       751.72       743.47       714.42       268.57       Oracle: 123.77         BIC       91.97       79.48       58.92       86.63       Oracle: 123.77         CV.1se       205.35       151.83       76.5       155.42       90.38 |
| BIC         93.41         79.6         59.12         85.74         Oracle: 124.19           CV.1se         198.73         146.75         74.36         154.43         88.12           CV.min         305.62         236.71         102.89         223.18         151.13 $sd(\mu)/\sigma = 2$ AICc         225.69         192.07         173.83         196.54 $\rho = 0.5$ AIC         751.72         743.47         714.42         268.57         Oracle: 123.77           BIC         91.97         79.48         58.92         86.63         Oracle: 123.77           CV.1se         205.35         151.83         76.5         155.42         90.38               |
| BIC       93.41       79.6       59.12       85.74         CV.1se       198.73       146.75       74.36       154.43       88.12         CV.min       305.62       236.71       102.89       223.18       151.13 $sd(\mu)/\sigma = 2$ AICc       225.69       192.07       173.83       196.54 $\rho = 0.5$ AIC       751.72       743.47       714.42       268.57       Oracle: 123.77         BIC       91.97       79.48       58.92       86.63       Oracle: 123.77         CV.1se       205.35       151.83       76.5       155.42       90.38  |
| CV.min       305.62       236.71       102.89       223.18       151.13 $sd(\mu)/\sigma = 2$ AICc       225.69       192.07       173.83       196.54 $\rho = 0.5$ AIC       751.72       743.47       714.42       268.57       Oracle: 123.77         BIC       91.97       79.48       58.92       86.63       07acle: 123.77         CV.1se       205.35       151.83       76.5       155.42       90.38   |
| AICc       225.69       192.07       173.83       196.54 $\rho = 0.5$ AIC       751.72       743.47       714.42       268.57       Oracle: 123.77         BIC       91.97       79.48       58.92       86.63       Oracle: 123.77         CV.1se       205.35       151.83       76.5       155.42       90.38  |
| AIC       751.72       743.47       714.42       268.57         BIC       91.97       79.48       58.92       86.63         CV.1se       205.35       151.83       76.5       155.42       90.38  |
| BIC 91.97 79.48 58.92 86.63 Oracle: 123.77  CV.1se 205.35 151.83 76.5 155.42 90.38  |
| CV.1se 205.35 151.83 76.5 155.42 90.38  |
|   |
|   |
| CV.min 310.8 240.87 106.84 222.72 154.28 $sd(\mu)/\sigma = 2$   |
| AICc 229.17 195.05 174.06 196.76 $\rho = 0.9$   |
| AIC 748.26 740.18 711.04 267.17 Oracle: 123.58  |
| BIC 93.14 79.97 59.82 88.14   |
| CV.1se 93.86 62.93 32.51 119.46 63.86   |
| CV.min 192.97 130.58 51.98 203.89 153.25 $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc 158.06 135.07 182.65 166.58 $\rho = 0$   |
| AIC 824.28 813.34 804.09 356.82   |
| BIC 24.33 27.67 10.73 40.98 Oracle: 90.22   |
| CV.1se 97.87 66 32.8 126.4 57.39  |
| CV.min 202.76 137.52 52.74 209.57 142.98 $sd(\mu)/\sigma = 1$   |
| AICc 162.27 138.56 181.45 173.6 $\rho = 0.5$  |
| AIC 827.91 817.81 807.78 371.71   |
| BIC 17.21 24.66 10.35 38.9 Oracle: 90.23  |
| CV.1se 102.12 68.89 32.98 126.27 59.9   |
| CV.min 205.75 143.69 54.71 207.26 145.74 $sd(\mu)/\sigma = 1$   |
| AICc 163.21 141.64 181.46 175.05 $\rho = 0.9$   |
| AIC 825.37 814.97 803.91 365.56   |
| BIC 15.59 23.61 9.46 38.24 Oracle: 89.22  |
| CV.1se 4.84 1.78 0.27 76.42 3.58  |
| CV.min 67.74 22.94 3.4 182.61 $\operatorname{sd}(\mu)/\sigma = 0.5$   |
| AICc 73.42 78.11 61.22 134.75 $\rho = 0$  |
| AIC 873.7 862.77 873.73 462.82  |
| BIC 0.44 0.51 0 2.68 Oracle: 56.16  |
| CV.1se 3.35 1.25 0.14 79.35 2.72  |
| CV.min 61.22 21.26 2.7 184.1 58.35 $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc 69.75 75.45 78.41 136.51 $\rho = 0.5$  |
| AIC 874.96 864.43 874.21 477.01   |
| BIC 0.27 0.29 0 2.05 Oracle: 56.21  |
| CV.1se 3.16 1.02 0.17 76.28 1.82  |
| CV.min 62.94 22.13 2.83 179.17 59.51 $sd(\mu)/\sigma = 0.5$   |
| AICc 71.97 76.23 66.45 134.42 $\rho = 0.9$  |
| AIC 872.60 862.02 872.35 471.88   |
| BIC 0.27 0.33 0 1.82 Oracle: 56.5   |

Table 93: Nonzero coefficients at n=1000, binary design, dense covariates, and decay 100.

| CV.1se       294.74       224.66       128.15       228       238.61         CV.min       408.34       325.49       175.48       300.71       364.97 $sd(\mu)/\sigma =$ AICc       283.24       251.72       253.6       252.77 $\rho =$ AIC       788.18       776.49       752.2       369.07         DISC       46.61       97.42       90.46       100.75 | = 0   |
|---|-------|
| AICc 283.24 251.72 253.6 252.77 $\rho = \frac{1}{2}$  | = 0   |
| AIC 788 18 776 40 752 2 360 07  |       |
| AIC 788.18 776.49 752.2 369.07  | .71   |
|   | . / 1 |
| BIC 46.61 87.42 98.48 108.5   |       |
| CV.1se 305.57 235.05 129.77 235.3 226.11  |       |
| CV.min 421.3 339.42 181.28 308.14 350.87 $\operatorname{sd}(\mu)/\sigma =$  | = 2   |
| AICc 289.92 258.65 252.81 259.51 $\rho = 0$   | 0.5   |
| AIC 792.48 780.96 756.95 381.33 Oracle: 208.7   | 70    |
| BIC 22.87 81.48 100.23 103.41   | .19   |
| CV.1se 311.09 238.15 134.29 234.09 232  |       |
| CV.min 425.03 341.01 187.11 307.37 356.24 $\operatorname{sd}(\mu)/\sigma =$   | = 2   |
| AICc 291.91 259.85 252.12 258.04 $\rho = 0$   | 0.9   |
| AIC 790.06 779.16 754.31 381.4 Oracle: 209.4  | 12    |
| BIC 17.89 78.71 103.31 100.59   | .43   |
| CV.1se 117.97 66.72 16.48 162.68 114  |       |
| CV.min 242.29 150.86 44.91 252.26 244.73 $\operatorname{sd}(\mu)/\sigma =$  | = 1   |
| AICc 180.21 169.95 232.87 199.96 $\rho =$   |       |
| AIC 845.94 833.3 832.89 447.23  | 25    |
| BIC 0.76 2.67 0.19 13.48 Oracle: 143.2  | .25   |
| CV.1se 115.95 65.9 13.95 167.65 110.69  |       |
| CV.min 248.62 157.09 41.49 256.44 248.62 $\operatorname{sd}(\mu)/\sigma =$  | = 1   |
| AICc 180.51 173.18 234.91 204.3 $\rho = 0$  |       |
| AIC 848.75 836.24 834.17 457.89   | 4.4   |
| BIC 0.66 1.65 0.03 9.28 Oracle : 14   | 44    |
| CV.1se 118.78 69.51 12.47 166.55 110.96   |       |
| CV.min 251.2 160.55 41.95 252.97 249.02 $\operatorname{sd}(\mu)/\sigma =$   | = 1   |
| AICc 179.73 174.42 236.68 205.2 $\rho = 0$  |       |
| AIC 846 39 833 79 831 4 457 58  |       |
| BIC 0.45 1.24 0.13 8.69 Oracle: 143   | 3.6   |
| CV.1se 1.75 0.14 0.03 81.17 1.44  |       |
| CV.min 50.5 7.13 1.01 194.17 52.22 $\operatorname{sd}(\mu)/\sigma = 0$  | 0.5   |
| AICc 61.46 92.2 42.85 137.24 $\rho =$   |       |
| AIC 881.85 869.79 887.57 510.94   |       |
| BIC 0.11 0.05 0 0.89 Oracle: 77.9   | .92   |
| CV.1se 1.26 0.12 0.02 82.25 1.08  |       |
| CV.min 41.82 6.08 0.75 193.11 39.59 $\operatorname{sd}(\mu)/\sigma = 0$   | 0.5   |
| AICc 53.43 85.17 50.76 138.06 $\rho = 0$  |       |
| AIC 882 18 871 13 887 71 523 07   |       |
| BIC 0.08 0.04 0 0.8 Oracle : 78.0   | .04   |
| CV.1se 0.77 0.12 0.01 77.97 0.72  |       |
| CV.min 40.83 5.28 0.77 188.83 39.76 $sd(\mu)/\sigma = 0$  | 0.5   |
| AICc 54.18 85.55 46.09 134.93 $\rho = 0$  |       |
| AIC 880.12 868.15 885.31 516.08   |       |
| BIC 0.1 0.06 0 0.69 Oracle: 77  | 1.5   |

Table 94: Nonzero coefficients at n=1000, binary design, dense covariates, and decay 200.

|                  | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | marginal AL | sparsenet MCP |                                       |
|------------------|--------|--------------------------------|------------------------------|-------------|---------------|---------------------------------------|
| CV.1se           | 383.94 | 283.47                         | 150.44                       | 298.63      | 405.93        |                                       |
| CV.min           | 511.85 | 408.4                          | 245.72                       | 379.06      | 544.93        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 309.75 | 297.8                          | 336.43                       | 300.16      |               | $\rho = 0$                            |
| AIC              | 821.08 | 804.86                         | 787.57                       | 470.44      |               | Oracle : 293.07                       |
| BIC              | 0.35   | 1.58                           | 98.03                        | 13.45       |               | Oracie . 293.07                       |
| CV.1se           | 386.54 | 288.5                          | 148.59                       | 299.91      | 407.31        |                                       |
| CV.min           | 519.75 | 416.18                         | 245.95                       | 379.94      | 555.02        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 308.44 | 301.81                         | 337.2                        | 301.94      |               | $\rho = 0.5$                          |
| AIC              | 825.11 | 809.5                          | 790.08                       | 477.91      |               | Oracle: 293.71                        |
| BIC              | 0.33   | 0.69                           | 81.75                        | 8.08        |               | Oracie : 293.71                       |
| CV.1se           | 394    | 292.04                         | 145.63                       | 296.62      | 412.44        |                                       |
| CV.min           | 524.47 | 420.01                         | 245.65                       | 378.06      | 560.97        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 310.24 | 301.48                         | 337.78                       | 297.73      |               | $\rho = 0.9$                          |
| AIC              | 822.44 | 806.85                         | 788.27                       | 478.03      |               | 0 1 202.26                            |
| BIC              | 0.31   | 0.75                           | 77.53                        | 6.91        |               | Oracle: 293.26                        |
| CV.1se           | 99.77  | 23.82                          | 0.51                         | 186.02      | 105.59        |                                       |
| CV.min           | 259.46 | 100.91                         | 5.01                         | 285.17      | 263.4         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 167.62 | 192.74                         | 279.62                       | 211.05      |               | $\rho = 0$                            |
| AIC              | 859.47 | 844.17                         | 852.09                       | 513.5       |               | •                                     |
| BIC              | 0.17   | 0.12                           | 0                            | 2.08        |               | Oracle : 216.99                       |
| CV.1se           | 82.81  | 14.43                          | 0.27                         | 187.17      | 85.67         |                                       |
| CV.min           | 249.8  | 85.88                          | 3.7                          | 286.65      | 254.83        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 156.61 | 191.14                         | 283.4                        | 211.14      |               | $\rho = 0.5$                          |
| AIC              | 861.78 | 846.79                         | 852.79                       | 520.13      |               | ,                                     |
| BIC              | 0.14   | 0.12                           | 0                            | 1.62        |               | Oracle: 214.81                        |
| CV.1se           | 82.72  | 16.1                           | 0.28                         | 181.5       | 83.58         |                                       |
| CV.nin           | 249.18 | 91.76                          | 3.45                         | 279.84      | 253.07        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 158.92 | 189.29                         | 279.88                       | 210.19      | 233.07        | $\rho = 0.9$                          |
| AIC              | 859.39 | 844.07                         | 850.26                       | 519.86      |               | ,                                     |
| BIC              | 0.14   | 0.08                           | 0                            | 1.45        |               | <i>Oracle</i> : 215.03                |
| CV.1se           | 0.7    | 0.01                           | 0.01                         | 81.98       | 0.76          |                                       |
| CV.13C<br>CV.min | 36.36  | 2.03                           | 0.47                         | 198.47      | 36.68         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 46.73  | 112.57                         | 22.42                        | 139.26      | 30.00         | $\rho = 0$                            |
| AIC              | 885.63 | 873.54                         | 896.81                       | 537.14      |               | •                                     |
| BIC              | 0.07   | 0.01                           | 23.29                        | 0.52        |               | Oracle:90.72                          |
| CV.1se           | 0.69   | 0.01                           | 0                            | 80.73       | 0.67          |                                       |
| CV.13C<br>CV.min | 29.29  | 1.66                           | 0.39                         | 197.07      | 27.85         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 37.82  | 101.97                         | 23.89                        | 137.07      | 27.63         | $\rho = 0.5$                          |
| AICC             | 885.94 | 874.09                         | 896.62                       | 543         |               | $\rho = 0.5$                          |
| BIC              |        | 0.01                           |                              | 0.42        |               | <i>Oracle</i> : 91.39                 |
|                  | 0.05   |                                | 5.37                         |             | 0.56          |                                       |
| CV.1se           | 0.18   | 0.01                           | 0.01                         | 74.07       | 0.56          | ad()/- 0.5                            |
| CV.min           | 27.58  | 1.41                           | 0.33                         | 189.77      | 25.25         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 38.09  | 99.59                          | 23.41                        | 134.13      |               | $\rho = 0.9$                          |
| AIC              | 883.15 | 871.17                         | 893.98                       | 538.49      |               | Oracle: 89.48                         |
| BIC              | 0.06   | 0.01                           | 6.28                         | 0.45        |               |                                       |

Table 95: Nonzero coefficients at n=1000, continuous design, dense covariates, and decay 10.

|                  | lasso  | $\operatorname{GL} \gamma = 1$ |        | marginal AL | sparsenet MCP |                                       |
|------------------|--------|--------------------------------|--------|-------------|---------------|---------------------------------------|
| CV.1se           | 40.23  | 30.77                          | 20.09  | 29.14       | 18.78         |                                       |
| CV.min           | 103.76 | 78.8                           | 31.81  | 53.81       | 32.47         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 98.46  | 71.29                          | 25.58  | 50.62       |               | $\rho = 0$                            |
| AIC              | 609.88 | 607.64                         | 580.35 | 51.92       |               | Oracle : 33.25                        |
| BIC              | 30.07  | 25.32                          | 18.57  | 25.45       |               | 07 acic . 33.23                       |
| CV.1se           | 85.95  | 59.01                          | 22.88  | 35.13       | 18.98         |                                       |
| CV.min           | 173.58 | 132.96                         | 51.72  | 45.41       | 30.13         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 146.22 | 111.74                         | 45.27  | 45.18       |               | $\rho = 0.5$                          |
| AIC              | 539.76 | 539.6                          | 515.24 | 45.28       |               | Oracle : 32.89                        |
| BIC              | 39.09  | 29.4                           | 16.72  | 34.08       |               | Oracie . 32.89                        |
| CV.1se           | 150.02 | 120.25                         | 60.25  | 11.45       | 32.54         |                                       |
| CV.min           | 226.55 | 191.62                         | 98.54  | 12.54       | 58.04         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 190.68 | 160.9                          | 82.9   | 12.54       |               | $\rho = 0.9$                          |
| AIC              | 243    | 239.05                         | 197.57 | 12.54       |               | Oracle : 30.44                        |
| BIC              | 71.07  | 57.39                          | 20.73  | 12.46       |               | Oracie: 30.44                         |
| CV.1se           | 24.05  | 18.18                          | 12.51  | 38.68       | 11.99         |                                       |
| CV.min           | 77.57  | 53.9                           | 19.19  | 117.71      | 25.94         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 79.04  | 49.77                          | 13.8   | 97.49       |               | $\rho = 0$                            |
| AIC              | 741.44 | 735.3                          | 707.14 | 154.26      |               | 0 1 26 10                             |
| BIC              | 19.89  | 15.73                          | 10.19  | 18.04       |               | <i>Oracle</i> : 26.18                 |
| CV.1se           | 45.8   | 31.51                          | 12.76  | 65.94       | 12.36         |                                       |
| CV.min           | 125.9  | 93.68                          | 28.08  | 125.17      | 23.86         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 115.44 | 82.27                          | 24.26  | 112.66      |               | $\rho = 0.5$                          |
| AIC              | 688.78 | 684                            | 652.99 | 129.65      |               | ,                                     |
| BIC              | 19.86  | 15.23                          | 8.09   | 24.1        |               | <i>Oracle</i> : 25.84                 |
| CV.1se           | 62.36  | 64.82                          | 38.31  | 15.39       | 24.64         |                                       |
| CV.min           | 158.96 | 137.62                         | 66.45  | 26.62       | 50.78         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 141.65 | 114.83                         | 50.41  | 26.15       |               | $\rho = 0.9$                          |
| AIC              | 377.88 | 388.6                          | 358.26 | 26.24       |               | ,                                     |
| BIC              | 1.36   | 1.04                           | 1.11   | 15.95       |               | <i>Oracle</i> : 23.28                 |
| CV.1se           | 8.8    | 7                              | 4.92   | 44.83       | 5.08          |                                       |
| CV.min           | 48.52  | 28.86                          | 9.74   | 141.58      | 21.95         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 56.72  | 24.17                          | 4.06   | 106.35      |               | $\rho = 0$                            |
| AIC              | 829.75 | 821.38                         | 811.62 | 313.25      |               | ,                                     |
| BIC              | 8.98   | 6.23                           | 1.63   | 10.14       |               | <i>Oracle</i> : 19.21                 |
| CV.1se           | 4.39   | 5.4                            | 3.2    | 52.64       | 5.18          |                                       |
| CV.min           | 56.57  | 45.85                          | 11.03  | 139.38      | 16.07         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 66.87  | 38.72                          | 2.97   | 114.28      |               | $\rho = 0.5$                          |
| AIC              | 798.28 | 790.49                         | 773.39 | 252.81      |               | ,                                     |
| BIC              | 2.44   | 1.77                           | 0.96   | 3.45        |               | Oracle: 18.97                         |
| CV.1se           | 1.01   | 1                              | 1      | 12.12       | 1.22          |                                       |
| CV.nsc<br>CV.min | 6.89   | 5.06                           | 2.4    | 56.98       | 10.16         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 12.86  | 1.84                           | 1      | 55.73       | 10.10         | $\rho = 0.9$                          |
| AIC              | 533.45 | 552.92                         | 519.96 | 64.96       |               | ,                                     |
| BIC              | 1.36   | 1.03                           | 1      | 2.65        |               | <i>Oracle</i> : 16.45                 |
| DIC              | 1.50   | 1.03                           | 1      | 2.03        |               |                                       |

Table 96: Nonzero coefficients at n=1000, continuous design, dense covariates, and decay 50.

|                   | lasso  | $\operatorname{GL} \gamma = 1$ |        | marginal AL | sparsenet MCP |                                       |
|-------------------|--------|--------------------------------|--------|-------------|---------------|---------------------------------------|
| CV.1se            | 189.31 | 139.46                         | 73.87  | 147.15      | 91            |                                       |
| CV.min            | 294.18 | 225.93                         | 100.33 | 214.59      | 157.98        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 219.73 | 179.51                         | 129.5  | 189.09      |               | $\rho = 0$                            |
| AIC               | 744.98 | 736.27                         | 707.21 | 254.54      |               | Oracle: 122.78                        |
| BIC               | 92.2   | 75.5                           | 52.55  | 86.25       |               | Oracic . 122.76                       |
| CV.1se            | 286.64 | 223.7                          | 103.06 | 201.21      | 92.9          |                                       |
| CV.min            | 396.96 | 324.17                         | 154.11 | 258.04      | 140.39        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 282.54 | 240.41                         | 163.36 | 234.93      |               | $\rho = 0.5$                          |
| AIC               | 725.19 | 717.34                         | 686.23 | 275.34      |               | Oracle : 122.51                       |
| BIC               | 47.23  | 75.62                          | 59.96  | 85.34       |               | Oracie . 122.31                       |
| CV.1se            | 343.32 | 289.56                         | 174.1  | 48.16       | 139.93        |                                       |
| CV.min            | 433.1  | 383.15                         | 223.99 | 63.04       | 179.43        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 321.61 | 289.37                         | 208.99 | 62.33       |               | $\rho = 0.9$                          |
| AIC               | 439.84 | 423.48                         | 377.82 | 62.64       |               | Omasla , 110 51                       |
| BIC               | 1.5    | 1.05                           | 1.75   | 32.92       |               | Oracle: 119.51                        |
| CV.1se            | 94.13  | 62.87                          | 32.34  | 120.57      | 63.43         |                                       |
| CV.min            | 194.28 | 130.79                         | 51.03  | 205.17      | 151.64        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 156.58 | 120.05                         | 91.37  | 165.97      |               | $\rho = 0$                            |
| AIC               | 823.94 | 812.81                         | 803.32 | 357         |               |                                       |
| BIC               | 24.13  | 21.07                          | 1.31   | 40.85       |               | Oracle: 90.22                         |
| CV.1se            | 110.61 | 97.57                          | 41.36  | 149.28      | 57.1          |                                       |
| CV.min            | 247.13 | 199.81                         | 77.33  | 228.2       | 106.15        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 185.73 | 162.71                         | 130.64 | 196.87      |               | $\rho = 0.5$                          |
| AIC               | 813.03 | 804.22                         | 788.13 | 382.78      |               | '                                     |
| BIC               | 1.29   | 0.9                            | 0.12   | 4.35        |               | Oracle: 89.65                         |
| CV.1se            | 13.2   | 38.87                          | 28.91  | 46.86       | 86.02         |                                       |
| CV.min            | 91.69  | 148.19                         | 77.18  | 90.96       | 136.18        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 66.79  | 54.07                          | 51.49  | 87.81       |               | $\rho = 0.9$                          |
| AIC               | 567.7  | 553.16                         | 511.68 | 94.55       |               | '                                     |
| BIC               | 1.45   | 1.05                           | 1      | 3.31        |               | <i>Oracle</i> : 86.22                 |
| CV.1se            | 4.79   | 1.67                           | 0.21   | 79.02       | 3.63          |                                       |
| CV.min            | 66.4   | 24.39                          | 3.5    | 183.81      | 65.76         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 72.26  | 28.51                          | 0.32   | 135.4       |               | $\rho = 0$                            |
| AIC               | 872.68 | 861.48                         | 872.95 | 464.25      |               | ·                                     |
| BIC               | 0.38   | 0.09                           | 0      | 2.63        |               | <i>Oracle</i> : 55.94                 |
| CV.1se            | 0.13   | 0.05                           | 0.01   | 42.91       | 0.5           |                                       |
| CV.min            | 14.64  | 7.21                           | 0.83   | 146.94      | 13.54         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 30.47  | 3.29                           | 0.45   | 112.22      | 13.51         | $\rho = 0.5$                          |
| AIC               | 865.25 | 855.61                         | 859.09 | 477.54      |               | '                                     |
| BIC               | 0.16   | 0.07                           | 0      | 0.66        |               | <i>Oracle</i> : 55.62                 |
| CV.1se            | 0.17   | 0.19                           | 0.27   | 3.57        | 0.45          |                                       |
| CV.rise<br>CV.min | 7.51   | 4.62                           | 1.39   | 50.23       | 2.88          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 12.82  | 1.48                           | 0.93   | 56.12       | 2.00          | $\rho = 0.9$                          |
| AIC               | 694.36 | 675.13                         | 662.68 | 99.31       |               | i i                                   |
| BIC               | 1.3    | 1.01                           | 0.72   | 1.48        |               | Oracle: 52.3                          |
| БІС               | 1.3    | 1.01                           | 0.72   | 1.40        |               |                                       |

Table 97: Nonzero coefficients at n=1000, continuous design, dense covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 295.67 | 224.76                         | 126.9                    | 227.98      | 237.94        |                                       |
| CV.min | 409.33 | 324.61                         | 174.62                   | 300.53      | 365.75        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 283.83 | 244.32                         | 221.26                   | 252.41      |               | $\rho = 0$                            |
| AIC    | 787.27 | 775.72                         | 750.87                   | 367.77      |               | Oracle : 209.76                       |
| BIC    | 48.51  | 76.81                          | 94.48                    | 108.98      |               | 07 acic : 207.70                      |
| CV.1se | 381.43 | 313.85                         | 185.07                   | 258.75      | 183.17        |                                       |
| CV.min | 502.88 | 427.02                         | 253.3                    | 342.89      | 238.47        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 326.77 | 300.72                         | 247.32                   | 282.31      |               | $\rho = 0.5$                          |
| AIC    | 785.69 | 775.73                         | 749.02                   | 411.89      |               | Oracle: 209.36                        |
| BIC    | 0.79   | 0.54                           | 34.18                    | 3.68        |               | 07466.207.30                          |
| CV.1se | 424.02 | 368.39                         | 247.85                   | 61.94       | 209.98        |                                       |
| CV.min | 534.23 | 478.03                         | 314.91                   | 110.51      | 258.8         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 346.23 | 340.85                         | 289.79                   | 106.08      |               | $\rho = 0.9$                          |
| AIC    | 549.23 | 528.48                         | 478.09                   | 114.49      |               | Oracle : 205.71                       |
| BIC    | 1.48   | 1.05                           | 1                        | 2.21        |               | 07466.203.71                          |
| CV.1se | 118.11 | 65.7                           | 17.56                    | 164.9       | 113.82        |                                       |
| CV.min | 245.02 | 151.66                         | 45.64                    | 252.48      | 245.91        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 179.45 | 152.77                         | 172.19                   | 199.51      |               | $\rho = 0$                            |
| AIC    | 845.22 | 832.26                         | 831.89                   | 447.16      |               | Oracle: 143.47                        |
| BIC    | 0.88   | 0.61                           | 0.02                     | 14.12       |               | Oracie: 145.47                        |
| CV.1se | 22.33  | 21.53                          | 0.62                     | 140.9       | 25.15         |                                       |
| CV.min | 175.27 | 122.49                         | 6.11                     | 241.24      | 130.73        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 123.73 | 133.25                         | 175.33                   | 191.04      |               | $\rho = 0.5$                          |
| AIC    | 843.24 | 832.53                         | 824.17                   | 488.75      |               | 1 142 47                              |
| BIC    | 0.29   | 0.12                           | 0                        | 1.27        |               | Oracle: 143.47                        |
| CV.1se | 0.66   | 0.68                           | 0.53                     | 21.21       | 2.22          |                                       |
| CV.min | 9.09   | 8.97                           | 1.55                     | 88.13       | 14.64         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 16.5   | 1.8                            | 1.58                     | 92.84       |               | $\rho = 0.9$                          |
| AIC    | 648.45 | 629.05                         | 596.25                   | 147.76      |               | 1 120 45                              |
| BIC    | 1.46   | 1.04                           | 0.96                     | 1.54        |               | Oracle: 139.45                        |
| CV.1se | 1.41   | 0.22                           | 0.01                     | 84.18       | 1.24          |                                       |
| CV.min | 50.87  | 7.05                           | 0.99                     | 194.69      | 51.01         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 60.65  | 15.8                           | 0.77                     | 139.02      |               | $\rho = 0$                            |
| AIC    | 880.93 | 869.36                         | 887.1                    | 513.59      |               | ·                                     |
| BIC    | 0.09   | 0.01                           | 72.43                    | 0.91        |               | <i>Oracle</i> : 77.65                 |
| CV.1se | 0.03   | 0.01                           | 0                        | 33.29       | 0.46          |                                       |
| CV.min | 9.02   | 2.35                           | 0.31                     | 135.51      | 9.12          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 20.81  | 0.5                            | 0.54                     | 101.99      |               | $\rho = 0.5$                          |
| AIC    | 871.52 | 859.96                         | 871.15                   | 515.82      |               |                                       |
| BIC    | 0.06   | 0.01                           | 0                        | 0.35        |               | <i>Oracle</i> : 77.66                 |
| CV.1se | 0.03   | 0.04                           | 0.05                     | 0.93        | 0.44          |                                       |
| CV.min | 6.97   | 4.16                           | 1.25                     | 33.26       | 4.64          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 12.79  | 1.19                           | 0.34                     | 37.12       |               | $\rho = 0.9$                          |
| AIC    | 746.35 | 724.68                         | 727.14                   | 91.97       |               | ·                                     |
| BIC    | 0.72   | 0.56                           | 0.09                     | 1.17        |               | <i>Oracle</i> : 73.55                 |
|        | -      |                                |                          |             |               | L                                     |

Table 98: Nonzero coefficients at n=1000, continuous design, dense covariates, and decay 200.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|---|--------|--------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| AICc 308.96 290.14 321.3 300.18 $\rho = 0$ AIC 820.4 803.49 785.31 467.88 BIC 0.4 0.13 239.99 13.26 $\rho = 0$ CV.Ise 362.56 272.47 21.94 237.95 337.59 $\rho = 0.0$ CV.min 545.77 453.54 80.12 341.17 570.23 $\rho = 0.0$ AIC 206.92 294.14 346.83 258.82 $\rho = 0.5$ AIC 825.52 811.79 789.99 506.01 $\rho = 0.0$ BIC 0.18 0.06 11.17 1.12 $\rho = 0.0$ CV.min 367.65 299.18 8.68 108.77 236.57 $\rho = 0.0$ AIC 21.03 49.19 373.04 108.62 $\rho = 0.0$ AIC 655.08 630.68 585.9 205.08 BIC 1.43 1.02 0.83 1.57 $\rho = 0.0$ CV.min 262.26 97.96 5.38 285.37 264.16 $\rho = 0.0$ AIC 859.08 842.76 851.85 513.31 $\rho = 0.0$ AIC 859.08 842.76 851.85 513.31 $\rho = 0.0$ CV.min 43.6 11.7 0.7 220.4 43.56 $\rho = 0.0$ AIC 850.78 20.82 92.93 157.62 $\rho = 0.0$ AIC 850.78 20.82 92.93 157.62 $\rho = 0.0$ AIC 850.8 842.84 841.34 536.23 $\rho = 0.0$ CV.min 89.4 5.47 1.44 47.71 5.17 $\rho = 0.0$ AIC 19.13 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ CV.Ise 0.08 0.06 0.12 2.54 0.43 $\rho = 0.0$ AIC 19.13 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $\rho = 0.0$ AIC 19.13 695.50 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $\rho = 0.0$ CV.Ise 0.54 0.02 0.01 84.71 0.61 $\rho = 0.0$ AIC 885.04 873.33 897.03 543 $\rho = 0.0$ AIC 872.97 860.48 877.79 531.04 BIC 0.05 $\rho = 0.0$ AIC 872.97 860.48 877.79 531.04 BIC 0.05 $\rho = 0.0$ AIC 778.52 754.45 769.48 99.03 $\rho = 0.0$  |        |        |                                | 148.34                   |             |               |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        | 514.87 |                                |                          |             | 546.18        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                | 321.3                    |             |               | $\rho = 0$                            |
| Signature   Si  |        |        |                                |                          |             |               | Oracle : 203 21                       |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 0.4    |                                | 239.99                   | 13.26       |               | Oracie . 293.21                       |
| AICc 206.92 294.14 346.83 258.82 $\rho = 0.5$ AIC 825.52 811.79 789.99 506.01 BIC 0.18 0.06 11.17 1.12 $\rho = 0.5$ CV.1se 138.52 113.35 1.64 26.09 58.83 $\rho = 0.9$ AICc 21.03 49.19 373.04 108.62 $\rho = 0.9$ AICc 21.03 49.19 373.04 108.62 $\rho = 0.9$ AIC 655.08 630.68 585.9 205.08 BIC 1.43 1.02 0.83 1.57 $\rho = 0.9$ AIC 1.43 1.02 0.83 1.57 $\rho = 0.9$ AIC 1.44 1.72.26 167.66 211.65 $\rho = 0.9$ AIC 859.08 842.76 851.85 513.31 $\rho = 0.9$ AIC 859.08 842.76 851.85 513.31 $\rho = 0.9$ AIC CV.ise 1.16 0.22 0.01 100.15 0.94 CV.min 43.6 11.7 0.7 220.4 43.56 $\rho = 0.5$ AIC 856.8 842.84 841.34 536.23 $\rho = 0.5$ AIC 856.8 842.84 841.34 536.23 $\rho = 0.5$ AIC 856.8 842.84 841.34 536.23 $\rho = 0.5$ AIC 1.51 1.57 0.61 55.82 $\rho = 0.9$ AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $\rho = 0.9$ AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $\rho = 0.9$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 630.51 1.99 0.41 1.99.88 34.32 $\rho = 0.9$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 630.51 1.99 0.41 1.99.88 34.32 $\rho = 0.9$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 0 630.51 0.52 $\rho = 0.9$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 0 630.51 0.52 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 BIC 0.07 0 630.51 0.52 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 $\rho = 0.5$ AIC 11.34 0.51 0.04 32.27 $\rho = 0.5$ AIC 11.34 0.51   | CV.1se | 362.56 | 272.47                         |                          | 237.95      |               |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min |        | 453.54                         | 80.12                    | 341.17      | 570.23        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         0.18         0.06         11.17         1.12         Oracle : 293.08           CV.Ise         138.52         113.35         1.64         26.09         58.83         sd(μ)/σ = 2           AICe         21.03         49.19         373.04         108.62 $\rho = 0.9$ AIC         655.08         630.68         585.9         205.08         Oracle : 292.24           CV.1se         100.97         21.71         0.46         188.19         103.56           CV.min         262.26         97.96         5.38         285.37         264.16         sd(μ)/σ = 1           AIC         859.08         842.76         851.85         513.31         Oracle : 215.38           CV.1se         1.16         0.22         0.01         100.15         0.94           CV.1se         1.16         0.22         0.01         100.15         0.94           CV.min         43.6         11.7         0.7         220.4         43.56         sd(μ)/σ = 1           AIC         856.8         842.84         841.34         536.23         Oracle : 215.2           CV.lse         0.08         0.06         0.12         2.54         0.43           CV.min <td>AICc</td> <td>206.92</td> <td>294.14</td> <td>346.83</td> <td>258.82</td> <td></td> <td><math>\rho = 0.5</math></td>  | AICc   | 206.92 | 294.14                         | 346.83                   | 258.82      |               | $\rho = 0.5$                          |
| BIC         0.18         0.06         11.17         1.12           CV.Isic         138.52         113.35         1.64         26.09         58.83           CV.min         367.65         299.18         8.68         108.77         236.57 $sd(\mu)/\sigma = 2$ AICc         21.03         49.19         373.04         108.62 $\rho = 0.9$ AIC         655.08         630.68         585.9         205.08         Oracle : 292.24           CV.Ise         100.97         21.71         0.46         188.19         103.56           CV.Ise         100.97         21.71         0.46         188.19         103.56           CV.min         262.26         97.96         5.38         285.37         264.16 $sd(\mu)/\sigma = 1$ AIC         164.94         172.26         167.66         211.65 $\rho = 0$ AIC         859.08         842.76         851.85         513.31         Oracle : 215.38           CV.Ise         1.16         0.22         0.01         100.15         0.94           CV.Ise         1.16         0.22         0.01         100.15         0.94           CV.Ise         0.08         0.06   |        | 825.52 | 811.79                         | 789.99                   | 506.01      |               | Oracle : 203.08                       |
| $\begin{array}{c} \text{CV.min} & 367.65 \\ \text{AICc} & 21.03 \\ \text{AIC} & 21.03 \\ \text{AIJ} & 49.19 \\ \text{AIS} & 373.04 \\ \text{BIC} & 1.43 \\ \text{I.02} & 0.83 \\ \text{I.57} \\ \text{CV.1se} & 100.97 \\ \text{CV.min} & 262.26 \\ \text{AIC} & 97.96 \\ \text{AIC} & 164.94 \\ \text{I.72.26} & 167.66 \\ \text{AIC} & 164.94 \\ \text{I.72.26} & 167.66 \\ \text{AIC} & 11.65 \\ \text{AIC} & 10.02 \\ \text{CV.min} & 262.26 \\ \text{AIC} & 859.08 \\ \text{A42.76} & 851.85 \\ \text{S13.81} \\ \text{BIC} & 0.21 \\ \text{CV.min} & 43.6 \\ \text{AIC} & 11.7 \\ \text{AIC} & 50.78 \\ \text{AIC} & 20.82 \\ \text{AIC} & 856.8 \\ \text{B42.84} & 841.34 \\ \text{S41.34} & 536.23 \\ \text{BIC} & 0.09 \\ \text{CV.min} & 8.94 \\ \text{CV.min} & 8.94 \\ \text{CV.min} & 8.94 \\ \text{AIC} & 15.13 \\ \text{AIC} & 15.13 \\ \text{AIC} & 1.57 \\ \text{AIC} & 10.02 \\ \text{CV.min} & 36.97 \\ \text{AIC} & 0.78 \\ \text{AIC} & 87.33 \\ \text{AIC} & 87.32 \\ \text{AIC} & 17.52 \\ \text{AIC} & 17.58 \\ \text{CV.1se} & 0.02 \\ \text{O} & 0 & 0.99 \\ \text{AIC} & 17.52 \\ \text{AIC} & 17.52 \\ \text{AIC} & 17.53 \\ \text{AIC} & 17.53 \\ \text{AIC} & 17.52 \\ \text{AIC} & 17.58 \\ \text{AIC} & 17.52 \\ \text{AIC} & 17.58 \\ \text{AIC} & 17.52 \\ \text{AIC} & 17.58 \\ \text{AIC} & 17.59 \\ \text{AIC} & 17.59 \\ \text{AIC} & 17.59 \\ \text{AIC} & 17.59 \\ \text{AIC} & 17$ | BIC    | 0.18   | 0.06                           | 11.17                    | 1.12        |               | Oracie . 293.00                       |
| AICc 21.03 49.19 373.04 108.62 $\rho = 0.9$ AIC 655.08 630.68 585.9 205.08 BIC 1.43 1.02 0.83 1.57 $\rho = 0.9$ CV.1se 100.97 21.71 0.46 188.19 103.56 $\rho = 0.9$ AIC 164.94 172.26 167.66 211.65 $\rho = 0$ AIC 859.08 842.76 851.85 513.31 $\rho = 0.02$ Oracle : 215.38 DIC 0.21 0.02 57.73 2.33 $\rho = 0.01$ 0.01 0.01 0.01 0.49 $\rho = 0.09$ AIC 15.13 1.57 0.61 55.82 $\rho = 0.09$ 0.02 0 0 0.49 $\rho = 0.09$ AIC 15.13 1.57 0.61 55.82 $\rho = 0.09$ AIC 15.13 1.57 0.61 55.82 $\rho = 0.09$ AIC 885.04 873.33 897.03 543 DIC 0.07 0 630.51 0.52 $\rho = 0.09$ AIC 872.97 860.48 877.79 531.04 $\rho = 0.09$ AIC 872.97 860.48 877.79 531.04 $\rho = 0.09$ AIC 872.97 860.48 877.79 531.04 $\rho = 0.09$ AIC 872.97 860.48 877.9 531.04 $\rho = 0.09$ AIC 872.97 860.48 877.9 531.04 $\rho = 0.5$ AIC 872.97 860.48 877.9 531.04 $\rho = 0.5$ AIC 872.97 860.48 877.99 531.04 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 $\rho = 0.5$ AIC 872.97 860.48 877.99 531.04 $\rho = 0.5$ AIC 872.97 860.48 877.99 531.04 $\rho = 0.5$ AIC 872.97   | CV.1se | 138.52 | 113.35                         | 1.64                     | 26.09       | 58.83         |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        | 299.18                         | 8.68                     | 108.77      | 236.57        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         1.43         1.02         0.83         1.57         Oracle: 292.24           CV.1se         100.97         21.71         0.46         188.19         103.56 $sd(\mu)/\sigma = 1$ CV.min         262.26         97.96         5.38         285.37         264.16 $sd(\mu)/\sigma = 1$ AIC         164.94         172.26         167.66         211.65 $\rho = 0$ AIC         859.08         842.76         851.85         513.31         Dracle: 215.38           CV.1se         1.16         0.22         0.01         100.15         0.94           CV.nse         1.16         0.22         0.01         100.15         0.94           CV.min         43.6         11.7         0.7         220.4         43.56 $sd(\mu)/\sigma = 1$ AIC         856.8         842.84         841.34         536.23         Oracle: 215.2           CV.1se         0.08         0.06         0.12         2.54         0.43           CV.nin         8.94         5.47         1.44         47.71         5.17 $sd(\mu)/\sigma = 1$ AIC         719.38         695.56         676.52         227.69         Oracle: 211.72  | AICc   | 21.03  | 49.19                          | 373.04                   | 108.62      |               | $\rho = 0.9$                          |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | AIC    | 655.08 | 630.68                         | 585.9                    | 205.08      |               | Orgalo : 202 24                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 1.43   | 1.02                           | 0.83                     | 1.57        |               | Oracie : 292.24                       |
| AICc 164.94 172.26 167.66 211.65 $\rho = 0$ AIC 859.08 842.76 851.85 513.31 $\rho = 0$ AIC 859.08 842.76 851.85 513.31 $\rho = 0$ CV.1se 1.16 0.22 0.01 100.15 0.94 $\rho = 0$ CV.min 43.6 11.7 0.7 220.4 43.56 $\rho = 0$ AICc 50.78 20.82 92.93 157.62 $\rho = 0.5$ AIC 856.8 842.84 841.34 536.23 $\rho = 0.5$ BIC 0.09 0.02 0 0 0.49 $\rho = 0.5$ CV.1se 0.08 0.06 0.12 2.54 0.43 $\rho = 0.5$ AIC 15.13 1.57 0.61 55.82 $\rho = 0.9$ AIC 719.38 695.56 676.52 227.69 $\rho = 0.9$ AIC 719.38 695.56 676.52 227.69 $\rho = 0.9$ BIC 1.02 0.78 0.29 1.44 $\rho = 0.5$ CV.1se 0.54 0.02 0.01 84.71 0.61 $\rho = 0.5$ AIC 885.04 873.33 897.03 543 $\rho = 0.5$ AIC 885.04 873.33 897.03 543 $\rho = 0.5$ AIC 885.04 873.33 897.03 543 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 $\rho = 0.5$ AIC 1.34 0.51 0.04 32.27 $\rho = 0.9$ AIC 778.52 754.45 769.48 99.03 $\rho = 0.9$  | CV.1se | 100.97 | 21.71                          | 0.46                     | 188.19      | 103.56        |                                       |
| AIC 859.08 842.76 851.85 513.31 $Oracle: 215.38$ BIC 0.21 0.02 57.73 2.33 $Oracle: 215.38$ CV.1se 1.16 0.22 0.01 100.15 0.94 CV.min 43.6 11.7 0.7 220.4 43.56 $sd(\mu)/\sigma = 1$ AICc 50.78 20.82 92.93 157.62 $\rho = 0.5$ AIC 856.8 842.84 841.34 536.23 BIC 0.09 0.02 0 0.49 $Oracle: 215.2$ CV.1se 0.08 0.06 0.12 2.54 0.43 $Oracle: 215.2$ AIC 15.13 1.57 0.61 55.82 $\rho = 0.9$ AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $Oracle: 211.72$ CV.1se 0.54 0.02 0.01 84.71 0.61 $Oracle: 211.72$ AICc 46.82 11.92 0 138.77 $Oracle: 211.72$ AICc 885.04 873.33 897.03 543 $Oracle: 211.72$ DV.1se 0.07 0 630.51 0.52 $Oracle: 211.72$ CV.1se 0.02 0 0 29.41 0.44 $Oracle: 211.72$ AICc 17.58 0.3 0 98.87 $Oracle: 211.72$ AICc 17.58 0.3 0 98.87 $Oracle: 211.72$ BIC 0.05 0 16.53 0.3 $Oracle: 20.5$ AIC 872.97 860.48 877.79 531.04 $Oracle: 20.5$ AIC 872.97 860.48 877.99 531.04   | CV.min | 262.26 | 97.96                          | 5.38                     | 285.37      | 264.16        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         0.21         0.02         57.73         2.33         Oracle : 215.38           CV.1se         1.16         0.22         0.01         100.15         0.94           CV.min         43.6         11.7         0.7         220.4         43.56         sd(μ)/σ = 1           AICc         50.78         20.82         92.93         157.62 $\rho = 0.5$ AIC         856.8         842.84         841.34         536.23         Oracle : 215.2           BIC         0.09         0.02         0         0.49         Oracle : 215.2           CV.1se         0.08         0.06         0.12         2.54         0.43         Oracle : 215.2           CV.nin         8.94         5.47         1.44         47.71         5.17         sd(μ)/σ = 1           AIC         719.38         695.56         676.52         227.69         Oracle : 211.72           CV.1se         0.54         0.02         0.01         84.71         0.61           CV.nin         36.97         1.99         0.41         199.88         34.32         sd(μ)/σ = 0.5           AIC         885.04         873.33         897.03         543         Oracle : 91.35   | AICc   | 164.94 | 172.26                         | 167.66                   | 211.65      |               | $\rho = 0$                            |
| BIC         0.21         0.02         57.73         2.33           CV.Ise         1.16         0.22         0.01         100.15         0.94           CV.min         43.6         11.7         0.7         220.4         43.56 $sd(\mu)/\sigma = 1$ AIC         50.78         20.82         92.93         157.62 $\rho = 0.5$ AIC         856.8         842.84         841.34         536.23         Oracle : 215.2           BIC         0.09         0.02         0         0.49         Oracle : 215.2           CV.Ise         0.08         0.06         0.12         2.54         0.43           CV.min         8.94         5.47         1.44         47.71         5.17 $sd(\mu)/\sigma = 1$ AIC         15.13         1.57         0.61         55.82 $\rho = 0.9$ AIC         719.38         695.56         676.52         227.69         Oracle : 211.72           CV.Ise         0.54         0.02         0.01         84.71         0.61         column         colum   | AIC    | 859.08 | 842.76                         | 851.85                   | 513.31      |               | O1- 215 29                            |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 0.21   | 0.02                           | 57.73                    | 2.33        |               | Oracie : 215.38                       |
| AICc 50.78 20.82 92.93 157.62 $ρ = 0.5$ AIC 856.8 842.84 841.34 536.23 $ρ = 0.5$ BIC 0.09 0.02 0 0.49 $ρ = 0.5$ CV.1se 0.08 0.06 0.12 2.54 0.43 CV.min 8.94 5.47 1.44 47.71 5.17 $p = 0.9$ AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $p = 0.5$ AICc 46.82 11.92 0 138.77 $p = 0.5$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 630.51 0.52 $p = 0.9$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 630.51 0.52 $p = 0.5$ AIC 87.29 860.48 877.79 531.04 $p = 0.5$ AIC 87.29 860.48 877.79 531.04 $p = 0.5$ AIC 872.97 860.48 877.79 830.04 $p = 0.5$ AIC 872.97 860.48 877.79 80.03 $p = 0.5$ AIC 872.97 860.48 877.79 80.04 32.27 $p = 0.5$ AIC 872.97 860.48 877.99 872.90 $p = 0.5$ AIC 872.97 860.48 872.90 $p = 0.5$ AIC 872.97 873.45 769.48 99.03 $p = 0.5$ AIC 872.97 873.45 769.48 99.03   | CV.1se | 1.16   | 0.22                           | 0.01                     | 100.15      | 0.94          |                                       |
| AIC 856.8 842.84 841.34 536.23 $Oracle : 215.2$ BIC 0.09 0.02 0 0.49 $Oracle : 215.2$ CV.1se 0.08 0.06 0.12 2.54 0.43 $Oracle : 215.2$ CV.min 8.94 5.47 1.44 47.71 5.17 $Oracle : 215.2$ AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $Oracle : 211.72$ CV.1se 0.54 0.02 0.01 84.71 0.61 $Oracle : 211.72$ CV.min 36.97 1.99 0.41 199.88 34.32 $Oracle : 211.72$ AIC 885.04 873.33 897.03 543 $Oracle : 211.72$ BIC 0.07 0 630.51 0.52 $Oracle : 211.72$ CV.1se 0.02 0 0 0 29.41 0.44 $Oracle : 211.72$ AIC 872.97 860.48 877.79 531.04 $Oracle : 211.72$ Sd(μ)/ $Oracle : 211.72$ CV.1se 0.02 0 0 98.87 $Oracle : 211.72$ CV.1se 0.05 0 16.53 0.3 $Oracle : 211.72$ Sd(μ)/ $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ CV.1se 0.01 0.01 0.01 0.01 0.7 0.43 $Oracle : 211.72$ Oracle $Oracle : 211.72$  | CV.min | 43.6   | 11.7                           | 0.7                      | 220.4       | 43.56         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 0.09 0.02 0 0.49  | AICc   | 50.78  | 20.82                          | 92.93                    | 157.62      |               | $\rho = 0.5$                          |
| BIC 0.09 0.02 0 0.49  | AIC    | 856.8  | 842.84                         | 841.34                   | 536.23      |               | 0 1 215.2                             |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 0.09   | 0.02                           | 0                        |             |               | <i>Oracle</i> : 215.2                 |
| AICc 15.13 1.57 0.61 55.82 $\rho = 0.9$ AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $\rho = 0.9$ CV.1se 0.54 0.02 0.01 84.71 0.61 CV.min 36.97 1.99 0.41 199.88 34.32 $\rho = 0.5$ AICc 46.82 11.92 0 138.77 $\rho = 0.5$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 630.51 0.52 $\rho = 0.5$ CV.1se 0.02 0 0 0 29.41 0.44 CV.min 7.32 1.13 0.21 130.17 7.21 $\rho = 0.5$ AICc 17.58 0.3 0 98.87 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 BIC 0.05 0 16.53 0.3 $\rho = 0.5$ CV.1se 0.01 0.01 0.01 0.7 0.43 CV.min 5.43 2.73 0.68 30.47 4.77 $\rho = 0.5$ AICc 11.34 0.51 0.04 32.27 $\rho = 0.9$ AIC 778.52 754.45 769.48 99.03 $\rho = 0.9$   | CV.1se | 0.08   | 0.06                           | 0.12                     | 2.54        | 0.43          |                                       |
| AICc 15.13 1.57 0.61 55.82 $\rho = 0.9$ AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44 $\rho = 0.9$ Oracle : 211.72 $\rho = 0.9$ Oracle : 27.01   | CV.min | 8.94   | 5.47                           | 1.44                     | 47.71       | 5.17          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AIC 719.38 695.56 676.52 227.69 BIC 1.02 0.78 0.29 1.44    CV.1se 0.54 0.02 0.01 84.71 0.61 CV.min 36.97 1.99 0.41 199.88 34.32 $sd(\mu)/\sigma = 0.5$ AICc 46.82 11.92 0 138.77 $\rho = 0$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 630.51 0.52    CV.1se 0.02 0 0 29.41 0.44 CV.min 7.32 1.13 0.21 130.17 7.21 $sd(\mu)/\sigma = 0.5$ AICc 17.58 0.3 0 98.87 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 BIC 0.05 0 16.53 0.3    CV.1se 0.01 0.01 0.01 0.07 0.7 0.43 CV.min 5.43 2.73 0.68 30.47 4.77 $sd(\mu)/\sigma = 0.5$ AICc 11.34 0.51 0.04 32.27 $\rho = 0.9$ AIC 778.52 754.45 769.48 99.03    Oracle : 211.72 Oracle : 211.72 $Oracle : 211.72$  | AICc   |        |                                | 0.61                     | 55.82       |               |                                       |
| BIC 1.02 0.78 0.29 1.44  CV.1se 0.54 0.02 0.01 84.71 0.61  CV.min 36.97 1.99 0.41 199.88 34.32 $sd(\mu)/\sigma = 0.5$ AICc 46.82 11.92 0 138.77 $\rho = 0$ AIC 885.04 873.33 897.03 543  BIC 0.07 0 630.51 0.52  CV.1se 0.02 0 0 29.41 0.44  CV.min 7.32 1.13 0.21 130.17 7.21 $sd(\mu)/\sigma = 0.5$ AICc 17.58 0.3 0 98.87 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04  BIC 0.05 0 16.53 0.3  CV.1se 0.01 0.01 0.01 0.7 0.43  CV.min 5.43 2.73 0.68 30.47 4.77 $sd(\mu)/\sigma = 0.5$ AIC 11.34 0.51 0.04 32.27 $\rho = 0.9$ AIC 778.52 754.45 769.48 99.03  | AIC    |        |                                | 676.52                   | 227.69      |               | 0 1 211 72                            |
| $\begin{array}{ c c c c c c c }\hline \text{CV.1se} & 0.54 & 0.02 & 0.01 & 84.71 & 0.61 \\ \hline \text{CV.min} & 36.97 & 1.99 & 0.41 & 199.88 & 34.32 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ \hline \text{AICc} & 46.82 & 11.92 & 0 & 138.77 & & & & & \\ \hline \text{AIC} & 885.04 & 873.33 & 897.03 & 543 & & & \\ \hline \text{BIC} & 0.07 & 0 & 630.51 & 0.52 & & & & \\ \hline \text{CV.1se} & 0.02 & 0 & 0 & 29.41 & 0.44 \\ \hline \text{CV.min} & 7.32 & 1.13 & 0.21 & 130.17 & 7.21 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ \hline \text{AICc} & 17.58 & 0.3 & 0 & 98.87 & & & & \\ \hline \text{AIC} & 872.97 & 860.48 & 877.79 & 531.04 \\ \hline \text{BIC} & 0.05 & 0 & 16.53 & 0.3 & & & \\ \hline \text{CV.1se} & 0.01 & 0.01 & 0.01 & 0.7 & 0.43 \\ \hline \text{CV.min} & 5.43 & 2.73 & 0.68 & 30.47 & 4.77 & \operatorname{sd}(\mu)/\sigma = 0.5 \\ \hline \text{AICc} & 11.34 & 0.51 & 0.04 & 32.27 & & & \\ \hline \text{AIC} & 778.52 & 754.45 & 769.48 & 99.03 & & & \\ \hline \text{Oracle}: 87.01 \\ \hline \end{array}$   | BIC    |        | 0.78                           | 0.29                     |             |               | Oracle: 211.72                        |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se |        |                                |                          |             | 0.61          |                                       |
| AICc 46.82 11.92 0 138.77 $\rho = 0$ AIC 885.04 873.33 897.03 543 BIC 0.07 0 630.51 0.52  CV.1se 0.02 0 0 29.41 0.44  CV.min 7.32 1.13 0.21 130.17 7.21 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 17.58 0.3 0 98.87 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 BIC 0.05 0 16.53 0.3  CV.1se 0.01 0.01 0.01 0.7  CV.min 5.43 2.73 0.68 30.47 4.77 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 11.34 0.51 0.04 32.27 $\rho = 0.9$ AIC 778.52 754.45 769.48 99.03  |        | 36.97  |                                |                          |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC 885.04 873.33 897.03 543 $Oracle: 91.35$ BIC 0.07 0 630.51 0.52 $Oracle: 91.35$ CV.1se 0.02 0 0 29.41 0.44 CV.min 7.32 1.13 0.21 130.17 7.21 $sd(\mu)/\sigma = 0.5$ AICc 17.58 0.3 0 98.87 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 $Oracle: 90.94$ BIC 0.05 0 16.53 0.3 $Oracle: 90.94$ CV.1se 0.01 0.01 0.01 0.7 0.43 $Oracle: 90.94$ AIC 11.34 0.51 0.04 32.27 $Oracle: 87.01$ AIC 778.52 754.45 769.48 99.03  | AICc   |        |                                | 0                        |             |               | . , ,                                 |
| BIC         0.07         0         630.51         0.52           CV.1se         0.02         0         0         29.41         0.44           CV.min         7.32         1.13         0.21         130.17         7.21 $sd(\mu)/\sigma = 0.5$ AICc         17.58         0.3         0         98.87 $\rho = 0.5$ AIC         872.97         860.48         877.79         531.04         Oracle: 90.94           BIC         0.05         0         16.53         0.3         Oracle: 90.94           CV.1se         0.01         0.01         0.7         0.43         Oracle: 90.94           CV.min         5.43         2.73         0.68         30.47         4.77 $sd(\mu)/\sigma = 0.5$ AICc         11.34         0.51         0.04         32.27 $\rho = 0.9$ AIC         778.52         754.45         769.48         99.03         Oracle: 87.01  | AIC    | 885.04 |                                |                          | 543         |               | ·                                     |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 0.07   | 0                              | 630.51                   | 0.52        |               | <i>Oracle</i> : 91.35                 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se | 0.02   | 0                              | 0                        | 29.41       | 0.44          |                                       |
| AICc 17.58 0.3 0 98.87 $\rho = 0.5$ AIC 872.97 860.48 877.79 531.04 BIC 0.05 0 16.53 0.3 Oracle : 90.94 CV.1se 0.01 0.01 0.01 0.7 0.43 CV.min 5.43 2.73 0.68 30.47 4.77 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 11.34 0.51 0.04 32.27 $\rho = 0.9$ AIC 778.52 754.45 769.48 99.03  |        | 7.32   |                                |                          |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC       872.97       860.48       877.79       531.04       Oracle: 90.94         BIC       0.05       0       16.53       0.3       Oracle: 90.94         CV.1se       0.01       0.01       0.7       0.43         CV.min       5.43       2.73       0.68       30.47       4.77 $sd(\mu)/\sigma = 0.5$ AICc       11.34       0.51       0.04       32.27 $\rho = 0.9$ AIC       778.52       754.45       769.48       99.03       Oracle: 87.01   | AICc   | 17.58  | 0.3                            | 0                        | 98.87       |               | . , ,                                 |
| BIC         0.05         0         16.53         0.3         Oracle: 90.94           CV.1se         0.01         0.01         0.01         0.7         0.43           CV.min         5.43         2.73         0.68         30.47         4.77 $sd(\mu)/\sigma = 0.5$ AICc         11.34         0.51         0.04         32.27 $\rho = 0.9$ AIC         778.52         754.45         769.48         99.03         Oracle: 87.01  | AIC    |        | 860.48                         | 877.79                   |             |               | 0 1 00 04                             |
| CV.1se     0.01     0.01     0.01     0.7     0.43       CV.min     5.43     2.73     0.68     30.47     4.77 $sd(\mu)/\sigma = 0.5$ AICc     11.34     0.51     0.04     32.27 $\rho = 0.9$ AIC     778.52     754.45     769.48     99.03   | BIC    |        |                                | 16.53                    |             |               | <i>Oracle</i> : 90.94                 |
| CV.min 5.43 2.73 0.68 30.47 4.77 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 11.34 0.51 0.04 32.27 $\rho = 0.9$ AIC 778.52 754.45 769.48 99.03   | CV.1se |        |                                | 0.01                     |             | 0.43          |                                       |
| AICc 11.34 0.51 0.04 32.27 $\rho = 0.9$<br>AIC 778.52 754.45 769.48 99.03   |        |        |                                |                          |             |               | $sd(\mu)/\sigma = 0.5$                |
| AIC 778.52 754.45 769.48 99.03 Oracle: 87.01  |        |        |                                |                          |             |               | . , ,                                 |
| Dracle : X / 111  |        |        |                                |                          |             |               |                                       |
|   |        |        |                                |                          | 0.57        |               | <i>Oracie</i> : 87.01                 |

Table 99: Nonzero coefficients at n=1000, binary design, sparse covariates, and decay 10.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}~\gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--|--------|--------|--------------------------------|-------------------------|-------------|---------------|---------------------------------------|
| AICc 98.98 77.6 49.53 50.88 $\rho = 0$ AIC 610.24 607.85 580.06 51.93 BIC 30.26 26.27 20.03 25.44 $\rho = 0$ CV.1se 44.05 32.41 20.14 30.74 18.92 $\rho = 0$ AIC 104.11 81.17 52.37 52.6 $\rho = 0.5$ AIC 610.47 607.84 581.21 53.89 $\rho = 0.5$ AIC 610.47 607.84 581.21 53.89 $\rho = 0.5$ AIC 30.88 26.52 19.98 25.81 $\rho = 0.5$ CV.1se 46.51 33.25 20.37 30.94 18.89 $\rho = 0.5$ AIC 603.01 600.65 573.87 53.42 $\rho = 0.9$ AIC 603.01 600.65 573.87 53.42 $\rho = 0.9$ AIC 31.45 26.79 19.89 26.34 $\rho = 0.9$ AIC 77.65 53.99 19.18 115.31 26.75 $\rho = 0.9$ AIC 740.95 735.1 706.81 151.88 $\rho = 0$ AIC 740.95 735.1 706.81 151.88 $\rho = 0$ CV.1se 25.48 18.62 12.19 40.73 11.94 $\rho = 0.5$ AIC 83.27 62.65 48.1 99 $\rho = 0.5$ AIC 737.07 730.88 702.58 11.45 $\rho = 0.5$ AIC 737.07 730.88 702.58 151.4 BIC 19.8 16.68 11.48 18.41 $\rho = 0.5$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.5$ CV.1se 8.8 6.95 4.91 41.65 5.07 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.5$ CV.1se 8.8 6.95 4.91 41.65 5.07 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.5$ CV.1se 8.8 6.95 7.28 3.27 10.28 $\rho = 0.5$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.5$ CV.1se 8.8 6.95 7.28 3.27 10.28 $\rho = 0.5$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.5$ CV.1se 8.8 6.95 7.28 3.27 10.28 $\rho = 0.5$ CV.1se 8.92 58.6 42.8 41.65 105.83 $\rho = 0.5$ AIC 59.86 42   |        | 40.31  |                                | 20.05                   | 28.86       | 18.91         |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.min |        |                                |                         | 53.45       | 32.56         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         30.26         26.27         20.03         25.44         Oracle: 100           CV.Ise         44.05         32.41         20.14         30.74         18.92 $sd(\mu)/\sigma = 2$ AIC         104.11         81.17         52.37         52.6 $\rho = 0.5$ AIC         610.47         607.84         581.21         53.89         Oracle: 100           BIC         30.88         26.52         19.98         25.81         Oracle: 100           CV.Ise         46.51         33.25         20.37         30.94         18.89           CV.min         114.65         86.73         34.43         54.94         33.32 $sd(\mu)/\sigma = 2$ AIC         106.36         82.32         52.09         52.42 $\rho = 0.9$ AIC         603.01         600.65         573.87         53.42 $Oracle: 100$ CV.Ise         24.12         18         12.28         37.66         11.93 $cd(\mu)/\sigma = 1$ AIC         79.7         60.07         48.95         98.08 $\rho = 0$ AIC         740.95         735.1         706.81         151.88 $Oracle: 100$ CV.Is   |        | 98.98  |                                | 49.53                   |             |               | $\rho = 0$                            |
| Signature   Si   |        |        |                                |                         |             |               | Oracle : 100                          |
| $ \begin{array}{c} \text{CV.min} & 111.63 & 84.08 & 33.12 & 55.42 & 32.39 & \mathrm{sd}(\mu)/\sigma = 2 \\ \text{AICc} & 104.11 & 81.17 & 52.37 & 52.6 & \rho = 0.5 \\ \text{AIC} & 610.47 & 607.84 & 581.21 & 53.89 & Oracle : 100 \\ \text{BIC} & 30.88 & 26.52 & 19.98 & 25.81 & Oracle : 100 \\ \hline \text{CV.lise} & 46.51 & 33.25 & 20.37 & 30.94 & 18.89 & \text{cV.min} \\ \text{CV.min} & 114.65 & 86.73 & 34.43 & 54.94 & 33.32 & \mathrm{sd}(\mu)/\sigma = 2 \\ \text{AICc} & 106.36 & 82.32 & 52.09 & 52.42 & \rho = 0.9 \\ \text{AIC} & 603.01 & 600.65 & 573.87 & 53.42 & Oracle : 100 \\ \hline \text{CV.lise} & 24.12 & 18 & 12.28 & 37.66 & 11.93 & \text{CV.min} \\ \text{CV.min} & 77.65 & 53.99 & 19.18 & 115.31 & 26.75 & \mathrm{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 79.7 & 60.07 & 48.95 & 98.08 & Oracle : 100 \\ \hline \text{CV.lise} & 25.48 & 18.62 & 12.19 & 40.73 & 11.94 & \text{cV.min} \\ \text{CV.min} & 82.88 & 57.91 & 18.81 & 119.38 & 24.97 & \mathrm{sd}(\mu)/\sigma = 1 \\ \text{AICc} & 83.27 & 62.65 & 48.1 & 99 & \rho = 0.5 \\ \hline \text{AIC} & 740.95 & 735.1 & 706.81 & 151.88 & Oracle : 100 \\ \hline \text{CV.lise} & 25.48 & 18.62 & 12.19 & 40.73 & 11.94 & \text{cV.min} \\ \hline \text{CV.min} & 82.88 & 57.91 & 18.81 & 119.38 & 24.97 & \mathrm{sd}(\mu)/\sigma = 1 \\ \hline \text{AICc} & 83.27 & 62.65 & 48.1 & 99 & \rho = 0.5 \\ \hline \text{AIC} & 742.55 & 736.42 & 708.63 & 158.35 & Oracle : 100 \\ \hline \text{CV.lise} & 27.06 & 19.2 & 12.25 & 40.53 & 11.86 & \text{cV.min} \\ \hline \text{CV.min} & 85.96 & 60.33 & 19.87 & 114.79 & 25.6 & \mathrm{sd}(\mu)/\sigma = 1 \\ \hline \text{AICc} & 85.49 & 64.06 & 48.59 & 100.28 & \rho = 0.9 \\ \hline \text{AIC} & 737.07 & 730.88 & 702.58 & 151.4 & Oracle : 100 \\ \hline \text{CV.lise} & 8.8 & 6.95 & 4.91 & 41.65 & 5.07 & \text{cV.min} \\ \hline \text{AIC} & 829.25 & 820.55 & 811.29 & 314.29 & \text{oracle} : 100 \\ \hline \text{CV.lise} & 8.95 & 7.28 & 3.27 & 10.28 & Oracle : 100 \\ \hline \text{CV.lise} & 8.74 & 6.96 & 4.82 & 45.44 & 4.89 & \text{cV.min} \\ \hline \text{CV.lin} & 50.7 & 31.3 & 9.68 & 143.2 & 20.67 & \mathrm{sd}(\mu)/\sigma = 0.5 \\ \hline \text{AIC} & 831.69 & 823.13 & 813.1 & 319.72 & Oracle : 100 \\ \hline \text{CV.lise} & 9.09 & 6.99 & 4.67 & 42.87 & 4.94 & \text{cV.min} \\ \hline \text{CV.lise} & 9.09 & 6.99 & 4.67 & 42.87 & 4.94 & \text{cV.min} \\ \hline \text{CV.lise} & 9.09 & 6.99 & 4.67 & 42.87 & 4.94 & \text{cV.min} \\ \hline \text{CV.lise} & 9.09 & 6.99 & 4.67 & 42.87 &$   | BIC    |        | 26.27                          |                         |             |               | 07 acic . 100                         |
| AICc 104.11 81.17 52.37 52.6 $\rho = 0.5$ AIC 610.47 607.84 581.21 53.89 BIC 30.88 26.52 19.98 25.81 $\rho = 0.5$ CV.1se 46.51 33.25 20.37 30.94 18.89 CV.min 114.65 86.73 34.43 54.94 33.32 $\rho = 0.9$ AIC 106.36 82.32 52.09 52.42 $\rho = 0.9$ AIC 603.01 600.65 573.87 53.42 BIC 31.45 26.79 19.89 26.34 $\rho = 0.9$ CV.lise 24.12 18 12.28 37.66 11.93 $\rho = 0.9$ AIC 79.7 60.07 48.95 98.08 $\rho = 0.9$ AIC 740.95 735.1 706.81 151.88 BIC 19.82 16.68 11.65 18.05 $\rho = 0.9$ AIC 82.88 57.91 18.81 119.38 24.97 $\rho = 0.9$ AIC 742.55 736.42 708.63 158.35 $\rho = 0.5$ AIC 747.56 60.33 19.87 114.79 25.6 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.92 82.86 9.81 139.88 22.67 $\rho = 0.9$ AIC 82.93 82.31 83.11 195.62 $\rho = 0.9$ AIC 82.93 82.31 83.11 195.62 $\rho = 0.9$ AIC 82.94 60.96 4.82 45.44 4.89 $\rho = 0.9$ AIC 82.95 86 42.8 41.65 105.83 $\rho = 0.9$ AIC 82.95 86 42.8 41.65 105.83 $\rho = 0.9$ AIC 82.95 86 42.8 41.65 105.83 $\rho = 0.9$ AIC 82.95 86 42.8 41.65 105.83 $\rho = 0.9$ AIC 82.97 82.97 9.71 136.41 20.61 $\rho = 0.9$ AIC 82.97 82.97 9.71 136.41 20.61 $\rho = 0.9$ AIC 82.76 819.49 808.99 303.88 $\rho = 0.9$ AIC 82.76 819.49 808.99 303.88 $\rho = 0.9$ A  |        |        |                                |                         |             |               |                                       |
| AIC 610.47 607.84 581.21 53.89 $Oracle:100$ BIC 30.88 26.52 19.98 25.81 $Oracle:100$ $Or$  | CV.min |        |                                |                         |             | 32.39         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         30.88         26.52         19.98         25.81         Oracle: 100           CV. Ise         46.51         33.25         20.37         30.94         18.89         sd(μ)/σ = 2           CV.min         114.65         86.73         34.43         54.94         33.32         sd(μ)/σ = 2           AIC         106.36         82.32         52.09         52.42         ρ = 0.9           AIC         603.01         600.65         573.87         53.42         Oracle : 100           EV.1se         24.12         18         12.28         37.66         11.93           CV.nise         24.12         18         12.28         37.66         11.93           CV.min         77.65         53.99         19.18         115.31         26.75         sd(μ)/σ = 1           AIC         79.7         60.07         48.95         98.08         ρ = 0.7           AIC         740.95         735.1         706.81         151.88           BIC         19.82         16.68         11.65         18.05           CV.lise         25.48         18.62         12.19         40.73         11.94           CV.min         82.88         57.91         18.81   | AICc   | 104.11 | 81.17                          | 52.37                   | 52.6        |               | $\rho = 0.5$                          |
| BIC         30.88         26.52         19.98         25.81           CV.1se         46.51         33.25         20.37         30.94         18.89           CV.min         114.65         86.73         34.43         54.94         33.32         sd(μ)/σ = 2           AICc         106.36         82.32         52.09         52.42 $\rho$ = 0.9           AIC         603.01         600.65         573.87         53.42         Oracle : 100           CV.Ise         24.12         18         12.28         37.66         11.93           CV.min         77.65         53.99         19.18         115.31         26.75         sd(μ)/σ = 1           AIC         79.7         60.07         48.95         98.08 $\rho$ = 0           AIC         740.95         735.1         706.81         151.88         Oracle : 100           CV.lse         25.48         18.62         12.19         40.73         11.94         cv.min         82.88         57.91         18.81         119.38         24.97         sd(μ)/σ = 1         ρ = 0.5         AIC         742.55         736.42         708.63         158.35         Oracle : 100         Oracle : 100         Oracle : 100         Oracle : 100<  | AIC    |        |                                | 581.21                  | 53.89       |               | Oracle : 100                          |
| $\begin{array}{c} \text{CV.min} & 114.65 \\ \text{AICc} & 106.36 \\ \text{A2.32} \\ \text{S2.09} \\ \text{S2.09} \\ \text{S2.42} \\ \text{S2.09} \\ \text{S2.42} \\ \text{Oracle} : 100 \\ \text{Oracle} : 100 \\ \text{Oracle} : 100 \\ \text{CV.1se} & 24.12 \\ \text{AIC} \\ \text{CV.min} & 77.65 \\ \text{S3.99} \\ \text{IS} & 19.89 \\ \text{AIC} \\ \text{CV.min} & 77.65 \\ \text{S3.99} \\ \text{IS} & 19.89 \\ \text{AIC} \\ \text{CV.min} & 77.65 \\ \text{S3.99} \\ \text{IS} & 19.18 \\ \text{II} & 15.31 \\ \text{IS} & 12.28 \\ \text{S37.66} \\ \text{II.93} \\ \text{CV.min} \\ \text{AICc} & 79.7 \\ \text{G0.07} & 48.95 \\ \text{98.08} \\ \text{Pe} = 0 \\ \text{AIC} \\ \text{T40.95} & 735.1 \\ \text{T06.81} \\ \text{II5.88} \\ \text{BIC} \\ \text{II9.82} & 16.68 \\ \text{II.65} \\ \text{II.65} \\ \text{II.65} \\ \text{II.805} \\ \text{CV.Inin} \\ \text{S2.88} \\ \text{S7.91} \\ \text{II.881} \\ \text{II19.38} \\ \text{24.97} \\ \text{Sd}(\mu)/\sigma = 1 \\ \text{AICc} \\ \text{S3.27} \\ \text{G2.65} \\ \text{48.1} \\ \text{99} \\ \text{Pe} = 0.5 \\ \text{AIC} \\ \text{T42.55} \\ \text{736.42} \\ \text{708.63} \\ \text{I1.68} \\ \text{I1.48} \\ \text{II.479} \\ \text{CV.Inin} \\ \text{S5.96} \\ \text{G0.33} \\ \text{II.9.87} \\ \text{II.4.79} \\ \text{II.4.79} \\ \text{25.6} \\ \text{Sd}(\mu)/\sigma = 1 \\ \text{Pe} = 0.5 \\ \text{AICc} \\ \text{S5.49} \\ \text{G4.06} \\ \text{48.59} \\ \text{II0.028} \\ \text{Oracle} : 100 \\ \text{CV.Inin} \\ \text{S5.96} \\ \text{G0.33} \\ \text{II.48} \\ \text{II.48} \\ \text{II.49} \\ \text{II.479} \\ \text{25.6} \\ \text{Sd}(\mu)/\sigma = 1 \\ \text{Pe} = 0.9 \\ \text{AIC} \\ \text{T37.07} \\ \text{730.88} \\ \text{702.58} \\ \text{I51.4} \\ \text{BIC} \\ \text{II.991} \\ \text{II.668} \\ \text{II.48} \\ \text{II.48} \\ \text{II.48} \\ \text{II.49} \\ \text{CV.Inin} \\ \text{47.95} \\ \text{28.46} \\ \text{9.81} \\ \text{139.88} \\ \text{22.67} \\ \text{Sd}(\mu)/\sigma = 0.5 \\ \text{AICc} \\ \text{8.778} \\ \text{39.55} \\ \text{38.41} \\ \text{105.62} \\ \text{Pe} = 0 \\ \text{Oracle} : 100 \\ \text{CV.Ise} \\ \text{8.74} \\ \text{6.96} \\ \text{4.82} \\ \text{45.44} \\ \text{4.89} \\ \text{CV.min} \\ \text{50.7} \\ \text{31.3} \\ \text{9.68} \\ \text{143.2} \\ \text{20.67} \\ \text{Sd}(\mu)/\sigma = 0.5 \\ \text{Oracle} : 100 \\ \text{CV.Ise} \\ \text{9.09} \\ \text{6.99} \\ \text{4.67} \\ \text{42.87} \\ \text{4.94} \\ \text{CV.min} \\ \text{52.97} \\ \text{32.97} \\ \text{9.71} \\ \text{136.41} \\ \text{20.61} \\ \text{Sd}(\mu)/\sigma = 0.5 \\ \text{Oracle} : 100 \\ \text{Oracle}$ | BIC    |        |                                |                         |             |               | 07acic . 100                          |
| AICc 106.36 82.32 52.09 52.42 $\rho = 0.9$ AIC 603.01 600.65 573.87 53.42 $\rho = 0.9$ BIC 31.45 26.79 19.89 26.34 $\rho = 0.9$ CV.1se 24.12 18 12.28 37.66 11.93 $\rho = 0.9$ AIC 79.7 60.07 48.95 98.08 $\rho = 0.9$ AIC 740.95 735.1 706.81 151.88 $\rho = 0.9$ AIC 19.82 16.68 11.65 18.05 $\rho = 0.9$ AIC 82.54 18.62 12.19 40.73 11.94 $\rho = 0.9$ AIC 83.27 62.65 48.1 99 $\rho = 0.9$ AIC 742.55 736.42 708.63 158.35 $\rho = 0.5$ AIC 742.55 736.42 708.63 158.35 $\rho = 0.5$ AIC 742.55 736.42 708.63 158.35 $\rho = 0.5$ AIC 85.49 64.06 48.59 100.28 $\rho = 0.9$ AIC 73.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ AIC 73.07 730.88 702.58 151.4 $\rho = 0.9$ AIC 73.07 730.88 702.58 151.4 $\rho = 0.9$ AIC 82.25 82.55 811.29 314.29 $\rho = 0.5$ AIC 82.25 82.55 811.29 314.29 $\rho = 0.5$ AIC 82.25 82.55 811.29 314.29 $\rho = 0.5$ AIC 83.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 83.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 83.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 82.67 819.49 808.99 303.88 $\rho = 0.9$ AIC 82.67 819.49 808.99 303.88 $\rho = 0.9$ AIC 82.67 819.49 808.99 303.88   | CV.1se | 46.51  | 33.25                          | 20.37                   | 30.94       | 18.89         |                                       |
| AIC 603.01 600.65 573.87 53.42 $Oracle:100$ CV.1se 24.12 18 12.28 37.66 11.93 $Oracle:100$ CV.min 77.65 53.99 19.18 115.31 26.75 $oracle:100$ AICc 79.7 60.07 48.95 98.08 $oracle:100$ AIC 740.95 735.1 706.81 151.88 $oracle:100$ CV.min 82.88 57.91 18.81 119.38 24.97 $oracle:100$ CV.min 82.88 57.91 18.81 119.38 24.97 $oracle:100$ AIC 742.55 736.42 708.63 158.35 $oracle:100$ CV.1se 25.48 18.62 12.19 40.73 11.94 $oracle:100$ CV.min 82.88 57.91 18.81 119.38 24.97 $oracle:100$ CV.min 82.88 57.91 18.81 119.38 24.97 $oracle:100$ CV.1se 27.06 19.2 12.25 40.53 11.86 $oracle:100$ CV.1se 27.06 19.2 12.25 40.53 11.86 $oracle:100$ CV.min 85.96 60.33 19.87 114.79 25.6 $oracle:100$ AIC 737.07 730.88 702.58 151.4 $oracle:100$ CV.1se 8.84 6.95 4.91 41.65 5.07 $oracle:100$ CV.1se 8.8 6.95 4.91 41.65 5.07 $oracle:100$ CV.1se 8.8 6.95 4.91 41.65 5.07 $oracle:100$ CV.1se 8.95 7.28 3.27 10.28 $oracle:100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle:100$ CV.1se 8.90 6.99 4.67 42.87 4.94 $oracle:100$ CV.1se 9.09 6.99 4.67 42.87 4.94 $oracle:100$   | CV.min | 114.65 | 86.73                          | 34.43                   | 54.94       | 33.32         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC 31.45 26.79 19.89 26.34 $Oracle : 100$ CV.1se 24.12 18 12.28 37.66 11.93 $Oracle : 100$ CV.min 77.65 53.99 19.18 115.31 26.75 $oracle : 100$ AIC 79.7 60.07 48.95 98.08 $oracle : 100$ AIC 740.95 735.1 706.81 151.88 BIC 19.82 16.68 11.65 18.05 $Oracle : 100$ CV.1se 25.48 18.62 12.19 40.73 11.94 $oracle : 100$ CV.min 82.88 57.91 18.81 119.38 24.97 $oracle : 100$ AIC 83.27 62.65 48.1 99 $oracle : 100$ AIC 742.55 736.42 708.63 158.35 BIC 19.8 16.57 11.68 18.14 $oracle : 100$ CV.1se 27.06 19.2 12.25 40.53 11.86 $oracle : 100$ CV.1se 27.06 19.2 12.25 40.53 11.86 $oracle : 100$ AIC 85.49 64.06 48.59 100.28 $oracle : 100$ AIC 737.07 730.88 702.58 151.4 $oracle : 100$ BIC 19.91 16.68 11.48 18.43 $oracle : 100$ CV.1se 8.8 6.95 4.91 41.65 5.07 $oracle : 100$ CV.1se 8.8 6.95 4.91 41.65 5.07 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 8.74 6.96 4.82 45.44 4.89 $oracle : 100$ CV.1se 9.09 6.99 4.67 4.287 4.94 $oracle : 100$ CV.1se 9.09 6.99 4.67 4.287 4.94 $oracle : 100$ CV.1se 9.09 6.99 4.67 4.287 4.94 $oracle : 100$ CV.1se 9.09 6.99 4.67 4.287 4.94 $oracle : 100$ AIC 60.81 42.54 42.61 105.16 $oracle : 100$ AIC 60.81 42.54 42.61 10   | AICc   | 106.36 | 82.32                          | 52.09                   | 52.42       |               | $\rho = 0.9$                          |
| BIC         31.45         26.79         19.89         26.34           CV.1se         24.12         18         12.28         37.66         11.93           CV.min         77.65         53.99         19.18         115.31         26.75 $sd(\mu)/\sigma = 1$ AIC         740.95         735.1         706.81         151.88         Oracle : 100           CV.1se         25.48         18.62         12.19         40.73         11.94           CV.min         82.88         57.91         18.81         119.38         24.97 $sd(\mu)/\sigma = 1$ AIC         83.27         62.65         48.1         99 $\rho = 0.5$ AIC         742.55         736.42         708.63         158.35         Oracle : 100           EV.1se         27.06         19.2         12.25         40.53         11.86 $cv.$ min         85.96         60.33         19.87         114.79         25.6 $sd(\mu)/\sigma = 1$ AIC         737.07         730.88         702.58         151.4         Oracle : 100           CV.nin         47.95         28.46         9.81         139.88         22.67 $sd(\mu)/\sigma = 0.5$ CV.lse         8   | AIC    | 603.01 | 600.65                         | 573.87                  | 53.42       |               | Orgalo : 100                          |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 31.45  | 26.79                          | 19.89                   | 26.34       |               | Oracie . 100                          |
| AICc 79.7 60.07 48.95 98.08 $\rho = 0$ AIC 740.95 735.1 706.81 151.88 BIC 19.82 16.68 11.65 18.05  CV.1se 25.48 18.62 12.19 40.73 11.94 CV.min 82.88 57.91 18.81 119.38 24.97 $\rho = 0.5$ AIC 83.27 62.65 48.1 99 $\rho = 0.5$ AIC 742.55 736.42 708.63 158.35 $\rho = 0.5$ BIC 19.8 16.57 11.68 18.14  CV.nin 85.96 60.33 19.87 114.79 25.6 $\rho = 0.5$ AIC 85.49 64.06 48.59 100.28 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43  CV.1se 8.8 6.95 4.91 41.65 5.07  CV.min 47.95 28.46 9.81 139.88 22.67 $\rho = 0.5$ AIC 829.25 820.55 811.29 314.29 BIC 8.95 7.28 3.27 10.28  CV.1se 8.74 6.96 4.82 45.44 4.89 CV.min 50.7 31.3 9.68 143.2 20.67 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 BIC 8.24 6.9 3.23 9.92  CV.1se 9.09 6.99 4.67 42.87 4.94  CV.min 52.76 819.49 808.99 303.88   | CV.1se | 24.12  | 18                             | 12.28                   | 37.66       | 11.93         |                                       |
| AIC 740.95 735.1 706.81 151.88 $Oracle: 100$ $Oracle: 10$  | CV.min | 77.65  | 53.99                          | 19.18                   | 115.31      | 26.75         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 19.82 16.68 11.65 18.05  | AICc   | 79.7   | 60.07                          | 48.95                   | 98.08       |               | $\rho = 0$                            |
| BIC         19.82         16.68         11.65         18.05           CV.1se         25.48         18.62         12.19         40.73         11.94           CV.min         82.88         57.91         18.81         119.38         24.97 $sd(\mu)/\sigma = 1$ AIC         83.27         62.65         48.1         99 $\rho = 0.5$ AIC         742.55         736.42         708.63         158.35         Oracle : 100           BIC         19.8         16.57         11.68         18.14         Oracle : 100           CV.1se         27.06         19.2         12.25         40.53         11.86           CV.min         85.96         60.33         19.87         114.79         25.6 $sd(\mu)/\sigma = 1$ AIC         85.49         64.06         48.59         100.28 $\rho = 0.9$ AIC         737.07         730.88         702.58         151.4         Oracle : 100           CV.1se         8.8         6.95         4.91         41.65         5.07           CV.min         47.95         28.46         9.81         139.88         22.67 $sd(\mu)/\sigma = 0.5$ AIC         829.25 <td< td=""><td>AIC</td><td>740.95</td><td>735.1</td><td>706.81</td><td>151.88</td><td></td><td>01100</td></td<>   | AIC    | 740.95 | 735.1                          | 706.81                  | 151.88      |               | 01100                                 |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 19.82  | 16.68                          | 11.65                   | 18.05       |               | Oracie: 100                           |
| AICc 83.27 62.65 48.1 99 $\rho = 0.5$ AIC 742.55 736.42 708.63 158.35 $\rho = 0.5$ BIC 19.8 16.57 11.68 18.14 $\rho = 0.5$ CV.1se 27.06 19.2 12.25 40.53 11.86 $\rho = 0.5$ CV.min 85.96 60.33 19.87 114.79 25.6 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 $\rho = 0.9$ AIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ CV.1se 8.8 6.95 4.91 41.65 5.07 $\rho = 0.5$ AICc 829.25 820.55 811.29 314.29 BIC 8.95 7.28 3.27 10.28 $\rho = 0.5$ AIC 829.25 820.55 811.29 314.29 $\rho = 0.5$ AIC 829.25 820.55 81.29 314.29 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 829.7 32.97 9.71 136.41 20.61 $\rho = 0.5$ AIC 82.97 32.97 9.71 136.41 20.61 $\rho = 0.5$ AIC 82.97 32.97 9.71 136.41 20.61 $\rho = 0.5$ AIC 82.97 32.97 9.71 136.41 20.61 $\rho = 0.5$ AIC 82.97 81.49 808.99 303.88  | CV.1se | 25.48  | 18.62                          | 12.19                   | 40.73       | 11.94         |                                       |
| AIC 742.55 736.42 708.63 158.35 $BIC$ 19.8 16.57 11.68 18.14 $CV.1se$ 27.06 19.2 12.25 40.53 11.86 $CV.min$ 85.96 60.33 19.87 114.79 25.6 $cV.min$ 85.96 64.06 48.59 100.28 $cV.min$ 85.49 64.06 48.59 100.28 $cV.min$ 85.49 16.68 11.48 18.43 $cV.1se$ 8.8 6.95 4.91 41.65 5.07 $cV.1se$ 8.8 6.95 4.91 41.65 5.07 $cV.min$ 47.95 28.46 9.81 139.88 22.67 $cV.min$ 47.95 28.46 9.81 139.88 22.67 $cV.1se$ 829.25 820.55 811.29 314.29 $cV.1se$ 8.95 7.28 3.27 10.28 $cV.1se$ 8.74 6.96 4.82 45.44 4.89 $cV.1se$ 8.74 6.96 4.87 41.65 105.83 $cV.1se$ 8.74 6.99 3.23 9.92 $cV.1se$ 8.74 6.99 3.297 9.71 136.41 20.61 $cV.1se$ 8.74 6.99 6.99 4.67 42.87 4.94 $cV.1se$ 9.09 6.99 4.67 42.87 4.94 $cV.1se$  | CV.min | 82.88  | 57.91                          | 18.81                   | 119.38      | 24.97         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         19.8         16.57         11.68         18.14         Oracle: 100           CV.1se         27.06         19.2         12.25         40.53         11.86           CV.min         85.96         60.33         19.87         114.79         25.6         sd(μ)/σ = 1           AICc         85.49         64.06         48.59         100.28         ρ = 0.9           AIC         737.07         730.88         702.58         151.4         Oracle: 100           BIC         19.91         16.68         11.48         18.43         Oracle: 100           CV.1se         8.8         6.95         4.91         41.65         5.07           CV.min         47.95         28.46         9.81         139.88         22.67         sd(μ)/σ = 0.5           AIC         829.25         820.55         811.29         314.29         Oracle: 100           BIC         8.95         7.28         3.27         10.28         Oracle: 100           CV.1se         8.74         6.96         4.82         45.44         4.89           CV.min         50.7         31.3         9.68         143.2         20.67         sd(μ)/σ = 0.5           AIC         831.69<  | AICc   | 83.27  | 62.65                          | 48.1                    | 99          |               | $\rho = 0.5$                          |
| BIC         19.8         16.57         11.68         18.14           CV.1se         27.06         19.2         12.25         40.53         11.86           CV.min         85.96         60.33         19.87         114.79         25.6 $sd(\mu)/\sigma = 1$ AIC         85.49         64.06         48.59         100.28 $\rho = 0.9$ AIC         737.07         730.88         702.58         151.4         Oracle: 100           BIC         19.91         16.68         11.48         18.43         Oracle: 100           CV.1se         8.8         6.95         4.91         41.65         5.07           CV.min         47.95         28.46         9.81         139.88         22.67 $sd(\mu)/\sigma = 0.5$ AIC         829.25         820.55         811.29         314.29         Oracle: 100           BIC         8.95         7.28         3.27         10.28         Oracle: 100           CV.1se         8.74         6.96         4.82         45.44         4.89           CV.min         50.7         31.3         9.68         143.2         20.67 $sd(\mu)/\sigma = 0.5$ AIC         831.69         823.1  | AIC    | 742.55 | 736.42                         | 708.63                  | 158.35      |               | Oma ala . 100                         |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 19.8   | 16.57                          | 11.68                   | 18.14       |               | Oracie: 100                           |
| AICc 85.49 64.06 48.59 100.28 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ CV.1se 8.8 6.95 4.91 41.65 5.07 CV.min 47.95 28.46 9.81 139.88 22.67 $\rho = 0.5$ AICc 57.78 39.55 38.41 105.62 $\rho = 0.5$ AIC 829.25 820.55 811.29 314.29 BIC 8.95 7.28 3.27 10.28 $\rho = 0.5$ CV.min 50.7 31.3 9.68 143.2 20.67 $\rho = 0.5$ AICc 59.86 42.8 41.65 105.83 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 8.24 6.9 3.23 9.92 $\rho = 0.5$ CV.1se 9.09 6.99 4.67 42.87 4.94 CV.min 52.97 32.97 9.71 136.41 20.61 $\rho = 0.5$ AIC 827.67 819.49 808.99 303.88  | CV.1se | 27.06  | 19.2                           | 12.25                   | 40.53       | 11.86         |                                       |
| AICc 85.49 64.06 48.59 100.28 $\rho = 0.9$ AIC 737.07 730.88 702.58 151.4 $\rho = 0.9$ BIC 19.91 16.68 11.48 18.43 $\rho = 0.9$ CV.1se 8.8 6.95 4.91 41.65 5.07 CV.min 47.95 28.46 9.81 139.88 22.67 $\rho = 0.5$ AICc 57.78 39.55 38.41 105.62 $\rho = 0.5$ AIC 829.25 820.55 811.29 314.29 BIC 8.95 7.28 3.27 10.28 $\rho = 0.5$ CV.1se 8.74 6.96 4.82 45.44 4.89 CV.min 50.7 31.3 9.68 143.2 20.67 $\rho = 0.5$ AICc 59.86 42.8 41.65 105.83 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 $\rho = 0.5$ AIC 8.24 6.9 3.23 9.92 $\rho = 0.5$ CV.1se 9.09 6.99 4.67 42.87 4.94 CV.min 52.97 32.97 9.71 136.41 20.61 $\rho = 0.5$ AICc 60.81 42.54 42.61 105.16 $\rho = 0.9$ AIC 827.67 819.49 808.99 303.88   | CV.min | 85.96  | 60.33                          | 19.87                   | 114.79      | 25.6          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         19.91         16.68         11.48         18.43         Oracle: 100           CV.1se         8.8         6.95         4.91         41.65         5.07           CV.min         47.95         28.46         9.81         139.88         22.67 $sd(\mu)/\sigma = 0.5$ AICc         57.78         39.55         38.41         105.62 $\rho = 0$ AIC         829.25         820.55         811.29         314.29         Oracle: 100           BIC         8.95         7.28         3.27         10.28         Oracle: 100           CV.1se         8.74         6.96         4.82         45.44         4.89 $Oracle: 100$ AICc         59.86         42.8         41.65         105.83 $\rho = 0.5$ $Oracle: 100$ BIC         8.24         6.9         3.23         9.92         Oracle: 100           CV.1se         9.09         6.99         4.67         42.87         4.94           CV.min         52.97         32.97         9.71         136.41         20.61 $sd(\mu)/\sigma = 0.5$ AICc         60.81         42.54         42.61         105.16 $\rho = 0.9$  | AICc   | 85.49  | 64.06                          | 48.59                   | 100.28      |               | $\rho = 0.9$                          |
| BIC         19.91         16.68         11.48         18.43           CV.1se         8.8         6.95         4.91         41.65         5.07           CV.min         47.95         28.46         9.81         139.88         22.67 $sd(\mu)/\sigma = 0.5$ AICc         57.78         39.55         38.41         105.62 $\rho = 0$ AIC         829.25         820.55         811.29         314.29         Oracle: 100           BIC         8.95         7.28         3.27         10.28         Oracle: 100           CV.1se         8.74         6.96         4.82         45.44         4.89 $\sigma = 0.5$ CV.min         50.7         31.3         9.68         143.2         20.67 $sd(\mu)/\sigma = 0.5$ AICc         59.86         42.8         41.65         105.83 $\rho = 0.5$ AIC         831.69         823.13         813.1         319.72         Oracle: 100           CV.1se         9.09         6.99         4.67         42.87         4.94           CV.min         52.97         32.97         9.71         136.41         20.61 $sd(\mu)/\sigma = 0.5$ AIC         60.81   | AIC    | 737.07 | 730.88                         | 702.58                  | 151.4       |               | Oma ala . 100                         |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 19.91  | 16.68                          | 11.48                   | 18.43       |               | Oracie: 100                           |
| AICc 57.78 39.55 38.41 105.62 $\rho = 0$ AIC 829.25 820.55 811.29 314.29 BIC 8.95 7.28 3.27 10.28  CV.1se 8.74 6.96 4.82 45.44 4.89 CV.min 50.7 31.3 9.68 143.2 20.67 $sd(\mu)/\sigma = 0.5$ AICc 59.86 42.8 41.65 105.83 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 BIC 8.24 6.9 3.23 9.92  CV.1se 9.09 6.99 4.67 42.87 4.94 CV.min 52.97 32.97 9.71 136.41 20.61 $sd(\mu)/\sigma = 0.5$ AICc 60.81 42.54 42.61 105.16 $\rho = 0.9$ AIC 827.67 819.49 808.99 303.88  | CV.1se | 8.8    | 6.95                           | 4.91                    | 41.65       | 5.07          |                                       |
| AIC         829.25         820.55         811.29         314.29           BIC         8.95         7.28         3.27         10.28           CV.1se         8.74         6.96         4.82         45.44         4.89           CV.min         50.7         31.3         9.68         143.2         20.67 $sd(μ)/σ = 0.5$ AICc         59.86         42.8         41.65         105.83 $ρ = 0.5$ AIC         831.69         823.13         813.1         319.72         Oracle: 100           BIC         8.24         6.9         3.23         9.92         Oracle: 100           CV.1se         9.09         6.99         4.67         42.87         4.94           CV.min         52.97         32.97         9.71         136.41         20.61 $sd(μ)/σ = 0.5$ AICc         60.81         42.54         42.61         105.16 $ρ = 0.9$ AIC         827.67         819.49         808.99         303.88         Oracle: 100   | CV.min | 47.95  | 28.46                          | 9.81                    | 139.88      | 22.67         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| BIC         8.95         7.28         3.27         10.28         Oracle: 100           CV.1se         8.74         6.96         4.82         45.44         4.89           CV.min         50.7         31.3         9.68         143.2         20.67 $sd(\mu)/\sigma = 0.5$ AICc         59.86         42.8         41.65         105.83 $\rho = 0.5$ AIC         831.69         823.13         813.1         319.72         Oracle: 100           BIC         8.24         6.9         3.23         9.92         Oracle: 100           CV.1se         9.09         6.99         4.67         42.87         4.94           CV.min         52.97         32.97         9.71         136.41         20.61 $sd(\mu)/\sigma = 0.5$ AICc         60.81         42.54         42.61         105.16 $\rho = 0.9$ AIC         827.67         819.49         808.99         303.88         Oracle: 100   | AICc   | 57.78  | 39.55                          | 38.41                   | 105.62      |               | $\rho = 0$                            |
| BIC         8.95         7.28         3.27         10.28           CV.1se         8.74         6.96         4.82         45.44         4.89           CV.min         50.7         31.3         9.68         143.2         20.67 $sd(\mu)/\sigma = 0.5$ AIC         59.86         42.8         41.65         105.83 $\rho = 0.5$ AIC         831.69         823.13         813.1         319.72         Oracle: 100           BIC         8.24         6.9         3.23         9.92         Oracle: 100           CV.1se         9.09         6.99         4.67         42.87         4.94           CV.min         52.97         32.97         9.71         136.41         20.61 $sd(\mu)/\sigma = 0.5$ AIC         60.81         42.54         42.61         105.16 $\rho = 0.9$ AIC         827.67         819.49         808.99         303.88         Oracle: 100   | AIC    | 829.25 | 820.55                         | 811.29                  | 314.29      |               | Ongolo : 100                          |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | 8.95   | 7.28                           | 3.27                    | 10.28       |               | Oracie: 100                           |
| AICc 59.86 42.8 41.65 105.83 $\rho = 0.5$ AIC 831.69 823.13 813.1 319.72 BIC 8.24 6.9 3.23 9.92 Oracle : 100  CV.1se 9.09 6.99 4.67 42.87 4.94 CV.min 52.97 32.97 9.71 136.41 20.61 $sd(\mu)/\sigma = 0.5$ AICc 60.81 42.54 42.61 105.16 $\rho = 0.9$ AIC 827.67 819.49 808.99 303.88  | CV.1se | 8.74   | 6.96                           | 4.82                    | 45.44       | 4.89          |                                       |
| AIC       831.69       823.13       813.1       319.72         BIC       8.24       6.9       3.23       9.92         CV.1se       9.09       6.99       4.67       42.87       4.94         CV.min       52.97       32.97       9.71       136.41       20.61 $sd(\mu)/\sigma = 0.5$ AICc       60.81       42.54       42.61       105.16 $\rho = 0.9$ AIC       827.67       819.49       808.99       303.88       Oracle: 100  | CV.min | 50.7   | 31.3                           | 9.68                    | 143.2       | 20.67         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| BIC       8.24       6.9       3.23       9.92       Oracle: 100         CV.1se       9.09       6.99       4.67       42.87       4.94         CV.min       52.97       32.97       9.71       136.41       20.61 $sd(\mu)/\sigma = 0.5$ AICc       60.81       42.54       42.61       105.16 $\rho = 0.9$ AIC       827.67       819.49       808.99       303.88       Oracle: 100   | AICc   | 59.86  | 42.8                           | 41.65                   | 105.83      |               | $\rho = 0.5$                          |
| BIC       8.24       6.9       3.23       9.92         CV.1se       9.09       6.99       4.67       42.87       4.94         CV.min       52.97       32.97       9.71       136.41       20.61 $sd(\mu)/\sigma = 0.5$ AICc       60.81       42.54       42.61       105.16 $\rho = 0.9$ AIC       827.67       819.49       808.99       303.88       Oracle: 100   | AIC    | 831.69 | 823.13                         | 813.1                   | 319.72      |               | Oma ala . 100                         |
| CV.min 52.97 32.97 9.71 136.41 20.61 $\operatorname{sd}(\mu)/\sigma = 0.5$<br>AICc 60.81 42.54 42.61 105.16 $\rho = 0.9$<br>AIC 827.67 819.49 808.99 303.88  | BIC    | 8.24   | 6.9                            | 3.23                    | 9.92        |               | Oracie: 100                           |
| AICc 60.81 42.54 42.61 105.16 $\rho = 0.9$<br>AIC 827.67 819.49 808.99 303.88  | CV.1se | 9.09   | 6.99                           | 4.67                    | 42.87       | 4.94          |                                       |
| AIC 827.67 819.49 808.99 303.88  | CV.min | 52.97  | 32.97                          | 9.71                    | 136.41      | 20.61         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| $\perp Imagle : 100$   | AICc   | 60.81  | 42.54                          | 42.61                   | 105.16      |               | $\rho = 0.9$                          |
| BIC 7.99 6.61 3.12 9.98  | AIC    | 827.67 | 819.49                         | 808.99                  | 303.88      |               | Oma al a . 100                        |
|  | BIC    | 7.99   | 6.61                           | 3.12                    | 9.98        |               | Oracie: 100                           |

Table 100: Nonzero coefficients at n=1000, binary design, sparse covariates, and decay 50.

|                  | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |   |
|------------------|--------|--------------------------------|--------------------------|-------------|---------------|---|
| CV.1se           | 175.43 | 131.08                         | 74.19                    | 139.5       | 83.2          |   |
| CV.min           | 273.32 | 210.69                         | 97.36                    | 202.52      | 140           | $\operatorname{sd}(\mu)/\sigma = 2$     |
| AICc             | 212.68 | 178.18                         | 151.76                   | 181.73      |               | $\rho = 0$                              |
| AIC              | 742.41 | 733.99                         | 705                      | 242.57      |               | Oracle: 100                             |
| BIC              | 96.16  | 82.53                          | 61.51                    | 87.36       |               | Oracie : 100                            |
| CV.1se           | 188.41 | 140.01                         | 74.22                    | 147.32      | 81.29         |   |
| CV.min           | 289.76 | 221.83                         | 99.21                    | 213.1       | 134.08        | $\operatorname{sd}(\mu)/\sigma = 2$     |
| AICc             | 219.83 | 186.01                         | 157.36                   | 189.56      |               | $\rho = 0.5$                            |
| AIC              | 747.09 | 739.6                          | 711.53                   | 257.5       |               | Oracle: 100                             |
| BIC              | 96.13  | 82.15                          | 61.47                    | 87.16       |               | Oracie: 100                             |
| CV.1se           | 194.84 | 144.12                         | 76.4                     | 148.48      | 84.21         |   |
| CV.min           | 294.36 | 226.66                         | 103.29                   | 212.98      | 137.41        | $\operatorname{sd}(\mu)/\sigma = 2$     |
| AICc             | 224.82 | 188.63                         | 156.12                   | 190.14      |               | $\rho = 0.9$                            |
| AIC              | 744.2  | 736.1                          | 707.58                   | 256.68      |               | , |
| BIC              | 98.35  | 83.67                          | 62.07                    | 89.85       |               | Oracle: 100                             |
| CV.1se           | 92.82  | 63.09                          | 33.42                    | 116.47      | 61.88         |   |
| CV.min           | 189.27 | 129.13                         | 52.46                    | 199.8       | 146.01        | $\operatorname{sd}(\mu)/\sigma = 1$     |
| AICc             | 156.92 | 133.8                          | 177.89                   | 165.06      |               | $\rho = 0$                              |
| AIC              | 822.82 | 812.25                         | 802.46                   | 349.39      |               | ,                                       |
| BIC              | 27.09  | 29.39                          | 12.51                    | 42.5        |               | Oracle: 100                             |
| CV.1se           | 97.71  | 66.33                          | 34.01                    | 123.65      | 56.4          |   |
| CV.min           | 200.44 | 136.59                         | 53.86                    | 206.79      | 135.58        | $\operatorname{sd}(\mu)/\sigma = 1$     |
| AICc             | 160.48 | 137.61                         | 178.76                   | 171.72      |               | $\rho = 0.5$                            |
| AIC              | 826.98 | 816.89                         | 806.41                   | 366.05      |               | ,                                       |
| BIC              | 20.09  | 26.68                          | 12.12                    | 40.6        |               | Oracle: 100                             |
| CV.1se           | 101.85 | 69.13                          | 34.08                    | 124.03      | 58.66         |   |
| CV.min           | 203.2  | 142.1                          | 54.92                    | 203.48      | 139.78        | $\operatorname{sd}(\mu)/\sigma = 1$     |
| AICc             | 161.88 | 139.63                         | 170.51                   | 170.88      | 10,110        | $\rho = 0.9$                            |
| AIC              | 824.07 | 813.66                         | 803.39                   | 359.09      |               | ,                                       |
| BIC              | 18.13  | 25.73                          | 11.32                    | 40.25       |               | Oracle: 100                             |
| CV.1se           | 5.14   | 1.94                           | 0.32                     | 75.75       | 3.89          |   |
| CV.min           | 68.01  | 23.77                          | 3.63                     | 181.1       | 65.78         | $sd(\mu)/\sigma = 0.5$                  |
| AICc             | 73.78  | 78.02                          | 58.36                    | 134.92      | 00.70         | $\rho = 0$                              |
| AIC              | 873.17 | 862.19                         | 872.83                   | 460.57      |               | ,                                       |
| BIC              | 0.42   | 0.54                           | 0                        | 2.88        |               | Oracle: 100                             |
| CV.1se           | 3.73   | 1.4                            | 0.22                     | 79.67       | 2.83          |   |
| CV.rsc<br>CV.min | 62.83  | 22.25                          | 2.8                      | 184.49      | 60.13         | $\operatorname{sd}(\mu)/\sigma = 0.5$   |
| AICc             | 71.13  | 76.14                          | 77.37                    | 136.84      | 00.12         | $\rho = 0.5$                            |
| AIC              | 874.64 | 863.95                         | 873.95                   | 476.73      |               | ,                                       |
| BIC              | 0.32   | 0.31                           | 0                        | 2.06        |               | Oracle: 100                             |
| CV.1se           | 3.54   | 1.18                           | 0.2                      | 75.93       | 2.03          |   |
| CV.1sc<br>CV.min | 64.88  | 23.58                          | 3.04                     | 178.4       | 60.99         | $\operatorname{sd}(\mu)/\sigma = 0.5$   |
| AICc             | 72.02  | 78.07                          | 69.22                    | 134.39      | 00.77         | $\rho = 0.9$                            |
| AIC              | 872.43 | 861.77                         | 871.47                   | 470.23      |               |   |
| BIC              | 0.32   | 0.36                           | 0                        | 2           |               | Oracle: 100                             |
| ыс               | 0.32   | 0.30                           | U                        |             |               |   |

Table 101: Nonzero coefficients at n=1000, binary design, sparse covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 215.4  | 157.96                         | 101.28                          | 173.47      | 101.32        |                                       |
| CV.min | 309.72 | 229.02                         | 117.87                          | 231.36      | 130.33        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 237.05 | 193.49                         | 141.41                          | 206.89      |               | $\rho = 0$                            |
| AIC    | 768.26 | 758.21                         | 735.21                          | 298.73      |               | Oracle: 100                           |
| BIC    | 134.84 | 115.96                         | 90.19                           | 124.51      |               | 07 acte . 100                         |
| CV.1se | 231.16 | 169.53                         | 103.44                          | 185.96      | 103.13        |                                       |
| CV.min | 328.69 | 242.85                         | 120.28                          | 246.37      | 127.02        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 249.65 | 202.7                          | 145.94                          | 218.38      |               | $\rho = 0.5$                          |
| AIC    | 772.58 | 763.08                         | 739.67                          | 313.69      |               | Oracle: 100                           |
| BIC    | 139.79 | 120.25                         | 92.05                           | 128.5       |               | Oracle: 100                           |
| CV.1se | 237.69 | 173.96                         | 105.44                          | 187.29      | 107.38        |                                       |
| CV.min | 332.46 | 247.39                         | 124.42                          | 246.92      | 131.25        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 251.99 | 205.79                         | 146.88                          | 219.8       |               | $\rho = 0.9$                          |
| AIC    | 769.94 | 760.51                         | 737.48                          | 314.21      |               | Oma ala . 100                         |
| BIC    | 141.89 | 122.11                         | 92.61                           | 130.1       |               | Oracle: 100                           |
| CV.1se | 119.45 | 79.11                          | 35.38                           | 148.1       | 108.55        |                                       |
| CV.min | 228.04 | 153.54                         | 64.93                           | 229.09      | 220.12        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 181.78 | 160.48                         | 201.95                          | 189         |               | $\rho = 0$                            |
| AIC    | 839.55 | 827.34                         | 826                             | 408.19      |               | ·                                     |
| BIC    | 1.65   | 10.06                          | 1.15                            | 31.29       |               | Oracle: 100                           |
| CV.1se | 123.87 | 82.92                          | 34.86                           | 155.56      | 107.96        |                                       |
| CV.min | 239.32 | 163.23                         | 67.23                           | 237.8       | 225.34        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 186.12 | 166.46                         | 203.71                          | 194.05      |               | $\rho = 0.5$                          |
| AIC    | 842.41 | 831.19                         | 827.35                          | 420.37      |               | ,                                     |
| BIC    | 1.13   | 5.19                           | 0.59                            | 22.8        |               | Oracle: 100                           |
| CV.1se | 129.01 | 85.92                          | 34.2                            | 155.18      | 109.89        |                                       |
| CV.min | 243.13 | 167.63                         | 66.68                           | 233.79      | 226.19        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 187.36 | 169.38                         | 204.68                          | 196.69      |               | $\rho = 0.9$                          |
| AIC    | 840    | 828.47                         | 824.8                           | 420.29      |               |                                       |
| BIC    | 0.91   | 4.39                           | 0.79                            | 19.91       |               | Oracle: 100                           |
| CV.1se | 2.57   | 0.43                           | 0.05                            | 80.47       | 2.17          |                                       |
| CV.min | 59.44  | 10.68                          | 1.48                            | 189.97      | 58.18         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 66.39  | 89.24                          | 43.93                           | 139.2       |               | $\rho = 0$                            |
| AIC    | 879.35 | 868.09                         | 884.4                           | 496.45      |               | ·                                     |
| BIC    | 0.15   | 0.08                           | 0                               | 1.19        |               | Oracle: 100                           |
| CV.1se | 1.88   | 0.18                           | 0.02                            | 82.72       | 1.39          |                                       |
| CV.min | 50.8   | 9.75                           | 1.01                            | 191.88      | 50.04         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 60.04  | 85.66                          | 54.66                           | 140.12      |               | $\rho = 0.5$                          |
| AIC    | 880.25 | 869.19                         | 884.55                          | 509.2       |               |                                       |
| BIC    | 0.12   | 0.09                           | 0                               | 0.96        |               | Oracle: 100                           |
| CV.1se | 1.44   | 0.17                           | 0.02                            | 79.43       | 0.86          |                                       |
| CV.min | 51.62  | 9.15                           | 1.13                            | 188.07      | 49.41         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 62.19  | 85.73                          | 48.2                            | 137.21      |               | $\rho = 0.9$                          |
| AIC    | 878    | 866.48                         | 882.09                          | 502.58      |               |                                       |
| BIC    | 0.12   | 0.08                           | 0                               | 0.91        |               | Oracle: 100                           |
|        | U.12   | 0.00                           | <u></u>                         | V.71        |               |                                       |

Table 102: Nonzero coefficients at n=1000, binary design, sparse covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | GL $\gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|------------------|-------------|---------------|---------------------------------------|
| CV.1se | 223.47 | 154.74                         | 105.41           | 181.12      | 102.87        |                                       |
| CV.min | 315.85 | 217.6                          | 114.37           | 235.72      | 115.77        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 240.77 | 186.24                         | 117.42           | 211.66      |               | $\rho = 0$                            |
| AIC    | 778.83 | 767.52                         | 748.55           | 316.97      |               | Oracle: 100                           |
| BIC    | 151.59 | 123.47                         | 98.71            | 142.11      |               | Oracle: 100                           |
| CV.1se | 240.16 | 164.98                         | 106.23           | 194.44      | 103.18        |                                       |
| CV.min | 335.75 | 230.41                         | 115.06           | 250.41      | 115.2         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 253.11 | 194.89                         | 117.28           | 224.09      |               | $\rho = 0.5$                          |
| AIC    | 782.5  | 771.91                         | 752.25           | 331.54      |               | Oracle: 100                           |
| BIC    | 158.26 | 128.53                         | 99.79            | 149.37      |               | Oracle: 100                           |
| CV.1se | 246.41 | 169.61                         | 108.95           | 197.57      | 107.39        |                                       |
| CV.min | 338.95 | 235.48                         | 119.59           | 252.67      | 117.65        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 256.47 | 198                            | 118.41           | 227.23      |               | $\rho = 0.9$                          |
| AIC    | 779.85 | 768.82                         | 749.55           | 334.42      |               | 01100                                 |
| BIC    | 161.59 | 131.61                         | 100.9            | 152.24      |               | Oracle: 100                           |
| CV.1se | 129.48 | 81.48                          | 29.41            | 161.11      | 126.39        |                                       |
| CV.min | 242.28 | 157.77                         | 63.88            | 241.7       | 243.14        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 189.39 | 169.39                         | 217.21           | 199.46      |               | $\rho = 0$                            |
| AIC    | 845.87 | 832.2                          | 835.41           | 431.73      |               | ,                                     |
| BIC    | 0.45   | 3.82                           | 0.76             | 16.61       |               | Oracle: 100                           |
| CV.1se | 134.01 | 85.2                           | 25.91            | 169.33      | 128.57        |                                       |
| CV.min | 253.93 | 168.79                         | 62.37            | 250.16      | 251.34        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 196.41 | 178.87                         | 213.42           | 206.23      |               | $\rho = 0.5$                          |
| AIC    | 848.39 | 835.64                         | 836.52           | 443.43      |               | ,                                     |
| BIC    | 0.37   | 1.65                           | 0.13             | 10.15       |               | Oracle: 100                           |
| CV.1se | 139.37 | 87.46                          | 24.14            | 167.83      | 130.85        |                                       |
| CV.min | 257.87 | 171.74                         | 60.9             | 246.36      | 254.61        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 197.94 | 180.1                          | 215.47           | 206.57      |               | $\rho = 0.9$                          |
| AIC    | 845.72 | 833.26                         | 834.34           | 441.87      |               | ,                                     |
| BIC    | 0.39   | 1.11                           | 0.23             | 8.32        |               | Oracle: 100                           |
| CV.1se | 1.88   | 0.22                           | 0.02             | 81.93       | 1.62          |                                       |
| CV.min | 54.98  | 6.41                           | 0.92             | 193.49      | 54.94         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 63.37  | 99.88                          | 29.39            | 139.5       |               | $\rho = 0$                            |
| AIC    | 881.36 | 869.27                         | 889.4            | 509.19      |               | ,                                     |
| BIC    | 0.11   | 0.03                           | 0                | 0.86        |               | Oracle: 100                           |
| CV.1se | 1.43   | 0.09                           | 0.01             | 82.83       | 1.02          |                                       |
| CV.min | 44.69  | 5.2                            | 0.7              | 193.75      | 44.46         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 54.93  | 95.46                          | 36.01            | 139.94      |               | $\rho = 0.5$                          |
| AIC    | 882.37 | 870.91                         | 889.49           | 520.33      |               | ,                                     |
| BIC    | 0.09   | 0.03                           | 0                | 0.76        |               | Oracle: 100                           |
| CV.1se | 0.94   | 0.05                           | 0.01             | 79.93       | 0.68          |                                       |
| CV.min | 45.09  | 5.03                           | 0.74             | 191.22      | 42.83         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 56.35  | 95.23                          | 32.88            | 137.59      |               | $\rho = 0.9$                          |
| AIC    | 879.67 | 867.66                         | 886.91           | 511.9       |               | '                                     |
| BIC    | 0.09   | 0.04                           | 0                | 0.71        |               | Oracle: 100                           |
|        | 0.07   | 0.01                           |                  | V./ 1       |               |                                       |

Table 103: Nonzero coefficients at n=1000, continuous design, sparse covariates, and decay 10.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | lasso  | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | marginal AL | sparsenet MCP |                                       |
|---|--------|--------|--------------------------------|------------------------------|-------------|---------------|---------------------------------------|
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             |               |                                       |
| AIC 610.08 607.83 580.37 52.03 $Oracle: 100$ BIC 30.11 25.35 18.6 25.49 $Oracle: 100$ CV.lse 86.05 59.04 23.03 35.08 19 $Oracle: 100$ CV.min 173.55 132.87 51.75 45.39 30.05 $oracle: 100$ AIC 539.81 539.49 515.13 45.25 $oracle: 100$ BIC 39.2 29.42 16.74 34.1 $Oracle: 100$ CV.lse 150.05 120.12 60.24 11.46 32.46 $oracle: 100$ AIC 243.07 239.05 197.73 12.56 57.98 $oracle: 100$ AIC 243.07 239.05 197.73 12.56 $oracle: 100$ BIC 70.99 57.34 20.8 12.47 $oracle: 100$ AIC 71.49 735.39 707.33 154.27 $oracle: 100$ AIC 78.84 49.84 13.8 97.65 $oracle: 100$ AIC 78.84 49.84 13.8 97.65 $oracle: 100$ AIC 741.49 735.39 707.33 154.27 $oracle: 100$ AIC 19.86 15.71 10.18 18.01 $oracle: 100$ AIC 19.86 15.71 10.18 18.01 $oracle: 100$ AIC 19.86 15.71 10.18 18.01 $oracle: 100$ AIC 11.52 82.06 24.12 112.61 $oracle: 100$ AIC 377.46 388.23 358.14 26.22 BIC 13.6 1.04 1.11 15.95 $oracle: 100$ AIC 377.46 388.23 358.14 26.22 $oracle: 100$ AIC 829.74 821.32 811.77 313.14 $oracle: 100$ AIC 829.74 821.32 811.77 313.14 $oracle: 100$ AIC 67.06 38.82 2.93 141.49 21.83 $oracle: 100$ AIC 829.74 821.32 811.77 313.14 $oracle: 100$ AIC 56.7 24.13 4.05 106.25 $oracle: 100$ AIC 57.75 5.50 5.94 45.93 11.07 139.54 16.12 $oracle: 100$ AIC 57.75 5.76 5.70 64.99 11.  |        |        |                                |                              |             | 32.54         |                                       |
| BIC 30.11 25.35 18.6 25.49 $Oracle: 100$ CV.1se 86.05 59.04 23.03 35.08 19 $Oracle: 100$ 17.3.55 132.87 51.75 45.39 30.05 $oracle: 100$ 18.6 39.81 539.49 515.13 45.25 $oracle: 100$ 18.6 39.81 539.49 515.13 45.25 $oracle: 100$ 18.6 27.8 18.6 29.42 16.74 34.1 $oracle: 100$ 18.6 27.8 19.6 29.42 16.74 34.1 $oracle: 100$ 19.6 26.5 191.32 98.49 12.56 57.98 $oracle: 100$ 243.07 239.05 197.73 12.56 $oracle: 100$ 243.07 239.05 197.73 12.56 $oracle: 100$ 26.10 243.07 239.05 197.73 12.56 $oracle: 100$ 27.1 19.6 18.1 19.8 12.47 $oracle: 100$ 27.1 19.6 19.6 19.6 19.6 19.5 197.73 12.56 $oracle: 100$ 27.1 19.6 19.6 19.6 19.7 19.7 19.1 19.8 12.47 $oracle: 100$ 27.1 19.8 19.1 19.1  |        |        |                                | 25.64                        | 50.68       |               | $\rho = 0$                            |
| Signature   Si  |        |        |                                |                              |             |               | $Oracle \cdot 100$                    |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 30.11  | 25.35                          | 18.6                         | 25.49       |               | Oracic . 100                          |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se | 86.05  | 59.04                          | 23.03                        | 35.08       | 19            |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min | 173.55 | 132.87                         | 51.75                        | 45.39       | 30.05         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         39.2         29.42         16.74         34.1         Oracle: 100           CV.Ise         150.05         120.12         60.24         11.46         32.46 $\text{CV.min}$ 226.55         191.32         98.49         11.56         57.98 $\text{sd}(\mu)/\sigma = 2$ $\rho = 0.9$ AIC         190.69         161.01         82.82         12.56 $\rho = 0.9$ $\rho = 0.9$ AIC         243.07         239.05         197.73         12.56 $\rho = 0.9$ $\rho = 0.9$ BIC         70.99         57.34         20.8         12.47 $\rho = 0.9$ $\rho = 0.9$ CV.Ise         23.98         18.16         12.49         38.71         11.98 $\rho = 0.9$ CV.min         77.49         53.9         19.15         117.83         25.81 $\rho = 0.9$ AIC         741.49         735.39         707.33         154.27 $\rho = 0.0$ $\rho = 0.0$ AIC         741.49         735.39         707.33         154.27 $\rho = 0.0$ $\rho = 0.0$ V.V.Ise         45.77         31.55         12.77         65.81         12.38 $\rho = 0.0$ <  | AICc   | 146.39 | 111.64                         | 45.26                        | 45.15       |               | $\rho = 0.5$                          |
| BIC         39.2         29.42         16.74         34.1           CV.Isis         150.05         120.12         60.24         11.46         32.46           CV.min         226.55         191.32         98.49         12.56         57.98         sd(μ)/σ = 2           AICc         190.69         161.01         82.82         12.56 $\rho = 0.9$ AIC         243.07         239.05         197.73         12.56 $\rho = 0.9$ BIC         70.99         57.34         20.8         12.47 $\rho = 0.9$ CV.Ise         23.98         18.16         12.49         38.71         11.98           CV.min         77.49         53.9         19.15         117.83         25.81 $sd(μ)/σ = 1$ AIC         741.49         735.39         707.33         154.27 $\rho = 0$ AIC         741.49         735.39         707.33         154.27 $\rho = 0$ CV.lise         45.77         31.55         12.77         65.81         12.38           CV.min         125.9         93.66         27.99         125.2         23.83 $sd(μ)/σ = 1$ AIC         115.2 <t< td=""><td>AIC</td><td>539.81</td><td>539.49</td><td>515.13</td><td>45.25</td><td></td><td>Omagle : 100</td></t<>  | AIC    | 539.81 | 539.49                         | 515.13                       | 45.25       |               | Omagle : 100                          |
| $\begin{array}{c} \text{CV.min} & 226.55 \\ \text{AICc} & 190.69 \\ \text{AIC} & 190.69 \\ \text{AIC} & 243.07 \\ \text{CV.1se} & 239.05 \\ \text{Dracle} & 197.73 \\ \text{CV.min} & 77.49 \\ \text{AIC} & 78.84 \\ \text{AIC} & 49.84 \\ \text{AIC} & 190.69 \\ \text{Dracle} & 197.73 \\ \text{CV.min} & 77.49 \\ \text{AIC} & 78.84 \\ \text{AIC} & 49.84 \\ \text{AIS} & 97.65 \\ \text{AIC} & 78.84 \\ \text{A9.84} & 13.8 \\ \text{AIS} & 97.65 \\ \text{AIC} & 741.49 \\ \text{AIC} & 735.39 \\ \text{AIC} & 10.18 \\ \text{CV.min} & 125.9 \\ \text{AIC} & 15.71 \\ \text{CV.min} & 125.9 \\ \text{BIC} & 19.86 \\ \text{AIC} & 19.82 \\ \text{AIC} & 19.83 \\ \text{AIC} & 19.82 \\ \text{AIC} & 115.2 \\ \text{AIC} & 115.2 \\ \text{AIC} & 19.82 \\ \text{AIC} & 114.65 \\ \text{AIC} & 114.91 \\ \text{AIC} & 114.65 \\ \text{AIC} & 114.91 \\ \text{AIC} & 137.46 \\ \text{ASS.23} & 358.14 \\ \text{ACS} & 26.22 \\ \text{BIC} & 1.36 \\ \text{I.04} & 1.11 \\ \text{I.11} & 15.95 \\ \text{CV.Ise} & 8.78 \\ \text{AIC} & 377.46 \\ \text{ASS.23} & 358.14 \\ \text{ACS} & 28.79 \\ \text{AIC} & 82.974 \\ \text{AII} & 313.14 \\ \text{BIC} & 8.98 \\ \text{ACS} & 1.04 \\ \text{AII} & 11.10 \\ \text{AII} & 15.95 \\ \text{CV.Ise} & 43.3 \\ \text{AIC} & 337.46 \\ \text{ASS.23} & 358.14 \\ \text{ACS} & 26.12 \\ \text{ACS} & 24.13 \\ \text{ALOS} & 106.25 \\ \text{P} = 0.9 \\ \text{AICC} & 82.974 \\ \text{RSI.33} & 5.42 \\ \text{A.17} & 313.14 \\ \text{BIC} & 8.98 \\ \text{A.22} & 1.64 \\ \text{I.10.12} \\ \text{CV.Ise} & 4.33 \\ \text{A.42} & 3.21 \\ \text{S.25.9} & 5.19 \\ \text{CV.Ise} & 4.33 \\ \text{A.42} & 3.21 \\ \text{S.25.9} & 5.19 \\ \text{CV.Ise} & 1.01 \\ \text{AIC} & 798.16 \\ \text{790.33} & 773.25 \\ \text{252.9} \\ \text{BIC} & 2.46 \\ \text{1.78} & 0.96 \\ \text{3.45} \\ \text{CV.Ise} & 1.01 \\ \text{AIC} & 555.11 \\ \text{553.6} & 520.08 \\ \text{64.94} \\ \text{CV.pole} & 10.11 \\ \text{CV.min} & 6.85 \\ \text{55.05} & 52.08 \\ \text{64.94} \\ \text{CV.pole} & 10.01 \\ \text{CV.pole} & 10.0$ | BIC    | 39.2   | 29.42                          | 16.74                        | 34.1        |               | 07 acte . 100                         |
| AICc 190.69 161.01 82.82 12.56 $\rho = 0.9$ AIC 243.07 239.05 197.73 12.56 $\rho = 0.9$ BIC 70.99 57.34 20.8 12.47 $\rho = 0.9$ CV.1se 23.98 18.16 12.49 38.71 11.98 $\rho = 0.9$ AIC 741.49 735.39 19.15 117.83 25.81 $\rho = 0.9$ AIC 741.49 735.39 707.33 154.27 $\rho = 0.9$ AIC 19.86 15.71 10.18 18.01 $\rho = 0.9$ AIC 19.86 15.71 10.18 18.01 $\rho = 0.9$ AIC 15.2 82.06 24.12 112.61 $\rho = 0.9$ AIC 15.2 82.06 24.12 112.61 $\rho = 0.9$ AIC 15.2 82.06 24.12 112.61 $\rho = 0.9$ AIC 688.82 683.95 653.03 129.67 $\rho = 0.9$ AIC 19.82 15.2 8.11 24.07 $\rho = 0.9$ AIC 19.82 15.2 8.11 24.07 $\rho = 0.9$ AIC 19.82 15.2 8.11 24.07 $\rho = 0.9$ AIC 141.65 114.91 50.47 26.13 $\rho = 0.9$ AIC 377.46 388.23 358.14 26.22 $\rho = 0.9$ AIC 13.6 1.04 1.11 15.95 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.78 6.97 4.92 44.77 5.07 $\rho = 0.9$ AIC 8.98 6.22 1.64 10.12 $\rho = 0.5$ AIC 8.99.4 821.32 811.77 313.14 $\rho = 0.5$ AIC 6.70 38.82 3.21 52.59 5.19 $\rho = 0.5$ AIC 6.70 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 $\rho = 0.5$ AIC 12.81 1.83 1 153.65 6.99 10.11 $\rho = 0.5$ AIC 12.81 1.83 1 55.68 $\rho = 0.9$ AIC 535.11 553.6 520.08 64.94 $\rho = 0.9$ AIC 12.81 1.80  | CV.1se | 150.05 | 120.12                         | 60.24                        | 11.46       | 32.46         |                                       |
| AIC 243.07 239.05 197.73 12.56 $Oracle:100$  | CV.min | 226.55 | 191.32                         | 98.49                        | 12.56       | 57.98         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC         70.99         57.34         20.8         12.47         Oracle: 100           CV.1se         23.98         18.16         12.49         38.71         11.98 $sd(\mu)/\sigma = 1$ CV.min         77.49         53.9         19.15         117.83         25.81 $sd(\mu)/\sigma = 1$ AIC         78.84         49.84         13.8         97.65 $\rho = 0$ AIC         741.49         735.39         707.33         154.27 $\rho = 0$ BIC         19.86         15.71         10.18         18.01 $\rho = 0$ CV.1se         45.77         31.55         12.77         65.81         12.38           CV.min         125.9         93.66         27.99         125.2         23.83 $sd(\mu)/\sigma = 1$ AIC         115.2         82.06         24.12         112.61 $\rho = 0.5$ AIC         688.82         683.95         653.03         129.67 $\rho = 0.5$ BIC         19.82         15.2         8.11         24.07 $\rho = 0.5$ CV.lse         62.14         64.79         38.31         15.38         24.64           CV.min   | AICc   | 190.69 | 161.01                         | 82.82                        | 12.56       |               | $\rho = 0.9$                          |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | AIC    | 243.07 | 239.05                         | 197.73                       | 12.56       |               | Omasla . 100                          |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 70.99  | 57.34                          | 20.8                         | 12.47       |               | Oracle: 100                           |
| AICc 78.84 49.84 13.8 97.65 $\rho = 0$ AIC 741.49 735.39 707.33 154.27 BIC 19.86 15.71 10.18 18.01  CV.1se 45.77 31.55 12.77 65.81 12.38 CV.min 125.9 93.66 27.99 125.2 23.83 $\mathrm{sd}(\mu)/\sigma = 1$ AICc 115.2 82.06 24.12 112.61 $\rho = 0.5$ AIC 688.82 683.95 653.03 129.67 BIC 19.82 15.2 8.11 24.07  CV.1se 62.14 64.79 38.31 15.38 24.64 CV.min 158.84 137.59 66.38 26.63 50.69 $\mathrm{sd}(\mu)/\sigma = 1$ AICc 141.65 114.91 50.47 26.13 $\rho = 0.9$ AIC 377.46 388.23 358.14 26.22 BIC 1.36 1.04 1.11 15.95  CV.1se 8.78 6.97 4.92 44.77 5.07  CV.min 48.42 28.79 9.73 141.49 21.83 $\mathrm{sd}(\mu)/\sigma = 0.5$ AIC 829.74 821.32 811.77 313.14 BIC 8.98 6.22 1.64 10.12  CV.1se 4.33 5.42 3.21 52.59 5.19 CV.min 56.94 45.93 11.07 139.54 16.12 $\mathrm{sd}(\mu)/\sigma = 0.5$ AIC 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 BIC 2.46 1.78 0.96 3.45 CV.1se 1.01 1 1 12.07 1.21 CV.min 6.85 5.05 2.4 56.99 10.11 $\mathrm{sd}(\mu)/\sigma = 0.5$ AICc 12.81 1.83 1 55.68 64.94  Oracle : 100  | CV.1se | 23.98  | 18.16                          | 12.49                        | 38.71       | 11.98         |                                       |
| AICc 78.84 49.84 13.8 97.65 $\rho = 0$ AIC 741.49 735.39 707.33 154.27 BIC 19.86 15.71 10.18 18.01  CV.1se 45.77 31.55 12.77 65.81 12.38 CV.min 125.9 93.66 27.99 125.2 23.83 $sd(\mu)/\sigma = 1$ AICc 115.2 82.06 24.12 112.61 $\rho = 0.5$ AIC 688.82 683.95 653.03 129.67 BIC 19.82 15.2 8.11 24.07  CV.1se 62.14 64.79 38.31 15.38 24.64 CV.min 158.84 137.59 66.38 26.63 50.69 $sd(\mu)/\sigma = 1$ AICc 141.65 114.91 50.47 26.13 $\rho = 0.9$ AIC 377.46 388.23 358.14 26.22 BIC 1.36 1.04 1.11 15.95  CV.1se 8.78 6.97 4.92 44.77 5.07  CV.min 48.42 28.79 9.73 141.49 21.83 $sd(\mu)/\sigma = 0.5$ AIC 829.74 821.32 811.77 313.14 BIC 8.98 6.22 1.64 10.12  CV.1se 4.33 5.42 3.21 52.59 5.19 CV.min 56.94 45.93 11.07 139.54 16.12 $sd(\mu)/\sigma = 0.5$ AIC 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 BIC 2.46 1.78 0.96 3.45  CV.1se 1.01 1 1 12.07 1.21 CV.min 6.85 5.05 2.4 56.99 10.11 $sd(\mu)/\sigma = 0.5$ AICc 12.81 1.83 1 55.68 64.94  Oracle : 100  | CV.min | 77.49  | 53.9                           | 19.15                        | 117.83      | 25.81         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC         19.86         15.71         10.18         18.01         Oracte: 100           CV.1se         45.77         31.55         12.77         65.81         12.38 $sd(\mu)/\sigma = 1$ CV.min         125.9         93.66         27.99         125.2         23.83 $sd(\mu)/\sigma = 1$ AIC         688.82         683.95         653.03         129.67         Oracle: 100           BIC         19.82         15.2         8.11         24.07         Oracle: 100           CV.1se         62.14         64.79         38.31         15.38         24.64         Oracle: 100           CV.nin         158.84         137.59         66.38         26.63         50.69 $sd(\mu)/\sigma = 1$ AIC         377.46         388.23         358.14         26.22         Oracle: 100           BIC         1.36         1.04         1.11         15.95         Oracle: 100           CV.1se         8.78         6.97         4.92         44.77         5.07         Oracle: 100           CV.nin         48.42         28.79         9.73         141.49         21.83 $sd(\mu)/\sigma = 0.5$ AIC         829.74         821.32         811.77  | AICc   | 78.84  | 49.84                          | 13.8                         | 97.65       |               | . , , ,                               |
| BIC         19.86         15./1         10.18         18.01           CV.1se         45.77         31.55         12.77         65.81         12.38           CV.min         125.9         93.66         27.99         125.2         23.83 $sd(\mu)/\sigma = 1$ AIC         115.2         82.06         24.12         112.61 $\rho = 0.5$ AIC         688.82         683.95         653.03         129.67         Oracle: 100           BIC         19.82         15.2         8.11         24.07         Oracle: 100           CV.1se         62.14         64.79         38.31         15.38         24.64           CV.min         158.84         137.59         66.38         26.63         50.69 $sd(\mu)/\sigma = 1$ AIC         141.65         114.91         50.47         26.13 $\rho = 0.9$ AIC         377.46         388.23         358.14         26.22         Oracle: 100           CV.1se         8.78         6.97         4.92         44.77         5.07           CV.min         48.42         28.79         9.73         141.49         21.83 $sd(\mu)/\sigma = 0.5$ AIC         829.74   | AIC    | 741.49 | 735.39                         | 707.33                       | 154.27      |               | 0 1 100                               |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | BIC    | 19.86  | 15.71                          | 10.18                        | 18.01       |               | <i>Oracle</i> : 100                   |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se | 45.77  | 31.55                          | 12.77                        | 65.81       | 12.38         |                                       |
| AICc 115.2 82.06 24.12 112.61 $\rho = 0.5$ AIC 688.82 683.95 653.03 129.67 $\rho = 0.5$ BIC 19.82 15.2 8.11 24.07 $\rho = 0.5$ CV.1se 62.14 64.79 38.31 15.38 24.64 $\rho = 0.5$ AIC 377.46 388.23 358.14 26.22 $\rho = 0.9$ AIC 1.36 1.04 1.11 15.95 $\rho = 0.9$ AIC 82.74 821.32 811.77 313.14 $\rho = 0.5$ AIC 82.974 821.32 811.77 313.14 $\rho = 0.5$ AIC 82.974 821.32 811.77 313.14 $\rho = 0.5$ AIC 82.974 82.32 811.77 313.14 $\rho = 0.5$ AIC 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 $\rho = 0.5$ AIC 1.01 1 1 12.07 1.21 $\rho = 0.5$ AIC 12.81 1.83 1 55.68 $\rho = 0.9$ AIC 1.81 1.83 1 64.94 $\rho = 0.9$ AIC 1.81 1.81 1.83 1 1 55.68 $\rho = 0.9$ AIC 1.81 1.82 1 1.83 1 1 55.68 $\rho = 0.9$ AIC 1.81 1.83 1 1 55.68 $\rho = 0.9$ AIC 1.81 1.82 1 1.83 1 1 55.68 $\rho = 0.9$ AIC 1.81 1.82 1 1.83 1 1 55.68 $\rho = 0.9$ AIC 1.81 1.82 1 1.83 1 1 55.68 $\rho = 0.$  |        |        |                                | 27.99                        |             |               | $\operatorname{sd}(\mu)/\sigma = 1$   |
| BIC 19.82 15.2 8.11 24.07  CV.1se 62.14 64.79 38.31 15.38 24.64 CV.min 158.84 137.59 66.38 26.63 50.69 $sd(\mu)/\sigma = 1$ AICc 141.65 114.91 50.47 26.13 $\rho = 0.9$ AIC 377.46 388.23 358.14 26.22 BIC 1.36 1.04 1.11 15.95  CV.1se 8.78 6.97 4.92 44.77 5.07 CV.min 48.42 28.79 9.73 141.49 21.83 $sd(\mu)/\sigma = 0.5$ AICc 56.7 24.13 4.05 106.25 $\rho = 0$ AIC 829.74 821.32 811.77 313.14 BIC 8.98 6.22 1.64 10.12  CV.1se 4.33 5.42 3.21 52.59 5.19 CV.min 56.94 45.93 11.07 139.54 16.12 $sd(\mu)/\sigma = 0.5$ AICc 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 BIC 2.46 1.78 0.96 3.45  CV.1se 1.01 1 1 12.07 1.21 CV.min 6.85 5.05 2.4 56.99 10.11 $sd(\mu)/\sigma = 0.5$ AICc 12.81 1.83 1 55.68 $\rho = 0.9$ AIC 535.11 553.6 520.08 64.94  |        | 115.2  | 82.06                          | 24.12                        | 112.61      |               |                                       |
| BIC         19.82         15.2         8.11         24.07           CV.1se         62.14         64.79         38.31         15.38         24.64           CV.min         158.84         137.59         66.38         26.63         50.69 $sd(\mu)/\sigma = 1$ AICc         141.65         114.91         50.47         26.13 $\rho = 0.9$ AIC         377.46         388.23         358.14         26.22         Oracle: 100           CV.1se         8.78         6.97         4.92         44.77         5.07           CV.min         48.42         28.79         9.73         141.49         21.83 $sd(\mu)/\sigma = 0.5$ AIC         56.7         24.13         4.05         106.25 $\rho = 0$ AIC         829.74         821.32         811.77         313.14         Oracle: 100           CV.1se         4.33         5.42         3.21         52.59         5.19           CV.min         56.94         45.93         11.07         139.54         16.12 $sd(\mu)/\sigma = 0.5$ AIC         798.16         790.33         773.25         252.9         Oracle: 100           CV.1se         1.01   | AIC    | 688.82 | 683.95                         | 653.03                       | 129.67      |               | 0 1 100                               |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 19.82  | 15.2                           | 8.11                         | 24.07       |               | Oracle: 100                           |
| AICc 141.65 114.91 50.47 26.13 $\rho = 0.9$ AIC 377.46 388.23 358.14 26.22 BIC 1.36 1.04 1.11 15.95 $\rho = 0.9$ Oracle : 100 CV.1se 8.78 6.97 4.92 44.77 5.07 CV.min 48.42 28.79 9.73 141.49 21.83 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 56.7 24.13 4.05 106.25 $\rho = 0$ AIC 829.74 821.32 811.77 313.14 $\rho = 0.5$ BIC 8.98 6.22 1.64 10.12 $\rho = 0.5$ CV.1se 4.33 5.42 3.21 52.59 5.19 CV.min 56.94 45.93 11.07 139.54 16.12 $\rho = 0.5$ AICc 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 $\rho = 0.5$ AIC 1.01 1 1 1 1.00 1.00 1.00 1.00 1.00 1.  | CV.1se | 62.14  | 64.79                          | 38.31                        | 15.38       | 24.64         |                                       |
| AICc 141.65 114.91 50.47 26.13 $\rho = 0.9$ AIC 377.46 388.23 358.14 26.22 BIC 1.36 1.04 1.11 15.95 $\rho = 0.9$ Oracle : 100 CV.1se 8.78 6.97 4.92 44.77 5.07 CV.min 48.42 28.79 9.73 141.49 21.83 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 56.7 24.13 4.05 106.25 $\rho = 0$ AIC 829.74 821.32 811.77 313.14 $\rho = 0.5$ BIC 8.98 6.22 1.64 10.12 $\rho = 0.5$ CV.1se 4.33 5.42 3.21 52.59 5.19 CV.min 56.94 45.93 11.07 139.54 16.12 $\rho = 0.5$ AICc 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 $\rho = 0.5$ AIC 1.01 1 1 1 1.00 1.00 1.00 1.00 1.00 1.  |        |        |                                |                              |             | 50.69         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AIC 377.46 388.23 358.14 26.22 $Oracle:100$ BIC 1.36 1.04 1.11 15.95 $Oracle:100$ CV.1se 8.78 6.97 4.92 44.77 5.07 $Ovacle:100$ CV.min 48.42 28.79 9.73 141.49 21.83 $ovacle:100$ AIC 829.74 821.32 811.77 313.14 $ovacle:100$ BIC 8.98 6.22 1.64 10.12 $ovacle:100$ CV.1se 4.33 5.42 3.21 52.59 5.19 $ovacle:100$ CV.min 56.94 45.93 11.07 139.54 16.12 $ovacle:100$ AIC 798.16 790.33 773.25 252.9 $ovacle:100$ BIC 2.46 1.78 0.96 3.45 $ovacle:100$ CV.1se 1.01 1 1 12.07 1.21 $ovacle:100$ CV.1se 1.01 1 1 12.07 1.21 $ovacle:100$ CV.min 6.85 5.05 2.4 56.99 10.11 $ovacle:100$ AIC 535.11 553.6 520.08 64.94 $ovacle:100$   |        |        |                                |                              |             |               |                                       |
| BIC 1.36 1.04 1.11 15.95  |        |        |                                |                              |             |               | '                                     |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        |        |                                |                              |             |               | <i>Oracle</i> : 100                   |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |        |                                |                              |             | 5.07          |                                       |
| AICc 56.7 24.13 4.05 106.25 $\rho = 0$ AIC 829.74 821.32 811.77 313.14 BIC 8.98 6.22 1.64 10.12  CV.1se 4.33 5.42 3.21 52.59 5.19  CV.min 56.94 45.93 11.07 139.54 16.12 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9  BIC 2.46 1.78 0.96 3.45  CV.1se 1.01 1 1 12.07 1.21  CV.min 6.85 5.05 2.4 56.99 10.11 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 12.81 1.83 1 55.68 $\rho = 0.9$ AIC 535.11 553.6 520.08 64.94   |        |        |                                |                              |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC         829.74         821.32         811.77         313.14         Oracle : 100           BIC         8.98         6.22         1.64         10.12         Oracle : 100           CV.1se         4.33         5.42         3.21         52.59         5.19           CV.min         56.94         45.93         11.07         139.54         16.12         sd(μ)/σ = 0.5           AICc         67.06         38.82         2.93         114.56         ρ = 0.5           AIC         798.16         790.33         773.25         252.9         Oracle : 100           BIC         2.46         1.78         0.96         3.45         Oracle : 100           CV.1se         1.01         1         1         12.07         1.21           CV.min         6.85         5.05         2.4         56.99         10.11         sd(μ)/σ = 0.5           AICc         12.81         1.83         1         55.68         ρ = 0.9           AIC         535.11         553.6         520.08         64.94         Oracle : 100  | AICc   | 56.7   | 24.13                          | 4.05                         | 106.25      |               |                                       |
| BIC         8.98         6.22         1.64         10.12           CV.1se         4.33         5.42         3.21         52.59         5.19           CV.min         56.94         45.93         11.07         139.54         16.12 $sd(\mu)/\sigma = 0.5$ AICc         67.06         38.82         2.93         114.56 $\rho = 0.5$ AIC         798.16         790.33         773.25         252.9         Oracle: 100           BIC         2.46         1.78         0.96         3.45         Oracle: 100           CV.1se         1.01         1         1         12.07         1.21           CV.min         6.85         5.05         2.4         56.99         10.11 $sd(\mu)/\sigma = 0.5$ AICc         12.81         1.83         1         55.68 $\rho = 0.9$ AIC         535.11         553.6         520.08         64.94         Oracle: 100   | AIC    | 829.74 | 821.32                         | 811.77                       | 313.14      |               | 0 1 100                               |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 8.98   | 6.22                           | 1.64                         | 10.12       |               | <i>Oracle</i> : 100                   |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se | 4.33   | 5.42                           |                              | 52.59       | 5.19          |                                       |
| AICc 67.06 38.82 2.93 114.56 $\rho = 0.5$ AIC 798.16 790.33 773.25 252.9 BIC 2.46 1.78 0.96 3.45 $\rho = 0.5$ CV.1se 1.01 1 1 12.07 1.21 CV.min 6.85 5.05 2.4 56.99 10.11 $\rho = 0.5$ AICc 12.81 1.83 1 55.68 $\rho = 0.9$ AIC 535.11 553.6 520.08 64.94   |        |        | 45.93                          | 11.07                        | 139.54      | 16.12         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC       798.16       790.33       773.25       252.9         BIC       2.46       1.78       0.96       3.45         CV.1se       1.01       1       1       12.07       1.21         CV.min       6.85       5.05       2.4       56.99       10.11 $sd(\mu)/\sigma = 0.5$ AICc       12.81       1.83       1       55.68 $\rho = 0.9$ AIC       535.11       553.6       520.08       64.94  |        |        |                                |                              |             |               |                                       |
| BIC         2.46         1.78         0.96         3.45         Oracle: 100           CV.1se         1.01         1         1         12.07         1.21           CV.min         6.85         5.05         2.4         56.99         10.11 $sd(\mu)/\sigma = 0.5$ AICc         12.81         1.83         1         55.68 $\rho = 0.9$ AIC         535.11         553.6         520.08         64.94         Oracle: 100   |        |        |                                |                              |             |               |                                       |
| CV.1se       1.01       1       1       12.07       1.21         CV.min       6.85       5.05       2.4       56.99       10.11 $sd(\mu)/\sigma = 0.5$ AICc       12.81       1.83       1       55.68 $\rho = 0.9$ AIC       535.11       553.6       520.08       64.94   |        |        |                                |                              |             |               | <i>Oracle</i> : 100                   |
| CV.min 6.85 5.05 2.4 56.99 10.11 $\operatorname{sd}(\mu)/\sigma = 0.5$ AICc 12.81 1.83 1 55.68 $\rho = 0.9$ AIC 535.11 553.6 520.08 64.94   |        |        |                                |                              |             | 1.21          |                                       |
| AICc 12.81 1.83 1 55.68<br>AIC 535.11 553.6 520.08 64.94 $\rho = 0.9$   |        |        |                                |                              |             |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC 535.11 553.6 520.08 64.94 Oracle : 100  |        |        |                                |                              |             |               | \ ' / /                               |
|   |        |        |                                |                              |             |               |                                       |
| 1.50 1.00 1 2.07  | BIC    | 1.36   | 1.03                           | 1                            | 2.67        |               | <i>Oracle</i> : 100                   |

Table 104: Nonzero coefficients at n=1000, continuous design, sparse covariates, and decay 50.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 177.38 | 131.7                          | 74.1                     | 139.2       | 83.5          |                                       |
| CV.min | 275.72 | 210.8                          | 97.57                    | 203.17      | 139.13        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 212.26 | 171.93                         | 108.71                   | 182.62      |               | $\rho = 0$                            |
| AIC    | 741.02 | 732.57                         | 703.83                   | 242.07      |               | Oracle: 100                           |
| BIC    | 95.76  | 78.13                          | 54.98                    | 87.86       |               | 07 acic . 100                         |
| CV.1se | 284.92 | 221.99                         | 104.54                   | 200.39      | 91.86         |                                       |
| CV.min | 390.74 | 318.95                         | 154.52                   | 253.92      | 139.8         | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 283.84 | 240.7                          | 155.72                   | 232.46      |               | $\rho = 0.5$                          |
| AIC    | 719.34 | 711.54                         | 681.23                   | 267.94      |               | Oracle: 100                           |
| BIC    | 62.29  | 84.45                          | 62.49                    | 91.74       |               | Oracie . 100                          |
| CV.1se | 342.59 | 289.9                          | 175.27                   | 48.48       | 139.78        |                                       |
| CV.min | 426.59 | 380.66                         | 224.62                   | 62.76       | 179.84        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 323.91 | 291.1                          | 206.31                   | 62.23       |               | $\rho = 0.9$                          |
| AIC    | 432.07 | 415.11                         | 370.19                   | 62.42       |               | Oracle: 100                           |
| BIC    | 1.55   | 1.06                           | 4.77                     | 34.2        |               | Oracie . 100                          |
| CV.1se | 93.83  | 63.48                          | 33.21                    | 117.33      | 61.69         |                                       |
| CV.min | 191.52 | 129.04                         | 51.84                    | 200.59      | 145.7         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 156.08 | 118.76                         | 84.3                     | 163.3       |               | $\rho = 0$                            |
| AIC    | 822.66 | 811.93                         | 802.09                   | 348.76      |               | 0                                     |
| BIC    | 26.51  | 23.2                           | 1.76                     | 42.37       |               | Oracle: 100                           |
| CV.1se | 116.23 | 101.52                         | 43.51                    | 150.2       | 57.17         |                                       |
| CV.min | 248.97 | 201.84                         | 79.21                    | 228.54      | 105.01        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 188.55 | 164.27                         | 129.46                   | 198.09      |               | $\rho = 0.5$                          |
| AIC    | 811.45 | 802.63                         | 786.48                   | 377.81      |               | Oma ala . 100                         |
| BIC    | 1.34   | 0.96                           | 0.16                     | 4.54        |               | Oracle: 100                           |
| CV.1se | 16.24  | 49.35                          | 37.22                    | 47.73       | 92.25         |                                       |
| CV.min | 110.88 | 164.45                         | 92.11                    | 90.68       | 141.73        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 77.11  | 65.1                           | 63.49                    | 88.14       |               | $\rho = 0.9$                          |
| AIC    | 564.08 | 550.45                         | 509.2                    | 94.01       |               | 0                                     |
| BIC    | 1.46   | 1.06                           | 1                        | 3.43        |               | Oracle: 100                           |
| CV.1se | 5.04   | 1.84                           | 0.27                     | 78.71       | 3.9           |                                       |
| CV.min | 67.7   | 25                             | 3.78                     | 182.97      | 65.96         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 73.06  | 29.17                          | 0.23                     | 135.27      |               | $\rho = 0$                            |
| AIC    | 872.57 | 861.49                         | 872.49                   | 464.17      |               | Oracle: 100                           |
| BIC    | 0.42   | 0.1                            | 0                        | 2.77        |               | Oracie: 100                           |
| CV.1se | 0.13   | 0.06                           | 0.02                     | 43.35       | 0.49          |                                       |
| CV.min | 14.69  | 7.95                           | 0.88                     | 147.92      | 13.99         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 30.49  | 3.35                           | 0.77                     | 112.34      |               | $\rho = 0.5$                          |
| AIC    | 864.61 | 855.17                         | 859.36                   | 476.25      |               | 0                                     |
| BIC    | 0.17   | 0.07                           | 0                        | 0.7         |               | Oracle: 100                           |
| CV.1se | 0.17   | 0.19                           | 0.28                     | 3.68        | 0.45          |                                       |
| CV.min | 7.69   | 4.71                           | 1.41                     | 51.18       | 2.9           | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 12.68  | 1.51                           | 0.94                     | 56.79       |               | $\rho = 0.9$                          |
| AIC    | 692.69 | 673.84                         | 660.71                   | 101.17      |               | ,                                     |
| BIC    | 1.3    | 1.01                           | 0.74                     | 1.5         |               | Oracle: 100                           |
|        |        |                                |                          |             |               |                                       |

Table 105: Nonzero coefficients at n=1000, continuous design, sparse covariates, and decay 100.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}~\gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|-------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 216.7  | 158.99                         | 101.3                   | 173.7       | 101.8         |                                       |
| CV.min | 312.77 | 230.16                         | 117.75                  | 232.7       | 132.73        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 238.55 | 186.96                         | 107.23                  | 207.88      |               | $\rho = 0$                            |
| AIC    | 767.5  | 757.71                         | 734.48                  | 297.7       |               | Oracle: 100                           |
| BIC    | 136.65 | 112.43                         | 87.7                    | 125.42      |               | 07 acic . 100                         |
| CV.1se | 351.92 | 280.15                         | 152.5                   | 261.44      | 138.66        |                                       |
| CV.min | 448.81 | 363.11                         | 190.88                  | 328         | 170.95        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 332.16 | 280.87                         | 159.41                  | 287.02      |               | $\rho = 0.5$                          |
| AIC    | 760.54 | 751.67                         | 726.14                  | 361.97      |               | Oracle: 100                           |
| BIC    | 1.19   | 6.74                           | 120.59                  | 12.88       |               | 07acic . 100                          |
| CV.1se | 409.63 | 353.68                         | 229.43                  | 68.54       | 198.23        |                                       |
| CV.min | 490.29 | 435.49                         | 269.98                  | 105.81      | 229.09        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 373.98 | 338.52                         | 227.04                  | 102.44      |               | $\rho = 0.9$                          |
| AIC    | 496.49 | 474.8                          | 427.14                  | 106.07      |               | Oracle: 100                           |
| BIC    | 2.07   | 1.34                           | 2.69                    | 5.12        |               | 07 acte . 100                         |
| CV.1se | 121.2  | 79.38                          | 35.15                   | 149.49      | 107.9         |                                       |
| CV.min | 229.92 | 153.4                          | 64.98                   | 231.73      | 221.09        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 180.82 | 144.1                          | 136.48                  | 189.01      |               | $\rho = 0$                            |
| AIC    | 838.97 | 826.44                         | 824.64                  | 408.23      |               | 0                                     |
| BIC    | 1.65   | 2.86                           | 0.11                    | 31.63       |               | Oracle: 100                           |
| CV.1se | 75.16  | 77.87                          | 8.87                    | 160.02      | 77.52         |                                       |
| CV.min | 252.28 | 210.01                         | 41.08                   | 248.98      | 158.93        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 175.12 | 184.13                         | 177.3                   | 207.76      |               | $\rho = 0.5$                          |
| AIC    | 836.61 | 826.58                         | 817.29                  | 462.59      |               | Oracle: 100                           |
| BIC    | 0.38   | 0.2                            | 0                       | 1.65        |               | Oracie: 100                           |
| CV.1se | 1.15   | 3.51                           | 0.81                    | 32.58       | 21.48         |                                       |
| CV.min | 19.35  | 34.54                          | 3.75                    | 97.19       | 72.07         | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 21.41  | 6.15                           | 13.14                   | 101.16      |               | $\rho = 0.9$                          |
| AIC    | 626.79 | 608.57                         | 575.17                  | 142.13      |               | Oracle: 100                           |
| BIC    | 1.67   | 1.15                           | 0.99                    | 1.86        |               | Oracie: 100                           |
| CV.1se | 2.53   | 0.45                           | 0.06                    | 83.46       | 1.85          |                                       |
| CV.min | 58.87  | 10.96                          | 1.34                    | 192.27      | 60.1          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 67.63  | 21.93                          | 1.15                    | 139.02      |               | $\rho = 0$                            |
| AIC    | 878.63 | 867.27                         | 884.18                  | 495.35      |               | Oracle: 100                           |
| BIC    | 0.16   | 0.01                           | 16.91                   | 1.21        |               | Oracie: 100                           |
| CV.1se | 0.01   | 0                              | 0                       | 36.25       | 0.46          |                                       |
| CV.min | 10.17  | 3.22                           | 0.36                    | 140.85      | 10.11         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 22.94  | 0.87                           | 0.43                    | 105.6       |               | $\rho = 0.5$                          |
| AIC    | 870.74 | 859.63                         | 869.23                  | 510.63      |               | Oracle: 100                           |
| BIC    | 0.06   | 0.02                           | 0                       | 0.38        |               | Oracle: 100                           |
| CV.1se | 0.04   | 0.05                           | 0.08                    | 1.22        | 0.44          |                                       |
| CV.min | 8.2    | 4.73                           | 1.42                    | 36.78       | 4.99          | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 14.12  | 1.34                           | 0.47                    | 40.6        |               | $\rho = 0.9$                          |
| AIC    | 736.73 | 715.86                         | 715.33                  | 93.56       |               | Oracle: 100                           |
| BIC    | 0.88   | 0.66                           | 0.14                    | 1.32        |               | Oracle: 100                           |
| _      |        |                                |                         |             |               |                                       |

Table 106: Nonzero coefficients at n=1000, continuous design, sparse covariates, and decay 200.

|        | lasso  | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\ \gamma=10$ | marginal AL | sparsenet MCP |                                       |
|--------|--------|--------------------------------|--------------------------|-------------|---------------|---------------------------------------|
| CV.1se | 224.63 | 155.19                         | 105.5                    | 181.42      | 102.74        |                                       |
| CV.min | 318.5  | 217.92                         | 114.43                   | 236.28      | 116.28        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 241.9  | 179.16                         | 101.41                   | 213.12      |               | $\rho = 0$                            |
| AIC    | 777.82 | 767.04                         | 748.05                   | 317.5       |               | Oracle: 100                           |
| BIC    | 150.79 | 120.13                         | 98.02                    | 141.96      |               | 07acie . 100                          |
| CV.1se | 368.76 | 279.52                         | 144.89                   | 287.33      | 113.1         |                                       |
| CV.min | 460.6  | 352.01                         | 163.65                   | 357.34      | 126.15        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 341.81 | 272.18                         | 128.97                   | 309.03      |               | $\rho = 0.5$                          |
| AIC    | 776.77 | 767.31                         | 744.78                   | 401.13      |               | Oracle: 100                           |
| BIC    | 0.52   | 15.34                          | 123.67                   | 3.36        |               | Oracie : 100                          |
| CV.1se | 434.56 | 363.17                         | 226.51                   | 86.17       | 186.96        |                                       |
| CV.min | 518.82 | 437.77                         | 250.23                   | 144.27      | 211.49        | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 391.51 | 338.85                         | 201.81                   | 138.83      |               | $\rho = 0.9$                          |
| AIC    | 533.99 | 511.1                          | 466.14                   | 149.71      |               | Omasla . 100                          |
| BIC    | 2.86   | 1.9                            | 51.45                    | 2.99        |               | Oracle: 100                           |
| CV.1se | 132.12 | 82.35                          | 29.31                    | 162.1       | 127.28        |                                       |
| CV.min | 244.8  | 158.63                         | 64.23                    | 242.68      | 244.45        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 192.86 | 152.89                         | 145.25                   | 200.17      |               | $\rho = 0$                            |
| AIC    | 845.23 | 831.63                         | 834.85                   | 433.28      |               | ,                                     |
| BIC    | 0.51   | 0.42                           | 0.06                     | 16          |               | Oracle: 100                           |
| CV.1se | 39.08  | 39.47                          | 0.84                     | 157.52      | 43.03         |                                       |
| CV.min | 217.3  | 167.02                         | 6.82                     | 252.89      | 178.42        | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 140.57 | 184.71                         | 200.87                   | 206.66      |               | $\rho = 0.5$                          |
| AIC    | 844.4  | 833.66                         | 828.74                   | 492.97      |               | ,                                     |
| BIC    | 0.17   | 0.07                           | 0                        | 1.01        |               | Oracle: 100                           |
| CV.1se | 0.76   | 0.77                           | 0.52                     | 17.07       | 2.19          |                                       |
| CV.min | 15.64  | 13.74                          | 2.38                     | 88.07       | 15.8          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 20.44  | 4.15                           | 9.33                     | 95.41       |               | $\rho = 0.9$                          |
| AIC    | 663.89 | 643.78                         | 617.88                   | 192.64      |               | ,                                     |
| BIC    | 2.14   | 1.41                           | 0.87                     | 2.52        |               | Oracle: 100                           |
| CV.1se | 1.82   | 0.18                           | 0.03                     | 84.71       | 1.36          |                                       |
| CV.min | 54.45  | 6.51                           | 1.01                     | 194.39      | 54.99         | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 63.21  | 17.4                           | 0                        | 139.85      |               | $\rho = 0$                            |
| AIC    | 880.57 | 868.78                         | 888.79                   | 509.84      |               | ·                                     |
| BIC    | 0.1    | 0                              | 171.44                   | 0.9         |               | Oracle: 100                           |
| CV.1se | 0.01   | 0.01                           | 0                        | 34.1        | 0.45          |                                       |
| CV.min | 9.14   | 2.15                           | 0.33                     | 138.25      | 9.14          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 20.94  | 0.44                           | 0                        | 102.34      |               | $\rho = 0.5$                          |
| AIC    | 871.94 | 859.89                         | 873.45                   | 519.26      |               | ,                                     |
| BIC    | 0.06   | 0.01                           | 0                        | 0.29        |               | Oracle: 100                           |
| CV.1se | 0.03   | 0.03                           | 0.04                     | 1.03        | 0.45          |                                       |
| CV.min | 8.37   | 4.41                           | 1.28                     | 32.84       | 6             | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 14.04  | 1.13                           | 0.16                     | 35.73       | Ü             | $\rho = 0.9$                          |
| AIC    | 757.48 | 735.05                         | 742.32                   | 103.11      |               | ,                                     |
| BIC    | 0.55   | 0.36                           | 0.03                     | 1.11        |               | Oracle: 100                           |
|        | 0.55   | 0.50                           | 0.05                     | 1,11        |               |                                       |

Table 107: FDR | Sensitivity for n=100, binary design, dense covariates, and decay 10.

|                   | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|-------------------|-------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.32   0.24 | 0.20   0.21                    | 0.04   0.10                     | 0.74   0.44      | 0.18   0.21   |                                       |
| CV.min            | 0.74   0.46 | 0.57   0.39                    | 0.17   0.19                     | 0.84   0.51      | 0.54   0.40   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.59   0.37 | 0.44   0.34                    | 0.82   0.42                     | 0.68   0.40      | •             | $\rho = 0$                            |
| AIC               | 0.89   0.59 | 0.88   0.55                    | 0.88   0.44                     | 0.87   0.54      |               | = 21.2                                |
| BIC               | 0.89   0.58 | 0.88   0.55                    | 0.88   0.44                     | 0.84   0.52      |               | $\bar{s}_{Oracle} = 21.3$             |
| CV.1se            | 0.29   0.18 | 0.20   0.17                    | 0.04   0.09                     | 0.76   0.42      | 0.15   0.18   |                                       |
| CV.min            | 0.72   0.41 | 0.57   0.35                    | 0.17   0.17                     | 0.86   0.49      | 0.49   0.35   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.60   0.33 | 0.45   0.31                    | 0.83   0.40                     | 0.70   0.37      | '             | $\rho = 0.5$                          |
| AIC               | 0.90   0.57 | 0.89   0.54                    | 0.89   0.43                     | 0.88   0.52      |               |                                       |
| BIC               | 0.90   0.56 | 0.89   0.54                    | 0.89   0.43                     | 0.86   0.50      |               | $\bar{s}_{Oracle} = 20.9$             |
| CV.1se            | 0.28   0.17 | 0.19   0.15                    | 0.04   0.08                     | 0.77   0.40      | 0.17   0.17   |                                       |
| CV.min            | 0.74   0.39 | 0.57   0.32                    | 0.16 0.15                       | 0.86   0.47      | 0.50   0.32   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.62   0.30 | 0.46   0.29                    | 0.84   0.38                     | 0.72   0.35      | ı             | $\rho = 0.9$                          |
| AIC               | 0.90   0.55 | 0.89   0.52                    | 0.89 0.41                       | 0.89   0.49      |               |                                       |
| BIC               | 0.90   0.55 | 0.89   0.52                    | 0.89 0.40                       | 0.86   0.48      |               | $\bar{s}_{Oracle} = 20.7$             |
| CV.1se            | 0.10   0.05 | 0.06   0.03                    | 0.02   0.02                     | 0.85   0.42      | 0.16   0.05   |                                       |
| CV.min            | 0.57   0.25 | 0.35   0.14                    | 0.12   0.05                     | 0.91   0.49      | 0.51   0.23   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.55   0.23 | 0.46   0.21                    | 0.93   0.29                     | 0.78   0.34      | 3.000   3.000 | $\rho = 0$                            |
| AIC               | 0.94   0.54 | 0.94   0.46                    | 0.94   0.31                     | 0.93   0.51      |               | ,                                     |
| BIC               | 0.93   0.54 | 0.94   0.46                    | 0.94   0.30                     | 0.92   0.51      |               | $\bar{s}_{Oracle} = 14.5$             |
| CV.1se            | 0.08   0.03 | 0.05   0.02                    | 0.02   0.02                     | 0.86   0.40      | 0.15   0.04   |                                       |
| CV.rise<br>CV.min | 0.56   0.22 | 0.34   0.13                    | 0.12   0.05                     | 0.92   0.47      | 0.51   0.20   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.56   0.20 | 0.45   0.17                    | 0.93   0.28                     | 0.80   0.31      | 0.21   0.20   | $\rho = 0.5$                          |
| AIC               | 0.94   0.51 | 0.94   0.44                    | 0.95   0.20                     | 0.93   0.48      |               | ,                                     |
| BIC               | 0.94   0.51 | 0.94   0.44                    | 0.95   0.30                     | 0.93   0.48      |               | $\bar{s}_{Oracle} = 14.4$             |
| CV.1se            | 0.08   0.03 | 0.06   0.03                    | 0.02   0.02                     | 0.86   0.38      | 0.17   0.05   |                                       |
| CV.13C            | 0.58   0.21 | 0.35   0.12                    | 0.02   0.02                     | 0.92   0.46      | 0.53   0.19   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.58   0.19 | 0.42   0.16                    | 0.13   0.03                     | 0.81   0.30      | 0.55   0.17   | $\rho = 0.9$                          |
| AIC               | 0.94   0.51 | 0.42   0.10                    | 0.95   0.27                     | 0.93   0.47      |               |                                       |
| BIC               | 0.94   0.51 | 0.94   0.43                    | 0.95   0.29                     | 0.93   0.47      |               | $\bar{s}_{Oracle} = 14.1$             |
| CV.1se            | 0.03   0.01 | 0.01   0.00                    | 0.01   0.00                     | 0.94   0.34      | 0.30   0.02   |                                       |
| CV.13C            | 0.43   0.10 | 0.01   0.00                    | 0.01   0.00                     | 0.96   0.42      | 0.55   0.10   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.55   0.11 | 0.79   0.19                    | 0.98   0.20                     | 0.91   0.23      | 0.55   0.10   | $\rho = 0$                            |
| AIC               | 0.97   0.46 | 0.75   0.15                    | 0.98   0.22                     | 0.97   0.44      |               | $\rho = 0$                            |
| BIC               | 0.97   0.46 | 0.97   0.34                    | 0.98   0.22                     | 0.97   0.44      |               | $\bar{s}_{Oracle} = 7.8$              |
| CV.1se            | 0.03   0.01 | 0.02   0.01                    | 0.02   0.00                     | 0.94   0.32      | 0.30   0.01   |                                       |
| CV.1se<br>CV.min  | 0.03   0.01 | 0.02   0.01                    | 0.02   0.00                     | 0.94   0.32      | 0.58   0.09   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.45   0.09 | 0.23   0.03                    | 0.12   0.01                     | 0.90   0.40      | 0.38   0.09   | $\rho = 0.5$                          |
|                   | ,           |                                |                                 | ,                |               | $\rho = 0.5$                          |
| AIC               | 0.97   0.43 | $0.98 \mid 0.32$               | 0.98   0.20                     | $0.97 \mid 0.42$ |               | $\bar{s}_{Oracle} = 8.0$              |
| BIC               | 0.97   0.43 | 0.98   0.31                    | 0.98   0.20                     | 0.97   0.42      | 0.21   0.02   |                                       |
| CV.1se            | 0.03   0.01 | $0.03 \mid 0.00$               | $0.02 \mid 0.00$                | 0.94   0.32      | 0.31   0.02   | ad(u)/= 05                            |
| CV.min            | 0.45   0.10 | 0.21   0.03                    | $0.10 \mid 0.02$                | $0.97 \mid 0.39$ | 0.61   0.10   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.57   0.10 | $0.71 \mid 0.17$               | 0.98   0.19                     | $0.92 \mid 0.23$ |               | $\rho = 0.9$                          |
| AIC               | 0.97   0.45 | 0.98   0.33                    | 0.98   0.21                     | 0.97   0.41      |               | $\bar{s}_{Oracle} = 7.6$              |
| BIC               | 0.97   0.44 | 0.98   0.33                    | 0.98   0.20                     | 0.97   0.41      |               |                                       |

Table 108: FDR | Sensitivity for n=100, binary design, dense covariates, and decay 50.

|                   | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|-------------------|-------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.07   0.01 | 0.02   0.00                    | 0.02   0.00                     | 0.79   0.19      | 0.21   0.01   |                                       |
| CV.min            | 0.46   0.07 | $0.18 \mid 0.01$               | $0.08 \mid 0.01$                | 0.84   0.25      | 0.53   0.08   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.47   0.05 | 0.77   0.12                    | 0.89   0.11                     | 0.72   0.11      |               | $\rho = 0$                            |
| AIC               | 0.86   0.29 | 0.88   0.21                    | 0.90   0.13                     | $0.85 \mid 0.26$ |               | 56.9                                  |
| BIC               | 0.86   0.29 | $0.88 \mid 0.20$               | 0.90   0.13                     | $0.85 \mid 0.26$ |               | $\bar{s}_{Oracle} = 56.8$             |
| CV.1se            | 0.05   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.80   0.17      | 0.20   0.01   |                                       |
| CV.min            | 0.45   0.06 | 0.20   0.01                    | $0.08 \mid 0.00$                | 0.84   0.23      | 0.50   0.06   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.48   0.04 | 0.76   0.11                    | 0.89   0.11                     | 0.74   0.11      |               | $\rho = 0.5$                          |
| AIC               | 0.87   0.28 | 0.88   0.20                    | 0.91   0.12                     | 0.86   0.25      |               | = 560                                 |
| BIC               | 0.87   0.28 | 0.88   0.20                    | 0.91   0.12                     | 0.86   0.25      |               | $\bar{s}_{Oracle} = 56.2$             |
| CV.1se            | 0.05   0.01 | 0.03   0.00                    | 0.01   0.00                     | 0.80   0.16      | 0.22   0.01   |                                       |
| CV.min            | 0.44   0.06 | 0.21   0.01                    | 0.10   0.00                     | 0.85   0.22      | 0.51   0.06   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.48   0.04 | 0.73   0.10                    | 0.90   0.10                     | 0.76 0.10        | '             | $\rho = 0.9$                          |
| AIC               | 0.87   0.27 | 0.89   0.20                    | 0.91   0.12                     | 0.86   0.24      |               |                                       |
| BIC               | 0.87   0.27 | 0.89 0.19                      | 0.91   0.12                     | 0.86   0.24      |               | $\bar{s}_{Oracle} = 56.5$             |
| CV.1se            | 0.04   0.00 | 0.01   0.00                    | 0.01   0.00                     | 0.88   0.19      | 0.28   0.01   |                                       |
| CV.min            | 0.43   0.05 | 0.18   0.01                    | 0.09   0.00                     | 0.91   0.25      | 0.55   0.05   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.52   0.04 | 0.90   0.13                    | 0.94   0.11                     | 0.84   0.11      | 0.00   0.00   | $\rho = 0$                            |
| AIC               | 0.92   0.30 | 0.94   0.20                    | 0.95   0.12                     | 0.92   0.27      |               | '                                     |
| BIC               | 0.92   0.29 | 0.94   0.20                    | 0.95   0.12                     | 0.92   0.27      |               | $\bar{s}_{Oracle} = 31.7$             |
| CV.1se            | 0.03   0.00 | 0.03   0.00                    | 0.01   0.00                     | 0.89   0.17      | 0.27   0.01   |                                       |
| CV.rise<br>CV.min | 0.43   0.04 | 0.21   0.01                    | 0.08   0.00                     | 0.92   0.23      | 0.54   0.04   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.52   0.04 | 0.90   0.12                    | 0.94   0.11                     | 0.85   0.11      | 0.51   0.01   | $\rho = 0.5$                          |
| AIC               | 0.93   0.28 | 0.94   0.19                    | 0.95   0.11                     | 0.92   0.25      |               | $\rho = 0.8$                          |
| BIC               | 0.93   0.28 | 0.94   0.19                    | 0.95   0.12                     | 0.92   0.25      |               | $\bar{s}_{Oracle} = 31.4$             |
| CV.1se            | 0.03   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.89   0.17      | 0.26   0.01   |                                       |
| CV.1sc<br>CV.min  | 0.03   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.92   0.17      | 0.55   0.04   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.42   0.04 | 0.20   0.01                    | 0.10   0.00                     | 0.92   0.23      | 0.55   0.04   | $\rho = 0.9$                          |
| AICC              | 0.93   0.04 | 0.89   0.12                    | 0.95   0.10                     | 0.93   0.25      |               | $\rho = 0.9$                          |
| BIC               | 0.93   0.27 | 0.94   0.19                    | 0.95   0.12                     | 0.93   0.23      |               | $\bar{s}_{Oracle} = 31.0$             |
|                   |             | <u>'</u>                       |                                 |                  | 0.21   0.01   |                                       |
| CV.1se            | 0.03   0.00 | 0.01   0.00                    | 0.02   0.00                     | 0.96   0.19      | 0.31   0.01   | ad()/- 05                             |
| CV.min            | 0.40   0.04 | $0.16 \mid 0.01$               | $0.10 \mid 0.00$                | 0.98   0.25      | 0.61   0.04   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AIC               | 0.57   0.04 | 0.98   0.13                    | 0.98   0.11                     | 0.94   0.11      |               | $\rho = 0$                            |
| AIC               | 0.98   0.29 | 0.98   0.18                    | 0.99   0.12                     | 0.98   0.27      |               | $\bar{s}_{Oracle} = 8.5$              |
| BIC               | 0.98   0.29 | 0.98   0.17                    | 0.99   0.12                     | 0.98   0.27      | 0.24   0.01   |                                       |
| CV.1se            | 0.01   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.97   0.18      | 0.34   0.01   | 1/ )/                                 |
| CV.min            | 0.42   0.03 | 0.16   0.01                    | 0.10   0.00                     | 0.98   0.24      | 0.59   0.03   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.53   0.03 | 0.98   0.13                    | 0.98   0.12                     | 0.94   0.11      |               | $\rho = 0.5$                          |
| AIC               | 0.98   0.28 | 0.98   0.18                    | 0.99   0.13                     | 0.98   0.26      |               | $\bar{s}_{Oracle} = 8.9$              |
| BIC               | 0.98   0.28 | 0.98   0.18                    | 0.98   0.13                     | 0.98   0.26      |               | - Oracle                              |
| CV.1se            | 0.02   0.00 | 0.01   0.00                    | 0.01   0.00                     | 0.96   0.18      | 0.33   0.01   |                                       |
| CV.min            | 0.41   0.04 | 0.18   0.01                    | 0.10   0.01                     | 0.98   0.25      | 0.62   0.04   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.59   0.04 | 0.98   0.13                    | 0.99   0.12                     | 0.95   0.12      |               | $\rho = 0.9$                          |
| AIC               | 0.98   0.29 | 0.98   0.19                    | 0.99   0.12                     | 0.98   0.27      |               | $\bar{s}_{Oracle} = 8.1$              |
| BIC               | 0.98   0.29 | 0.98   0.18                    | 0.99   0.12                     | 0.98   0.27      |               | Oracle 3.1                            |

Table 109: FDR | Sensitivity for n=100, binary design, dense covariates, and decay 100.

|                  | lasso                                | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                     |
|------------------|--------------------------------------|--------------------------------|---------------------------------|------------------|---------------|-------------------------------------|
| CV.1se           | 0.05   0.00                          | 0.02   0.00                    | 0.01   0.00                     | 0.80   0.13      | 0.24   0.00   |                                     |
| CV.min           | 0.42   0.04                          | 0.16   0.01                    | 0.09   0.00                     | 0.83   0.18      | 0.53   0.04   | $sd(\mu)/\sigma = 2$                |
| AICc             | 0.45   0.03                          | 0.83   0.10                    | 0.88   0.09                     | 0.75   0.07      |               | $\rho = 0$                          |
| AIC              | 0.85   0.23                          | 0.87   0.15                    | 0.89   0.10                     | 0.84   0.20      |               | <del>-</del> 70.1                   |
| BIC              | 0.85   0.23                          | 0.87   0.15                    | 0.89   0.10                     | 0.84   0.20      |               | $\bar{s}_{Oracle} = 78.1$           |
| CV.1se           | 0.03   0.00                          | 0.02   0.00                    | 0.01   0.00                     | 0.81   0.12      | 0.22   0.00   |                                     |
| CV.min           | 0.43   0.03                          | 0.18   0.00                    | 0.09   0.00                     | 0.84   0.17      | 0.51   0.03   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 0.47   0.02                          | 0.84   0.09                    | 0.89   0.08                     | 0.76   0.07      | ,             | $\rho = 0.5$                        |
| AIC              | 0.86   0.21                          | 0.88   0.15                    | 0.89   0.10                     | 0.85   0.19      |               | •                                   |
| BIC              | 0.86   0.21                          | 0.88   0.14                    | 0.89   0.10                     | 0.85 0.19        |               | $\bar{s}_{Oracle} = 77.8$           |
| CV.1se           | 0.04   0.00                          | 0.03   0.00                    | 0.01   0.00                     | 0.81   0.12      | 0.26   0.00   |                                     |
| CV.min           | 0.44   0.03                          | 0.20   0.00                    | 0.09   0.00                     | 0.84   0.17      | 0.55   0.03   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc             | 0.51   0.02                          | 0.84   0.09                    | 0.89   0.08                     | 0.77   0.06      | 0.00   0.00   | $\rho = 0.9$                        |
| AIC              | 0.86   0.21                          | 0.88   0.14                    | 0.89   0.10                     | 0.85   0.19      |               | ,                                   |
| BIC              | 0.86   0.21                          | 0.88   0.14                    | 0.89   0.09                     | 0.85   0.18      |               | $\bar{s}_{Oracle} = 77.2$           |
| CV.1se           | 0.04   0.00                          | 0.01   0.00                    | 0.01   0.00                     | 0.90   0.14      | 0.32   0.00   |                                     |
| CV.min           | 0.45   0.04                          | 0.16   0.00                    | 0.10   0.00                     | 0.92   0.19      | 0.60   0.03   | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | 0.55   0.03                          | 0.93   0.10                    | 0.94   0.09                     | 0.86   0.07      | 0.00   0.03   | $\rho = 0$                          |
| AIC              | 0.93   0.03                          | 0.94   0.15                    | 0.95   0.10                     | 0.92   0.21      |               | $\rho = 0$                          |
| BIC              | 0.93   0.23                          | 0.94   0.13                    | 0.95   0.10                     | 0.92   0.21      |               | $\bar{s}_{Oracle} = 38.0$           |
| CV.1se           | 0.04   0.00                          | 0.02   0.00                    | 0.02   0.00                     | 0.90   0.13      | 0.33   0.00   |                                     |
| CV.1sc<br>CV.min | 0.42   0.03                          | 0.02   0.00                    | 0.02   0.00                     | 0.90   0.13      | 0.59   0.03   | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc             | $0.42 \mid 0.03$<br>$0.52 \mid 0.02$ | 0.10   0.00                    | 0.05   0.00                     | 0.88   0.07      | 0.57   0.05   | $\rho = 0.5$                        |
| AIC              | 0.93   0.23                          | 0.94   0.15                    | 0.95   0.09                     | 0.93   0.20      |               | $\rho = 0.5$                        |
| BIC              | 0.93   0.23                          | 0.94   0.15                    | 0.95   0.10                     | 0.93   0.20      |               | $\bar{s}_{Oracle}$ = 36.9           |
| CV.1se           | 0.93   0.23                          | 0.01   0.00                    | 0.93   0.10                     | 0.90   0.13      | 0.29   0.01   |                                     |
| CV.1se<br>CV.min | 0.03   0.00                          | 0.01   0.00                    |                                 | '                | 0.58   0.03   | $\operatorname{sd}(\mu)/\sigma = 1$ |
|                  |                                      |                                | $0.10 \mid 0.00$                | ,                | 0.36   0.03   |                                     |
| AIC              | $0.56 \mid 0.02$                     | 0.93   0.10                    | 0.95   0.09                     | $0.87 \mid 0.07$ |               | $\rho = 0.9$                        |
| AIC              | 0.93   0.23                          | 0.94   0.15                    | 0.95   0.10                     | 0.93   0.20      |               | $\bar{s}_{Oracle} = 37.1$           |
| BIC              | 0.93   0.23                          | 0.94   0.15                    | 0.95   0.10                     | 0.93   0.20      | 0.24   0.00   |                                     |
| CV.1se           | $0.02 \mid 0.00$                     | 0.01   0.00                    | 0.02   0.00                     | 0.97   0.15      | 0.34   0.00   | -1()/- 0.5                          |
| CV.min           | 0.41   0.03                          | 0.15   0.00                    | $0.09 \mid 0.00$                | 0.98   0.21      | 0.62   0.03   | $sd(\mu)/\sigma = 0.5$              |
| AICc             | 0.57   0.02                          | 0.99   0.10                    | 0.99   0.09                     | 0.96   0.07      |               | $\rho = 0$                          |
| AIC              | 0.99   0.26                          | 0.99   0.14                    | 0.99   0.10                     | 0.98   0.23      |               | $\bar{s}_{Oracle} = 6.6$            |
| BIC              | 0.99   0.26                          | 0.99   0.14                    | 0.99   0.10                     | 0.98   0.23      | 0.07.1.0.04   |                                     |
| CV.1se           | 0.02   0.00                          | 0.01   0.00                    | 0.01   0.00                     | 0.97   0.15      | 0.35   0.01   | 1/ ) / 0.7                          |
| CV.min           | 0.43   0.02                          | 0.15   0.00                    | 0.09   0.00                     | 0.98   0.20      | 0.61   0.02   | $sd(\mu)/\sigma = 0.5$              |
| AICc             | 0.58   0.03                          | 0.99   0.10                    | 0.99   0.09                     | 0.95   0.09      |               | $\rho = 0.5$                        |
| AIC              | 0.99   0.24                          | 0.99   0.14                    | 0.99   0.10                     | 0.98   0.22      |               | $\bar{s}_{Oracle} = 6.9$            |
| BIC              | 0.99   0.24                          | 0.99   0.14                    | 0.99   0.10                     | 0.98   0.22      |               | ooracie o.,                         |
| CV.1se           | 0.03   0.00                          | 0.01   0.00                    | 0.02   0.00                     | 0.97   0.14      | 0.34   0.00   |                                     |
| CV.min           | 0.43   0.03                          | 0.16   0.00                    | $0.09 \mid 0.00$                | 0.98   0.20      | 0.63   0.03   | $\mathrm{sd}(\mu)/\sigma = 0.5$     |
| AICc             | 0.60   0.03                          | 0.99   0.11                    | $0.99 \mid 0.10$                | $0.96 \mid 0.08$ |               | $\rho = 0.9$                        |
| AIC              | 0.99   0.25                          | 0.99   0.15                    | 0.99   0.11                     | 0.98   0.23      |               | $\bar{s}_{Oracle} = 6.4$            |
| BIC              | 0.99   0.25                          | 0.99   0.15                    | 0.99   0.11                     | 0.98   0.23      |               | Oracle - 0.4                        |

Table 110: FDR | Sensitivity for n=100, binary design, dense covariates, and decay 200.

|                   | lasso            | $GL \gamma = 1$  | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|-------------------|------------------|------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.05   0.00      | 0.01   0.00      | 0.02   0.00                     | 0.83   0.10      | 0.27   0.00   |                                       |
| CV.min            | 0.43   0.03      | $0.16 \mid 0.00$ | $0.09 \mid 0.00$                | 0.85   0.14      | 0.57   0.03   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.50   0.02      | $0.86 \mid 0.07$ | $0.88 \mid 0.07$                | $0.79 \mid 0.05$ |               | $\rho = 0$                            |
| AIC               | $0.86 \mid 0.18$ | 0.88   0.12      | $0.89 \mid 0.08$                | 0.85   0.16      |               | $\bar{s}_{Oracle} = 91.2$             |
| BIC               | $0.86 \mid 0.18$ | 0.88   0.12      | $0.89 \mid 0.08$                | 0.85   0.15      |               | SOracle - 91.2                        |
| CV.1se            | 0.03   0.00      | 0.02   0.00      | 0.02   0.00                     | 0.83   0.09      | 0.26   0.00   |                                       |
| CV.min            | 0.42   0.02      | 0.16   0.00      | 0.10   0.00                     | 0.85   0.14      | 0.55   0.02   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.50   0.01      | 0.87   0.07      | 0.89   0.07                     | $0.79 \mid 0.05$ |               | $\rho = 0.5$                          |
| AIC               | 0.86   0.18      | 0.88   0.12      | 0.89   0.08                     | 0.86   0.15      |               | - 00.0                                |
| BIC               | 0.86   0.18      | 0.88   0.12      | 0.89   0.08                     | 0.86   0.15      |               | $\bar{s}_{Oracle} = 90.8$             |
| CV.1se            | 0.04   0.00      | 0.02   0.00      | 0.02   0.00                     | 0.83   0.09      | 0.29   0.00   |                                       |
| CV.min            | 0.44   0.02      | 0.18   0.00      | 0.11   0.00                     | 0.85   0.13      | 0.58   0.02   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.53   0.01      | 0.87   0.07      | 0.89   0.07                     | 0.81   0.04      | ,             | $\rho = 0.9$                          |
| AIC               | 0.86   0.17      | 0.88   0.12      | 0.89   0.08                     | 0.86   0.15      |               | - 00.2                                |
| BIC               | 0.86   0.17      | 0.88   0.11      | 0.89   0.08                     | 0.86   0.15      |               | $\bar{s}_{Oracle} = 90.3$             |
| CV.1se            | 0.03   0.00      | 0.01   0.00      | 0.01   0.00                     | 0.91   0.11      | 0.34   0.00   |                                       |
| CV.min            | 0.44   0.03      | 0.15   0.00      | 0.10   0.00                     | 0.93   0.16      | 0.64   0.03   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.55   0.02      | 0.94   0.08      | 0.95   0.08                     | 0.90   0.06      | ı             | $\rho = 0$                            |
| AIC               | 0.94   0.20      | 0.94   0.12      | 0.95   0.08                     | 0.93   0.17      |               | ,                                     |
| BIC               | 0.94   0.20      | 0.95   0.12      | 0.95   0.08                     | 0.93   0.17      |               | $\bar{s}_{Oracle} = 41.6$             |
| CV.1se            | 0.03   0.00      | 0.02   0.00      | 0.02   0.00                     | 0.92   0.11      | 0.32   0.00   |                                       |
| CV.min            | 0.45   0.02      | 0.17   0.00      | 0.09   0.00                     | 0.93   0.16      | 0.62   0.02   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.56   0.02      | 0.94   0.08      | 0.95   0.08                     | 0.90   0.05      | ı             | $\rho = 0.5$                          |
| AIC               | 0.94   0.20      | 0.94   0.12      | 0.95   0.09                     | 0.94   0.17      |               |                                       |
| BIC               | 0.94   0.19      | 0.94   0.12      | 0.95   0.09                     | 0.94   0.17      |               | $\bar{s}_{Oracle} = 41.3$             |
| CV.1se            | 0.04   0.00      | 0.01   0.00      | 0.01   0.00                     | 0.92   0.11      | 0.33   0.00   |                                       |
| CV.min            | 0.46   0.02      | 0.19   0.00      | 0.11   0.00                     | 0.93   0.15      | 0.62   0.02   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.56   0.02      | 0.94   0.08      | 0.95   0.08                     | 0.90   0.06      | 313-   313-   | $\rho = 0.9$                          |
| AIC               | 0.94   0.20      | 0.95   0.13      | 0.95   0.09                     | 0.94   0.17      |               | ,                                     |
| BIC               | 0.94   0.20      | 0.95   0.12      | 0.95   0.09                     | 0.94   0.17      |               | $\bar{s}_{Oracle} = 40.7$             |
| CV.1se            | 0.03   0.00      | 0.01   0.00      | 0.01   0.00                     | 0.98   0.11      | 0.35   0.00   |                                       |
| CV.min            | 0.42   0.02      | 0.14   0.00      | 0.09   0.00                     | 0.99   0.18      | 0.62   0.02   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.57   0.02      | 0.99   0.08      | 0.99   0.08                     | 0.97   0.06      | ı             | $\rho = 0$                            |
| AIC               | 0.99   0.24      | 0.99 0.11        | 0.99   0.08                     | 0.99   0.20      |               | ,                                     |
| BIC               | 0.99   0.24      | 0.99   0.10      | 0.99   0.08                     | 0.99   0.20      |               | $\bar{s}_{Oracle} = 5.1$              |
| CV.1se            | 0.03   0.00      | 0.01   0.00      | 0.01   0.00                     | 0.98   0.13      | 0.36   0.00   |                                       |
| CV.min            | 0.44   0.02      | 0.14   0.00      | 0.08   0.00                     | 0.99   0.18      | 0.64   0.02   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.57   0.03      | 0.99   0.09      | 0.99   0.09                     | 0.97   0.07      | ****          | $\rho = 0.5$                          |
| AIC               | 0.99   0.21      | 0.99   0.12      | 0.99   0.09                     | 0.99   0.20      |               |                                       |
| BIC               | 0.99   0.21      | 0.99   0.12      | 0.99   0.09                     | 0.99   0.20      |               | $\bar{s}_{Oracle} = 5.6$              |
| CV.1se            | 0.02   0.00      | 0.01   0.00      | 0.01   0.00                     | 0.97   0.13      | 0.35   0.01   |                                       |
| CV.rise<br>CV.min | 0.44   0.02      | 0.17   0.01      | 0.09   0.00                     | 0.99   0.19      | 0.65   0.03   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.58   0.03      | 0.99   0.10      | 0.99   0.09                     | 0.97   0.07      | 0.02   0.02   | $\rho = 0.9$                          |
| AIC               | 0.99   0.23      | 0.99   0.13      | 0.99   0.10                     | 0.99   0.21      |               |                                       |
| BIC               | 0.99   0.23      | 0.99   0.13      | 0.99   0.10                     | 0.99   0.21      |               | $\bar{s}_{Oracle} = 5.2$              |
|                   | 0.77   0.23      | 0.77   0.12      | 0.77   0.10                     | 0.77   0.21      |               |                                       |

Table 111: FDR | Sensitivity for n=100, continuous design, dense covariates, and decay 10.

|                  | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL                | sparsenet MCP |  |
|------------------|------------------|--------------------------------|---------------------------------|----------------------------|---------------|--|
| CV.1se           | 0.29   0.23      | 0.17   0.19                    | 0.03   0.10                     | 0.73   0.45                | 0.17   0.20   |  |
| CV.min           | 0.72   0.46      | 0.54   0.38                    | $0.15 \mid 0.19$                | $0.84 \mid 0.52$           | 0.52   0.39   | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc             | 0.58   0.37      | 0.24   0.25                    | $0.80 \mid 0.41$                | $0.67 \mid 0.40$           |               | $\rho = 0$   |
| AIC              | $0.89 \mid 0.59$ | $0.88 \mid 0.56$               | $0.88 \mid 0.44$                | $0.87 \mid 0.54$           |               | = -20.7  |
| BIC              | 0.89   0.59      | 0.88   0.56                    | 0.88   0.44                     | 0.84   0.53                |               | $\bar{s}_{Oracle} = 20.7$  |
| CV.1se           | 0.08   0.03      | 0.07   0.03                    | 0.02   0.03                     | 0.85   0.19                | 0.10   0.06   |  |
| CV.min           | 0.62   0.12      | 0.51   0.10                    | 0.14   0.06                     | 0.92   0.25                | 0.39   0.12   | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc             | 0.63   0.11      | 0.17   0.06                    | 0.70   0.18                     | 0.84   0.15                | '             | $\rho = 0.5$   |
| AIC              | 0.94   0.34      | 0.94   0.32                    | 0.94   0.25                     | 0.94 0.28                  |               |  |
| BIC              | 0.94   0.33      | 0.94   0.32                    | 0.94   0.25                     | 0.86 0.26                  |               | $\bar{s}_{Oracle} = 20.4$  |
| CV.1se           | 0.06   0.06      | 0.04   0.06                    | 0.01   0.06                     | 0.54   0.16                | 0.01   0.06   |  |
| CV.min           | 0.63   0.08      | 0.51   0.07                    | 0.14   0.06                     | 0.81   0.32                | 0.23   0.06   | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc             | 0.65   0.08      | 0.14   0.06                    | 0.00   0.06                     | 0.76   0.22                | 0.20   0.00   | $\rho = 0.9$   |
| AIC              | 0.97   0.19      | 0.97   0.17                    | 0.97   0.14                     | 0.86   0.44                |               |  |
| BIC              | 0.84   0.16      | 0.87   0.17                    | 0.97   0.14                     | 0.26   0.09                |               | $\bar{s}_{Oracle} = 18.3$  |
| CV.1se           | 0.09   0.05      | 0.05   0.04                    | 0.02   0.02                     | 0.84   0.42                | 0.12   0.05   |  |
| CV.1sc<br>CV.min | 0.54   0.24      | 0.03   0.04                    | 0.02   0.02                     | 0.64   0.42                | 0.50   0.23   | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc             | 0.57   0.23      | 0.33   0.14                    | 0.10   0.00                     | 0.78   0.34                | 0.30   0.23   | $\beta \sin(\mu)/\theta = 1$ $\rho = 0$  |
|                  |                  |                                | 0.93   0.28                     | ,                          |               | $\rho = 0$   |
| AIC              | 0.93   0.55      | 0.94   0.46                    |                                 |                            |               | $\bar{s}_{Oracle} = 14.4$  |
| BIC              | 0.93   0.54      | 0.94   0.46                    | 0.94   0.30                     | 0.92   0.51                | 0.17   0.02   |  |
| CV.1se           | 0.04   0.01      | 0.03   0.01                    | 0.02   0.01                     | 0.89   0.19                | 0.15   0.03   | 1/ )/ 1  |
| CV.min           | 0.50   0.09      | 0.37   0.06                    | 0.13   0.03                     | 0.95   0.26                | 0.47   0.08   | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc             | 0.59   0.09      | 0.10   0.03                    | 0.94   0.17                     | 0.87   0.14                |               | $\rho = 0.5$   |
| AIC              | 0.96   0.32      | 0.96   0.28                    | 0.97   0.20                     | 0.96   0.28                |               | $\bar{s}_{Oracle} = 14.2$  |
| BIC              | 0.96   0.32      | 0.96   0.28                    | 0.97   0.20                     | 0.95   0.28                |               | *Oracle  |
| CV.1se           | $0.06 \mid 0.08$ | $0.04 \mid 0.08$               | $0.01 \mid 0.09$                | $0.44 \mid 0.14$           | 0.01   0.09   |  |
| CV.min           | 0.64   0.14      | 0.51   0.11                    | $0.14 \mid 0.10$                | $0.86 \mid 0.24$           | 0.22   0.11   | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc             | 0.65   0.13      | 0.13   0.10                    | $0.02 \mid 0.10$                | $0.80 \mid 0.17$           |               | $\rho = 0.9$   |
| AIC              | 0.98   0.23      | $0.98 \mid 0.20$               | $0.98 \mid 0.17$                | $0.93 \mid 0.49$           |               | $\bar{s}_{Oracle} = 11.6$  |
| BIC              | 0.97   0.22      | 0.98   0.20                    | 0.98   0.16                     | 0.31   0.13                |               | SOracle - 11.0   |
| CV.1se           | 0.03   0.01      | 0.02   0.01                    | 0.01   0.00                     | 0.93   0.35                | 0.27   0.02   |  |
| CV.min           | 0.41   0.10      | 0.20   0.04                    | 0.10   0.02                     | 0.96   0.43                | 0.55   0.10   | $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc             | 0.53   0.11      | 0.24   0.06                    | 0.98   0.20                     | 0.90   0.25                |               | $\rho = 0$   |
| AIC              | 0.97   0.47      | 0.98   0.34                    | 0.98   0.22                     | 0.97   0.45                |               | _ 7.0  |
| BIC              | 0.97   0.46      | 0.98   0.34                    | 0.98   0.21                     | 0.97   0.45                |               | $\bar{s}_{Oracle} = 7.9$   |
| CV.1se           | 0.02   0.00      | 0.02   0.00                    | 0.01   0.00                     | 0.94   0.20                | 0.31   0.01   |  |
| CV.min           | 0.42   0.06      | 0.26   0.03                    | 0.13   0.01                     | 0.98   0.27                | 0.60   0.06   | $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc             | 0.57   0.07      | 0.07   0.01                    | 0.98   0.15                     | 0.93   0.15                |               | $\rho = 0.5$   |
| AIC              | 0.98   0.32      | 0.98   0.26                    | 0.99   0.17                     | 0.98   0.30                |               |  |
| BIC              | 0.98   0.31      | 0.98   0.25                    | 0.99   0.17                     | 0.98   0.30                |               | $\bar{s}_{Oracle} = 7.6$   |
| CV.1se           | 0.03   0.04      | 0.03   0.04                    | 0.01   0.05                     | 0.57   0.27                | 0.15   0.11   |  |
| CV.13C<br>CV.min | 0.51   0.25      | 0.40   0.21                    | 0.01   0.03                     | '                          | 0.48   0.24   | $\int sd(u)/\sigma = 0.5$  |
|                  |                  |                                | ,                               | 0.92   0.37<br>0.88   0.34 | 0.40   0.24   | $\begin{array}{c c} \operatorname{sd}(\mu)/\sigma = 0.5 \\ \rho = 0.9 \end{array}$ |
| AIC              | 0.63   0.28      | 0.10   0.13                    | 0.66   0.24                     | '                          |               | $\rho = 0.9$   |
| AIC              | 0.99   0.38      | 0.99   0.35                    | 0.99   0.31                     | 0.98   0.49                |               | $\bar{s}_{Oracle} = 5.5$   |
| BIC              | 0.99   0.38      | 0.99   0.35                    | 0.99   0.31                     | 0.62   0.33                |               |  |

Table 112: FDR | Sensitivity for n=100, continuous design, dense covariates, and decay 50.

|                   | lasso            | $GL \gamma = 1$  | $\operatorname{GL} \gamma = 10$ | marginal AL                          | sparsenet MCP    |   |
|-------------------|------------------|------------------|---------------------------------|--------------------------------------|------------------|---|
| CV.1se            | 0.06   0.01      | 0.03   0.00      | 0.01   0.00                     | 0.78   0.19                          | 0.18   0.01      |   |
| CV.min            | $0.47 \mid 0.08$ | $0.20 \mid 0.01$ | $0.09 \mid 0.00$                | 0.83   0.25                          | $0.51 \mid 0.07$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.47   0.05      | 0.36   0.05      | 0.89   0.11                     | 0.72   0.12                          |                  | $\rho = 0$  |
| AIC               | 0.86   0.29      | 0.88   0.21      | 0.90   0.13                     | 0.84   0.26                          |                  | <u></u>   |
| BIC               | 0.86   0.29      | 0.88   0.20      | 0.90   0.12                     | 0.84   0.26                          |                  | $\bar{s}_{Oracle} = 57.2$   |
| CV.1se            | 0.03   0.00      | 0.03   0.00      | 0.01   0.00                     | 0.86   0.09                          | 0.25   0.00      |   |
| CV.min            | 0.40   0.02      | 0.24   0.01      | $0.09 \mid 0.00$                | 0.90   0.13                          | 0.52   0.02      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.52   0.02      | 0.08   0.00      | 0.92   0.08                     | 0.85   0.05                          |                  | $\rho = 0.5$  |
| AIC               | 0.91   0.18      | 0.92   0.15      | 0.93   0.10                     | 0.91   0.16                          |                  | - 57.0  |
| BIC               | 0.91   0.18      | 0.92   0.15      | 0.93   0.10                     | 0.91   0.16                          |                  | $\bar{s}_{Oracle} = 57.0$   |
| CV.1se            | 0.04   0.00      | 0.04   0.01      | 0.02   0.01                     | 0.51   0.03                          | 0.08   0.01      |   |
| CV.min            | 0.54   0.03      | 0.44   0.02      | 0.18   0.01                     | 0.85   0.06                          | 0.41   0.02      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.62   0.03      | 0.10   0.01      | 0.43   0.04                     | 0.81   0.04                          |                  | $\rho = 0.9$  |
| AIC               | 0.93   0.14      | 0.93   0.12      | 0.93   0.10                     | 0.91   0.15                          |                  | - 550   |
| BIC               | 0.93   0.14      | 0.93   0.12      | 0.93   0.09                     | 0.50   0.05                          |                  | $\bar{s}_{Oracle} = 55.0$   |
| CV.1se            | 0.04   0.00      | 0.02   0.00      | 0.01   0.00                     | 0.88   0.19                          | 0.25   0.01      |   |
| CV.min            | 0.44   0.05      | 0.18   0.01      | 0.10   0.00                     | 0.91   0.25                          | 0.55   0.05      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.54   0.05      | 0.60   0.08      | 0.94   0.12                     | 0.84   0.12                          | ı                | $\rho = 0$  |
| AIC               | 0.93   0.30      | 0.94   0.20      | 0.95   0.13                     | 0.92   0.27                          |                  | ,   |
| BIC               | 0.93   0.30      | 0.94   0.20      | 0.95   0.13                     | 0.92   0.27                          |                  | $\bar{s}_{Oracle} = 30.6$   |
| CV.1se            | 0.03   0.00      | 0.02   0.00      | 0.01   0.00                     | 0.91   0.09                          | 0.30   0.00      |   |
| CV.min            | 0.36   0.02      | 0.23   0.01      | 0.11   0.00                     | 0.94   0.15                          | 0.56   0.02      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.52   0.02      | 0.14   0.01      | 0.96   0.08                     | 0.91   0.06                          | ****             | $\rho = 0.5$  |
| AIC               | 0.95   0.20      | 0.95   0.15      | 0.96   0.10                     | 0.95   0.17                          |                  | ,   |
| BIC               | 0.95   0.19      | 0.95   0.15      | 0.96   0.10                     | 0.95   0.17                          |                  | $\bar{s}_{Oracle} = 30.4$   |
| CV.1se            | 0.03   0.01      | 0.03   0.01      | 0.02   0.00                     | 0.54   0.04                          | 0.17   0.01      |   |
| CV.min            | 0.46   0.04      | 0.35   0.03      | 0.15   0.01                     | 0.89   0.09                          | 0.50   0.03      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.57   0.04      | 0.09   0.01      | 0.83   0.08                     | 0.85   0.07                          | 0.00   0.00      | $\rho = 0.9$  |
| AIC               | 0.96   0.16      | 0.96   0.14      | 0.96   0.11                     | 0.95   0.20                          |                  | ,   |
| BIC               | 0.96   0.16      | 0.96   0.14      | 0.96   0.11                     | 0.66   0.10                          |                  | $\bar{s}_{Oracle} = 27.7$   |
| CV.1se            | 0.03   0.00      | 0.02   0.00      | 0.02   0.00                     | 0.96   0.19                          | 0.30   0.00      |   |
| CV.rise<br>CV.min | 0.43   0.04      | 0.17   0.00      | 0.10   0.00                     | 0.98   0.24                          | 0.60   0.03      | $sd(\mu)/\sigma = 0.5$  |
| AICc              | 0.59   0.03      | 0.93   0.12      | 0.98   0.11                     | 0.95   0.11                          | 0.00   0.03      | $\rho = 0$  |
| AIC               | 0.98   0.29      | 0.98   0.12      | 0.99   0.11                     | 0.98   0.26                          |                  | ,   |
| BIC               | 0.98   0.29      | 0.98   0.18      | 0.99   0.11                     | 0.98   0.26                          |                  | $\bar{s}_{Oracle} = 8.7$  |
| CV.1se            | 0.02   0.00      | 0.01   0.00      | 0.01   0.00                     | 0.95   0.12                          | 0.32   0.00      |   |
| CV.13C            | 0.40   0.02      | 0.19   0.00      | 0.01   0.00                     | 0.98   0.17                          | 0.59   0.02      | $\operatorname{sd}(\mu)/\sigma = 0.5$   |
| AICc              | 0.59   0.03      | 0.50   0.05      | 0.99   0.10                     | 0.96   0.08                          | 0.57   0.02      | $\rho = 0.5$  |
| AIC               | 0.98   0.23      | 0.99   0.16      | 0.99   0.11                     | 0.98   0.20                          |                  | ,   |
| BIC               | 0.98   0.23      | 0.99   0.16      | 0.99   0.11                     | 0.98   0.20                          |                  | $\bar{s}_{Oracle} = 8.5$  |
| CV.1se            | 0.98   0.23      | 0.02   0.00      | 0.01   0.00                     | 0.58   0.10                          | 0.31   0.01      |   |
| CV.1sc<br>CV.min  | 0.42   0.07      | 0.02   0.00      | 0.01   0.00                     | 0.94   0.20                          | 0.60   0.07      | $sd(u)/\sigma = 0.5$  |
| AICc              | 0.42   0.07      | 0.27   0.04      | 0.12   0.01                     | 0.94   0.20                          | 0.00   0.07      | $\begin{vmatrix} \operatorname{sd}(\mu)/\sigma = 0.5 \\ \rho = 0.9 \end{vmatrix}$ |
| AICC              | 0.37   0.08      | 0.07   0.01      |                                 | $0.92 \mid 0.10$<br>$0.98 \mid 0.30$ |                  | ,   |
| BIC               | '                | 0.99   0.23      | $0.99 \mid 0.20$                |                                      |                  | $\bar{s}_{Oracle} = 7.3$  |
| DIC               | 0.99   0.28      | 0.99   0.23      | 0.99   0.20                     | 0.84   0.21                          |                  |   |

Table 113: FDR | Sensitivity for n=100, continuous design, dense covariates, and decay 100.

|                   | lasso       | $GL \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|-------------------|-------------|-----------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se            | 0.04   0.00 | 0.01   0.00     | 0.01   0.00                     | 0.80   0.13 | 0.22   0.00   |                                       |
| CV.min            | 0.43   0.04 | 0.15   0.00     | 0.08   0.00                     | 0.83   0.18 | 0.51   0.04   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.48   0.03 | 0.67   0.07     | $0.88 \mid 0.09$                | 0.74   0.07 |               | $\rho = 0$                            |
| AIC               | 0.85   0.23 | 0.87   0.15     | $0.89 \mid 0.10$                | 0.84   0.20 |               | _ 77.5                                |
| BIC               | 0.85   0.22 | 0.87   0.15     | 0.89   0.10                     | 0.84   0.20 |               | $\bar{s}_{Oracle} = 77.5$             |
| CV.1se            | 0.02   0.00 | 0.01   0.00     | 0.01   0.00                     | 0.86   0.07 | 0.26   0.00   |                                       |
| CV.min            | 0.39   0.01 | 0.20   0.00     | 0.09   0.00                     | 0.89   0.11 | 0.54   0.01   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.51   0.01 | 0.17   0.01     | 0.91   0.07                     | 0.85   0.04 |               | $\rho = 0.5$                          |
| AIC               | 0.90   0.16 | 0.90   0.12     | 0.91   0.09                     | 0.90   0.13 |               |                                       |
| BIC               | 0.90   0.15 | 0.90   0.12     | 0.91   0.09                     | 0.89   0.13 |               | $\bar{s}_{Oracle} = 77.5$             |
| CV.1se            | 0.03   0.00 | 0.03   0.00     | 0.02   0.00                     | 0.55   0.02 | 0.18   0.00   |                                       |
| CV.min            | 0.45   0.01 | 0.32   0.01     | 0.15   0.00                     | 0.85   0.04 | 0.47   0.01   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.56   0.01 | 0.09 0.00       | 0.84   0.06                     | 0.82   0.03 | '             | $\rho = 0.9$                          |
| AIC               | 0.91   0.13 | 0.92   0.11     | 0.92   0.09                     | 0.90   0.12 |               | 76.0                                  |
| BIC               | 0.91   0.13 | 0.92   0.11     | 0.92   0.09                     | 0.67   0.06 |               | $\bar{s}_{Oracle} = 76.0$             |
| CV.1se            | 0.04   0.00 | 0.02   0.00     | 0.01   0.00                     | 0.90   0.14 | 0.26   0.00   |                                       |
| CV.min            | 0.43   0.03 | 0.17   0.00     | 0.09   0.00                     | 0.92   0.19 | 0.57   0.03   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.54   0.03 | 0.86   0.09     | 0.95   0.09                     | 0.87   0.07 |               | $\rho = 0$                            |
| AIC               | 0.93   0.24 | 0.94   0.15     | 0.95   0.10                     | 0.93   0.21 |               | ,                                     |
| BIC               | 0.93   0.23 | 0.94   0.15     | 0.95   0.10                     | 0.92   0.21 |               | $\bar{s}_{Oracle} = 37.7$             |
| CV.1se            | 0.03   0.00 | 0.02   0.00     | 0.01   0.00                     | 0.92   0.08 | 0.32   0.00   |                                       |
| CV.min            | 0.39   0.01 | 0.21   0.00     | 0.10   0.00                     | 0.94   0.12 | 0.57   0.01   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.53   0.01 | 0.38   0.03     | 0.96   0.07                     | 0.92   0.04 | 0.07   0.00   | $\rho = 0.5$                          |
| AIC               | 0.95   0.17 | 0.95   0.13     | 0.96   0.09                     | 0.95   0.15 |               | ,                                     |
| BIC               | 0.95   0.17 | 0.95   0.12     | 0.96   0.08                     | 0.95   0.15 |               | $\bar{s}_{Oracle} = 37.2$             |
| CV.1se            | 0.02   0.00 | 0.02   0.00     | 0.01   0.00                     | 0.55   0.03 | 0.26   0.00   |                                       |
| CV.min            | 0.40   0.02 | 0.28   0.01     | 0.13   0.00                     | 0.92   0.07 | 0.54   0.02   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.53   0.02 | 0.07   0.00     | 0.95   0.08                     | 0.88   0.04 | 0.01   0.02   | $\rho = 0.9$                          |
| AIC               | 0.96   0.15 | 0.96   0.12     | 0.96   0.10                     | 0.95   0.16 |               | ,                                     |
| BIC               | 0.96   0.15 | 0.96   0.12     | 0.96   0.10                     | 0.74   0.09 |               | $\bar{s}_{Oracle} = 34.6$             |
| CV.1se            | 0.03   0.00 | 0.02   0.00     | 0.02   0.00                     | 0.97   0.15 | 0.34   0.00   |                                       |
| CV.rise<br>CV.min | 0.45   0.03 | 0.16   0.00     | 0.10   0.00                     | 0.98   0.20 | 0.63   0.02   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.59   0.03 | 0.98   0.10     | 0.99   0.10                     | 0.96   0.08 | 0.02   0.02   | $\rho = 0$                            |
| AIC               | 0.99   0.25 | 0.99   0.14     | 0.99   0.10                     | 0.98   0.22 |               | ,                                     |
| BIC               | 0.98   0.25 | 0.99   0.14     | 0.99   0.10                     | 0.98   0.22 |               | $\bar{s}_{Oracle} = 6.8$              |
| CV.1se            | 0.03   0.00 | 0.01   0.00     | 0.01   0.00                     | 0.95   0.10 | 0.34   0.00   |                                       |
| CV.13c            | 0.39   0.02 | 0.18   0.00     | 0.10   0.00                     | 0.99   0.17 | 0.63   0.02   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.55   0.02 | 0.82   0.07     | 0.99   0.09                     | 0.96   0.06 | 0.03   0.02   | $\rho = 0.5$                          |
| AIC               | 0.99   0.02 | 0.02   0.07     | 0.99   0.10                     | 0.99   0.20 |               |                                       |
| BIC               | 0.99   0.22 | 0.99   0.13     | 0.99   0.10                     | 0.99   0.20 |               | $\bar{s}_{Oracle} = 6.7$              |
| CV.1se            | 0.99   0.22 | 0.99   0.14     | 0.01   0.00                     | 0.57   0.07 | 0.31   0.00   |                                       |
| CV.1se<br>CV.min  | 0.01   0.00 | 0.01   0.00     | 0.01   0.00                     | 0.95   0.16 | 0.60   0.04   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.56   0.04 | 0.25   0.01     | 0.11   0.00                     | 0.93   0.10 | 0.00   0.04   | $\rho = 0.9$                          |
| AIC               | 0.99   0.04 | 0.00   0.00     | 0.99   0.13                     | 0.94   0.11 |               | ·                                     |
| BIC               | 0.99   0.24 | 0.99   0.20     | 0.99   0.16                     | 0.99   0.20 |               | $\bar{s}_{Oracle} = 6.4$              |
| DIC               | 0.99   0.24 | 0.99   0.20     | 0.99   0.10                     | 0.00   0.17 |               |                                       |

Table 114: FDR | Sensitivity for n=100, continuous design, dense covariates, and decay 200.

|        | lasso            | $GL \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|--------|------------------|-----------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se | 0.03   0.00      | 0.02   0.00     | 0.01   0.00                     | 0.82   0.10      | 0.25   0.00   |                                       |
| CV.min | 0.43   0.03      | 0.14   0.00     | $0.07 \mid 0.00$                | $0.85 \mid 0.14$ | 0.57   0.03   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.51   0.02      | 0.83   0.07     | $0.89 \mid 0.07$                | $0.79 \mid 0.05$ |               | $\rho = 0$                            |
| AIC    | 0.86   0.18      | 0.88   0.12     | $0.89 \mid 0.08$                | $0.85 \mid 0.16$ |               | $\bar{s}_{Oracle} = 91.1$             |
| BIC    | $0.86 \mid 0.18$ | 0.88   0.12     | $0.89 \mid 0.08$                | $0.85 \mid 0.16$ |               | $S_{Oracle} = 91.1$                   |
| CV.1se | 0.02   0.00      | 0.02   0.00     | 0.00   0.00                     | 0.86   0.06      | 0.27   0.00   |                                       |
| CV.min | 0.40   0.01      | 0.18   0.00     | 0.09   0.00                     | 0.88   0.10      | 0.54   0.01   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.51   0.01      | 0.44   0.03     | 0.90   0.06                     | 0.85   0.03      |               | $\rho = 0.5$                          |
| AIC    | 0.89   0.14      | 0.89   0.11     | 0.90   0.08                     | 0.89   0.12      |               | - 01.1                                |
| BIC    | 0.89   0.14      | 0.90   0.10     | 0.90   0.08                     | 0.89   0.12      |               | $\bar{s}_{Oracle} = 91.1$             |
| CV.1se | 0.02   0.00      | 0.02   0.00     | 0.01   0.00                     | 0.55   0.01      | 0.24   0.00   |                                       |
| CV.min | 0.42   0.01      | 0.27   0.00     | 0.13   0.00                     | 0.86   0.04      | 0.55   0.01   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.52   0.01      | 0.07   0.00     | 0.90   0.07                     | 0.83   0.02      | '             | $\rho = 0.9$                          |
| AIC    | 0.90   0.13      | 0.90   0.10     | 0.90   0.08                     | 0.90   0.11      |               | - 00.5                                |
| BIC    | 0.90   0.12      | 0.90   0.10     | 0.90   0.08                     | 0.75   0.06      |               | $\bar{s}_{Oracle} = 90.5$             |
| CV.1se | 0.04   0.00      | 0.02   0.00     | 0.02   0.00                     | 0.92   0.11      | 0.30   0.00   |                                       |
| CV.min | 0.42   0.02      | 0.15   0.00     | 0.11   0.00                     | 0.93   0.16      | 0.58   0.02   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.58   0.02      | 0.94   0.08     | 0.95   0.08                     | 0.90 0.06        | ı             | $\rho = 0$                            |
| AIC    | 0.94   0.20      | 0.94   0.12     | 0.95   0.08                     | 0.93   0.18      |               | ,                                     |
| BIC    | 0.94   0.20      | 0.95   0.12     | 0.95   0.08                     | 0.93   0.18      |               | $\bar{s}_{Oracle} = 41.2$             |
| CV.1se | 0.03   0.00      | 0.02   0.00     | 0.01   0.00                     | 0.92   0.06      | 0.32   0.00   |                                       |
| CV.min | 0.41   0.01      | 0.19   0.00     | 0.10   0.00                     | 0.94   0.11      | 0.62   0.01   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.54   0.01      | 0.71   0.05     | 0.95   0.07                     | 0.92   0.04      | 1             | $\rho = 0.5$                          |
| AIC    | 0.95   0.16      | 0.95   0.11     | 0.95   0.08                     | 0.95   0.13      |               |                                       |
| BIC    | 0.95   0.16      | 0.95   0.11     | 0.95   0.08                     | 0.95   0.13      |               | $\bar{s}_{Oracle} = 41.3$             |
| CV.1se | 0.02   0.00      | 0.02   0.00     | 0.01   0.00                     | 0.55   0.02      | 0.29   0.00   |                                       |
| CV.min | 0.39   0.01      | 0.25   0.01     | 0.10   0.00                     | 0.92   0.06      | 0.57   0.01   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.54   0.02      | 0.06   0.00     | 0.95   0.08                     | 0.89   0.04      | 0.07   0.01   | $\rho = 0.9$                          |
| AIC    | 0.95   0.15      | 0.95   0.12     | 0.96   0.10                     | 0.95   0.15      |               | ,                                     |
| BIC    | 0.95   0.15      | 0.95   0.12     | 0.96   0.10                     | 0.80   0.09      |               | $\bar{s}_{Oracle} = 39.9$             |
| CV.1se | 0.02   0.00      | 0.02   0.00     | 0.02   0.00                     | 0.98   0.12      | 0.33   0.00   |                                       |
| CV.min | 0.43   0.01      | 0.14   0.00     | 0.10   0.00                     | 0.99   0.17      | 0.64   0.02   | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 0.58   0.02      | 0.99   0.09     | 0.99   0.08                     | 0.97   0.06      | 0.0.1 0.02    | $\rho = 0$                            |
| AIC    | 0.99   0.21      | 0.99   0.13     | 0.99   0.08                     | 0.99   0.18      |               | ,                                     |
| BIC    | 0.99   0.20      | 0.99   0.12     | 0.99   0.08                     | 0.99   0.18      |               | $\bar{s}_{Oracle} = 5.4$              |
| CV.1se | 0.03   0.00      | 0.02   0.00     | 0.01   0.00                     | 0.95   0.09      | 0.33   0.00   |                                       |
| CV.min | 0.41   0.02      | 0.16   0.00     | 0.10   0.00                     | 0.99   0.15      | 0.63   0.01   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 0.57   0.01      | 0.97   0.07     | 0.99   0.08                     | 0.96   0.05      | 0.05   0.01   | $\rho = 0.5$                          |
| AIC    | 0.99   0.21      | 0.99   0.12     | 0.99   0.09                     | 0.99   0.18      |               |                                       |
| BIC    | 0.99   0.21      | 0.99   0.12     | 0.99   0.08                     | 0.99   0.18      |               | $\bar{s}_{Oracle} = 5.5$              |
| CV.1se | 0.01   0.00      | 0.01   0.00     | 0.01   0.00                     | 0.57   0.04      | 0.33   0.00   |                                       |
| CV.13C | 0.40   0.02      | 0.23   0.01     | 0.11   0.00                     | 0.97   0.12      | 0.61   0.03   | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 0.57   0.03      | 0.23   0.01     | 0.99   0.13                     | 0.94   0.08      | 0.01   0.03   | $\rho = 0.9$                          |
| AIC    | 0.97   0.03      | 0.99   0.18     | 0.99   0.15                     | 0.94   0.08      |               |                                       |
| BIC    | 0.99   0.23      | 0.99   0.18     | 0.99   0.15                     | 0.86   0.14      |               | $\bar{s}_{Oracle} = 5.3$              |
| DIC    | 0.33   0.43      | 0.22   0.18     | 0.99   0.13                     | 0.00   0.14      |               |                                       |

Table 115: FDR | Sensitivity for n=100, binary design, sparse covariates, and decay 10.

|                  | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL}\gamma=10$ | marginal AL      | sparsenet MCP    |                                       |
|------------------|------------------|--------------------------------|------------------------------|------------------|------------------|---------------------------------------|
| CV.1se           | 0.44   0.66      | 0.28   0.65                    | 0.05   0.44                  | 0.72   0.81      | 0.17   0.65      |                                       |
| CV.min           | $0.80 \mid 0.88$ | $0.65 \mid 0.86$               | 0.21   0.67                  | $0.85 \mid 0.87$ | $0.46 \mid 0.82$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.64   0.80      | 0.47   0.81                    | $0.80 \mid 0.88$             | $0.69 \mid 0.79$ |                  | $\rho = 0$                            |
| AIC              | 0.91   0.93      | 0.90   0.92                    | $0.88 \mid 0.88$             | $0.89 \mid 0.88$ |                  | ā - · - 10 0                          |
| BIC              | 0.91   0.92      | $0.90 \mid 0.92$               | $0.88 \mid 0.88$             | $0.82 \mid 0.85$ |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.42   0.55      | 0.27   0.56                    | 0.05   0.36                  | 0.76   0.78      | 0.17   0.60      |                                       |
| CV.min           | 0.80   0.83      | 0.66   0.82                    | 0.20   0.60                  | 0.86   0.84      | 0.44   0.80      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.64   0.74      | 0.50   0.77                    | 0.81   0.86                  | 0.71   0.74      |                  | $\rho = 0.5$                          |
| AIC              | 0.92   0.92      | 0.91   0.92                    | 0.88   0.87                  | 0.90   0.86      |                  | = 10.0                                |
| BIC              | 0.91   0.91      | 0.90   0.91                    | 0.88   0.87                  | 0.85   0.84      |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.42   0.51      | 0.30   0.52                    | 0.05   0.33                  | 0.77   0.75      | 0.19   0.57      |                                       |
| CV.min           | 0.80   0.80      | 0.68   0.78                    | 0.22   0.55                  | 0.87   0.82      | 0.47   0.75      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.66   0.69      | $0.52 \mid 0.72$               | 0.81   0.82                  | 0.72   0.70      | ,                | $\rho = 0.9$                          |
| AIC              | 0.92   0.89      | 0.91   0.89                    | 0.89   0.83                  | 0.90   0.84      |                  | _ 10.0                                |
| BIC              | 0.92   0.89      | 0.91   0.89                    | 0.89   0.83                  | 0.85   0.81      |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.12   0.10      | 0.08   0.07                    | 0.02   0.03                  | 0.84   0.56      | 0.13   0.10      |                                       |
| CV.min           | 0.64   0.40      | 0.39   0.25                    | 0.13   0.10                  | 0.91   0.62      | 0.54   0.36      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.59   0.35      | 0.44   0.29                    | 0.92   0.39                  | 0.78   0.48      | 1                | $\rho = 0$                            |
| AIC              | 0.94   0.66      | 0.94   0.58                    | 0.94   0.42                  | 0.93   0.64      |                  | ,                                     |
| BIC              | 0.94   0.66      | 0.94   0.58                    | 0.94   0.42                  | 0.93   0.63      |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.10   0.07      | 0.07   0.05                    | 0.03   0.03                  | 0.86   0.51      | 0.13   0.07      |                                       |
| CV.min           | 0.62   0.34      | 0.40   0.22                    | 0.11   0.09                  | 0.92   0.58      | 0.51   0.30      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.60   0.30      | 0.43   0.25                    | 0.93   0.38                  | 0.79   0.42      | 0.00             | $\rho = 0.5$                          |
| AIC              | 0.94   0.63      | 0.94   0.56                    | 0.95   0.40                  | 0.94   0.60      |                  | ,                                     |
| BIC              | 0.94   0.63      | 0.94   0.55                    | 0.95   0.40                  | 0.93   0.59      |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.11   0.07      | 0.07   0.05                    | 0.02   0.03                  | 0.86   0.48      | 0.14   0.08      |                                       |
| CV.min           | 0.62   0.32      | 0.41   0.21                    | 0.13   0.09                  | 0.92   0.56      | 0.51   0.28      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.60   0.28      | 0.43   0.23                    | 0.93   0.36                  | 0.81   0.40      | 0.01   0.20      | $\rho = 0.9$                          |
| AIC              | 0.94   0.61      | 0.94   0.55                    | 0.95   0.38                  | 0.94   0.58      |                  | ,                                     |
| BIC              | 0.94   0.61      | 0.94   0.54                    | 0.95   0.38                  | 0.93   0.58      |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.04   0.00      | 0.02   0.00                    | 0.01   0.00                  | 0.94   0.26      | 0.26   0.01      |                                       |
| CV.min           | 0.42   0.07      | 0.24   0.02                    | 0.11   0.01                  | 0.96   0.32      | 0.56   0.07      | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.56   0.07      | 0.73   0.13                    | 0.97   0.15                  | 0.90   0.17      | 0.00   0.07      | $\rho = 0$                            |
| AIC              | 0.97   0.36      | 0.97   0.27                    | 0.98   0.17                  | 0.96   0.34      |                  |                                       |
| BIC              | 0.97   0.36      | 0.97   0.27                    | 0.98   0.17                  | 0.96   0.34      |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.02   0.00      | 0.02   0.00                    | 0.01   0.00                  | 0.93   0.23      | 0.32   0.01      |                                       |
| CV.13C           | 0.44   0.06      | 0.02   0.00                    | 0.01   0.00                  | 0.96   0.29      | 0.59   0.06      | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 0.55   0.06      | 0.70   0.11                    | 0.97   0.14                  | 0.91   0.15      | 0.57   0.00      | $\rho = 0.5$                          |
| AIC              | 0.97   0.34      | 0.70   0.11                    | 0.98   0.14                  | 0.97   0.13      |                  |                                       |
| BIC              | 0.97   0.34      | 0.97   0.25                    | 0.98   0.16                  | 0.97   0.31      |                  | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.03   0.01      | 0.02   0.00                    | 0.01   0.00                  | 0.94   0.21      | 0.30   0.01      |                                       |
| CV.1se<br>CV.min | 0.03   0.01      | 0.02   0.00                    | 0.01   0.00                  | 0.94   0.21      | 0.60   0.06      | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.56   0.06      | 0.23   0.02                    | 0.12   0.01                  | 0.90   0.27      | 0.00   0.00      | $\rho = 0.9$                          |
| AIC              | 0.30   0.00      | 0.03   0.10                    | 0.97   0.14                  | 0.92   0.14      |                  |                                       |
| BIC              |                  | 0.97   0.23                    |                              | 0.97   0.30      |                  | $\bar{s}_{Oracle} = 10.0$             |
| DIC              | 0.97   0.32      | 0.97   0.24                    | 0.98   0.16                  | 0.97   0.29      |                  |                                       |

Table 116: FDR | Sensitivity for n=100, binary design, sparse covariates, and decay 50.

|                  | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP    |   |
|------------------|------------------|--------------------------------|---------------------------------|------------------|------------------|---|
| CV.1se           | 0.43   0.69      | 0.24   0.63                    | 0.05   0.24                     | 0.74   0.92      | 0.31   0.73      |   |
| CV.min           | $0.79 \mid 0.94$ | 0.61   0.91                    | $0.18 \mid 0.53$                | $0.85 \mid 0.95$ | $0.65 \mid 0.93$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | $0.63 \mid 0.88$ | $0.47 \mid 0.92$               | 0.81   0.90                     | $0.68 \mid 0.88$ |                  | $\rho = 0$  |
| AIC              | 0.91   0.98      | 0.90   0.98                    | 0.87   0.91                     | $0.89 \mid 0.96$ |                  | = -10.0   |
| BIC              | 0.91   0.98      | 0.90   0.98                    | 0.87   0.91                     | 0.87   0.95      |                  | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se           | 0.37   0.52      | 0.22   0.48                    | 0.04   0.19                     | 0.77   0.88      | 0.29   0.61      |   |
| CV.min           | 0.78   0.89      | 0.60   0.84                    | 0.16   0.42                     | 0.86   0.93      | 0.62   0.87      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.63   0.79      | 0.52   0.89                    | 0.82   0.88                     | 0.71   0.83      | ,                | $\rho = 0.5$  |
| AIC              | 0.91   0.97      | 0.90   0.97                    | 0.88   0.89                     | 0.89 0.94        |                  | ,   |
| BIC              | 0.91   0.97      | 0.90   0.97                    | 0.88   0.89                     | 0.88   0.94      |                  | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se           | 0.37   0.47      | 0.24   0.43                    | 0.04   0.14                     | 0.78   0.85      | 0.31   0.55      |   |
| CV.min           | 0.78   0.86      | 0.60   0.77                    | 0.17   0.36                     | 0.87 0.91        | 0.63   0.82      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.64   0.75      | 0.55   0.84                    | 0.82   0.83                     | 0.72   0.79      |                  | $\rho = 0.9$  |
| AIC              | 0.91   0.96      | 0.90   0.95                    | 0.89 0.84                       | 0.90 0.92        |                  | ,   |
| BIC              | 0.91   0.95      | 0.90   0.95                    | 0.88   0.84                     | 0.89   0.91      |                  | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se           | 0.10   0.07      | 0.04   0.03                    | 0.01   0.01                     | 0.85   0.59      | 0.16   0.07      |   |
| CV.min           | 0.60   0.38      | 0.30   0.17                    | 0.11   0.06                     | 0.91   0.67      | 0.55   0.35      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.56   0.32      | 0.61   0.36                    | 0.93   0.37                     | 0.78   0.49      | 0.55   0.55      | $\rho = 0$  |
| AIC              | 0.94   0.70      | 0.94   0.57                    | 0.95   0.39                     | 0.93   0.68      |                  | '   |
| BIC              | 0.94   0.70      | 0.94   0.57                    | 0.95   0.38                     | 0.93   0.68      |                  | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se           | 0.08   0.04      | 0.04   0.03                    | 0.01   0.01                     | 0.86   0.55      | 0.16   0.05      |   |
| CV.1sc<br>CV.min | 0.56   0.30      | 0.04   0.03                    | 0.01   0.01                     | 0.92   0.62      | 0.54   0.28      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.56   0.27      | 0.60   0.31                    | 0.10   0.03                     | 0.79   0.43      | 0.54   0.20      | $\rho = 0.5$  |
| AIC              | 0.94   0.67      | 0.00   0.51                    | 0.95   0.35                     | 0.93   0.64      |                  | $\rho = 0.5$  |
| BIC              | 0.94   0.67      | 0.94   0.53                    | 0.95   0.35                     | 0.93   0.64      |                  | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se           | 0.08   0.04      | 0.04   0.02                    | 0.93   0.33                     | 0.93   0.04      | 0.19   0.06      |   |
| CV.1se<br>CV.min |                  | 0.04   0.02                    | 0.02   0.01                     | 0.87   0.51      | 0.19   0.00      | $\operatorname{sd}(\mu)/\sigma = 1$   |
|                  | 0.56   0.28      | !                              |                                 | ,                | 0.30   0.20      | $\begin{array}{c c} \operatorname{sd}(\mu)/\delta = 1\\ \rho = 0.9 \end{array}$ |
| AIC              | 0.57   0.25      | 0.59   0.28                    | 0.94   0.33                     | $0.81 \mid 0.41$ |                  | $\rho = 0.9$  |
| AIC              | 0.94   0.65      | 0.94   0.53                    | 0.95   0.35                     | $0.93 \mid 0.62$ |                  | $\bar{s}_{Oracle} = 10.0$   |
| BIC              | 0.94   0.65      | 0.94   0.53                    | 0.95   0.35                     | 0.93   0.61      | 0.20   0.01      |   |
| CV.1se           | 0.02   0.00      | 0.02   0.00                    | 0.01   0.00                     | 0.93   0.26      | 0.29   0.01      | -1()/- 0.5  |
| CV.min           | 0.44   0.06      | 0.20   0.01                    | 0.10   0.01                     | 0.96   0.32      | 0.56   0.06      | $\operatorname{sd}(\mu)/\sigma = 0.5$   |
| AICc             | 0.54   0.06      | 0.92   0.17                    | 0.97   0.14                     | 0.91   0.16      |                  | $\rho = 0$  |
| AIC              | 0.97   0.37      | 0.97   0.25                    | 0.98   0.15                     | 0.96   0.34      |                  | $\bar{s}_{Oracle} = 10.0$   |
| BIC              | 0.97   0.36      | 0.97   0.25                    | 0.98   0.15                     | 0.96   0.34      | 0.22   0.01      |   |
| CV.1se           | 0.02   0.00      | 0.02   0.00                    | 0.01   0.00                     | 0.94   0.23      | 0.32   0.01      | 1/ )/   |
| CV.min           | 0.43   0.05      | 0.19   0.01                    | 0.10   0.01                     | 0.96   0.30      | 0.59   0.05      | $\operatorname{sd}(\mu)/\sigma = 0.5$   |
| AICc             | 0.55   0.05      | 0.89   0.15                    | 0.98   0.13                     | 0.91   0.15      |                  | $\rho = 0.5$  |
| AIC              | 0.97   0.34      | 0.97   0.23                    | 0.98   0.15                     | 0.97   0.32      |                  | $\bar{s}_{Oracle} = 10.0$   |
| BIC              | 0.97   0.34      | 0.97   0.23                    | 0.98   0.14                     | 0.97   0.32      |                  | ooracie 10.0  |
| CV.1se           | 0.03   0.00      | 0.03   0.00                    | 0.01   0.00                     | 0.94   0.21      | 0.30   0.01      |   |
| CV.min           | 0.46   0.06      | 0.21   0.01                    | 0.10   0.01                     | 0.96   0.28      | 0.61   0.05      | $\operatorname{sd}(\mu)/\sigma = 0.5$   |
| AICc             | $0.58 \mid 0.05$ | 0.90   0.14                    | 0.98   0.13                     | 0.92   0.14      |                  | $\rho = 0.9$  |
| AIC              | 0.97   0.33      | 0.98   0.23                    | 0.98   0.15                     | $0.97 \mid 0.30$ |                  | $\bar{s}_{Oracle} = 10.0$   |
| BIC              | 0.97   0.33      | 0.98   0.22                    | 0.98   0.15                     | 0.97   0.30      |                  | Oracie - 10.0   |

Table 117: FDR | Sensitivity for n=100, binary design, sparse covariates, and decay 100.

|                  | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP    |  |
|------------------|-------------|--------------------------------|---------------------------------|------------------|------------------|--|
| CV.1se           | 0.43   0.68 | 0.23   0.62                    | 0.05   0.23                     | 0.74   0.92      | 0.32   0.72      |  |
| CV.min           | 0.79   0.94 | 0.60   0.90                    | 0.16   0.49                     | 0.85   0.96      | 0.65   0.92      | $\operatorname{sd}(\mu)/\sigma = 2$                    |
| AICc             | 0.63   0.88 | 0.47   0.93                    | 0.82   0.90                     | 0.69   0.89      |                  | $\rho = 0$   |
| AIC              | 0.91   0.98 | 0.90   0.98                    | 0.87   0.90                     | 0.89   0.96      |                  | = 10.0   |
| BIC              | 0.91   0.98 | 0.89   0.98                    | 0.87   0.90                     | 0.87   0.96      |                  | $\bar{s}_{Oracle} = 10.0$                              |
| CV.1se           | 0.37   0.51 | 0.21   0.47                    | 0.04   0.16                     | 0.77   0.89      | 0.29   0.61      |  |
| CV.min           | 0.77   0.88 | 0.59   0.83                    | 0.15   0.40                     | 0.86 0.94        | 0.64   0.87      | $\operatorname{sd}(\mu)/\sigma = 2$                    |
| AICc             | 0.63   0.79 | 0.51   0.90                    | 0.82   0.87                     | 0.71   0.83      | '                | $\rho = 0.5$   |
| AIC              | 0.91   0.97 | 0.90   0.97                    | 0.88   0.88                     | 0.89 0.94        |                  | ·  |
| BIC              | 0.91   0.97 | 0.90   0.97                    | 0.88   0.88                     | 0.88 0.94        |                  | $\bar{s}_{Oracle} = 10.0$                              |
| CV.1se           | 0.37   0.46 | 0.22   0.41                    | 0.04   0.14                     | 0.78   0.86      | 0.30   0.54      |  |
| CV.min           | 0.78   0.86 | 0.59   0.76                    | 0.16   0.34                     | 0.87   0.91      | 0.64   0.83      | $\operatorname{sd}(\mu)/\sigma = 2$                    |
| AICc             | 0.64   0.75 | 0.55   0.85                    | 0.83   0.82                     | 0.72   0.80      | 010 1   0100     | $\rho = 0.9$   |
| AIC              | 0.91   0.96 | 0.90   0.95                    | 0.89   0.83                     | 0.90   0.92      |                  | · ·  |
| BIC              | 0.91   0.95 | 0.90   0.95                    | 0.88   0.83                     | 0.88   0.92      |                  | $\bar{s}_{Oracle} = 10.0$                              |
| CV.1se           | 0.10   0.06 | 0.04   0.03                    | 0.01   0.01                     | 0.85   0.60      | 0.17   0.07      |  |
| CV.min           | 0.59   0.38 | 0.29   0.15                    | 0.11   0.05                     | 0.91   0.67      | 0.56   0.34      | $\operatorname{sd}(\mu)/\sigma = 1$                    |
| AICc             | 0.55   0.32 | 0.65   0.38                    | 0.93   0.37                     | 0.78   0.49      | 0.50   0.51      | $\rho = 0$   |
| AIC              | 0.94   0.71 | 0.94   0.57                    | 0.95   0.38                     | 0.93   0.69      |                  | ′  |
| BIC              | 0.94   0.71 | 0.94   0.57                    | 0.95   0.38                     | 0.93   0.68      |                  | $\bar{s}_{Oracle} = 10.0$                              |
| CV.1se           | 0.07   0.04 | 0.04   0.03                    | 0.01   0.01                     | 0.86   0.55      | 0.18   0.05      |  |
| CV.1sc<br>CV.min | 0.56   0.30 | 0.04   0.03                    | 0.01   0.01                     | 0.80   0.53      | 0.18   0.03      | $\operatorname{sd}(\mu)/\sigma = 1$                    |
| AICc             | 0.56   0.27 | 0.62   0.33                    | 0.10   0.03                     | 0.72   0.03      | 0.55   0.26      | $\rho = 0.5$   |
| AIC              | 0.94   0.67 | 0.02   0.53                    | 0.95   0.36                     | 0.93   0.64      |                  | $\rho = 0.5$   |
| BIC              | 0.94   0.67 | 0.94   0.54                    | 0.95   0.36                     | 0.93   0.64      |                  | $\bar{s}_{Oracle} = 10.0$                              |
| CV.1se           | 0.08   0.04 | 0.04   0.02                    | 0.93   0.30                     | 0.93   0.04      | 0.17   0.05      |  |
| CV.1se<br>CV.min | 0.56   0.04 | 0.04   0.02                    | 0.02   0.01                     | 0.87   0.32      | 0.17   0.03      | $\operatorname{sd}(\mu)/\sigma = 1$                    |
|                  | ,           | ,                              |                                 | '                | 0.33   0.20      | $\beta \operatorname{sd}(\mu)/\delta = 1$ $\rho = 0.9$ |
| AICc             | 0.57   0.24 | 0.61   0.30                    | 0.94   0.33                     | 0.81   0.41      |                  | $\rho = 0.9$   |
| AIC              | 0.94   0.65 | 0.94   0.52                    | 0.95   0.35                     | 0.93   0.62      |                  | $\bar{s}_{Oracle} = 10.0$                              |
| BIC              | 0.94   0.65 | 0.94   0.52                    | 0.95   0.34                     | 0.93   0.61      | 0.20   0.01      |  |
| CV.1se           | 0.03   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.93   0.26      | 0.30   0.01      | -1()/- 0.5   |
| CV.min           | 0.44   0.06 | 0.21   0.01                    | 0.10   0.01                     | 0.96   0.32      | 0.57   0.06      | $\operatorname{sd}(\mu)/\sigma = 0.5$                  |
| AICc             | 0.54   0.06 | 0.93   0.17                    | 0.97   0.14                     | 0.91   0.16      |                  | $\rho = 0$   |
| AIC              | 0.97   0.37 | 0.97   0.24                    | 0.98   0.15                     | 0.96   0.34      |                  | $\bar{s}_{Oracle} = 10.0$                              |
| BIC              | 0.97   0.36 | 0.97   0.24                    | 0.98   0.15                     | 0.96   0.34      | 0.20   0.01      |  |
| CV.1se           | 0.02   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.94   0.23      | 0.30   0.01      | 1/ )/  |
| CV.min           | 0.43   0.05 | 0.18   0.01                    | 0.10   0.01                     | 0.96   0.30      | 0.59   0.05      | $\operatorname{sd}(\mu)/\sigma = 0.5$                  |
| AICc             | 0.56   0.05 | 0.92   0.15                    | 0.98   0.13                     | 0.91   0.15      |                  | $\rho = 0.5$   |
| AIC              | 0.97   0.34 | 0.97   0.24                    | 0.98   0.15                     | 0.97   0.32      |                  | $\bar{s}_{Oracle} = 10.0$                              |
| BIC              | 0.97   0.34 | 0.97   0.23                    | 0.98   0.14                     | 0.97   0.32      |                  | ooracie 1010   |
| CV.1se           | 0.02   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.94   0.21      | 0.31   0.01      |  |
| CV.min           | 0.46   0.05 | 0.20   0.01                    | 0.10   0.01                     | 0.96   0.28      | $0.61 \mid 0.05$ | $\operatorname{sd}(\mu)/\sigma = 0.5$                  |
| AICc             | 0.57   0.05 | 0.91   0.14                    | 0.98   0.13                     | 0.92   0.14      |                  | $\rho = 0.9$   |
| AIC              | 0.97   0.33 | 0.98   0.22                    | 0.98   0.14                     | $0.97 \mid 0.30$ |                  | $\bar{s}_{Oracle} = 10.0$                              |
| BIC              | 0.97   0.33 | 0.98   0.22                    | 0.98   0.14                     | 0.97   0.30      |                  | Oracie - 10.0  |

Table 118: FDR | Sensitivity for n=100, binary design, sparse covariates, and decay 200.

|                  | lasso                      | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL | sparsenet MCP |                                       |
|------------------|----------------------------|--------------------------------|---------------------------------|-------------|---------------|---------------------------------------|
| CV.1se           | 0.43   0.69                | 0.23   0.61                    | 0.05   0.23                     | 0.74   0.92 | 0.32   0.72   |                                       |
| CV.min           | 0.79   0.94                | 0.59   0.90                    | 0.17   0.50                     | 0.85   0.96 | 0.65   0.92   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.63   0.88                | 0.47   0.93                    | 0.82   0.89                     | 0.69   0.89 |               | $\rho = 0$                            |
| AIC              | 0.91   0.98                | 0.90   0.98                    | 0.87   0.90                     | 0.89   0.96 |               | = 10.0                                |
| BIC              | 0.91   0.98                | 0.89   0.98                    | 0.87   0.90                     | 0.87   0.96 |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.36   0.52                | 0.20   0.46                    | 0.03   0.16                     | 0.77   0.89 | 0.29   0.61   |                                       |
| CV.min           | 0.77   0.89                | 0.58   0.82                    | 0.15   0.40                     | 0.86 0.94   | 0.64   0.88   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.63   0.80                | 0.51   0.91                    | 0.82   0.88                     | 0.71   0.84 | '             | $\rho = 0.5$                          |
| AIC              | 0.91   0.97                | 0.90   0.97                    | 0.88   0.88                     | 0.89 0.94   |               | ·                                     |
| BIC              | 0.91   0.97                | 0.90   0.97                    | 0.87   0.88                     | 0.88   0.94 |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.38   0.47                | 0.22   0.42                    | 0.04   0.14                     | 0.78   0.86 | 0.30   0.55   |                                       |
| CV.min           | 0.78   0.86                | 0.59   0.76                    | 0.16   0.34                     | 0.87 0.91   | 0.64   0.83   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.64   0.74                | 0.55   0.85                    | 0.83   0.82                     | 0.72   0.80 | ı             | $\rho = 0.9$                          |
| AIC              | 0.91   0.96                | 0.90   0.95                    | 0.89   0.83                     | 0.90 0.92   |               | · ·                                   |
| BIC              | 0.91   0.95                | 0.90   0.95                    | 0.88   0.83                     | 0.89 0.92   |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.10   0.07                | 0.04   0.03                    | 0.02   0.01                     | 0.85   0.59 | 0.17   0.07   |                                       |
| CV.min           | 0.59   0.38                | 0.28   0.15                    | 0.11   0.06                     | 0.91   0.67 | 0.55   0.34   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.55   0.32                | 0.67   0.38                    | 0.93   0.37                     | 0.78   0.49 | 3.00          | $\rho = 0$                            |
| AIC              | 0.94   0.71                | 0.94   0.57                    | 0.95   0.38                     | 0.93   0.68 |               | ,                                     |
| BIC              | 0.94   0.70                | 0.94   0.57                    | 0.95   0.38                     | 0.93   0.68 |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.08   0.04                | 0.04   0.03                    | 0.02   0.01                     | 0.87   0.54 | 0.17   0.05   |                                       |
| CV.13C           | 0.55   0.30                | 0.27   0.12                    | 0.10   0.04                     | 0.92   0.62 | 0.53   0.28   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.56   0.26                | 0.64   0.33                    | 0.94   0.34                     | 0.79   0.43 | 0.55   0.20   | $\rho = 0.5$                          |
| AIC              | 0.94   0.67                | 0.94   0.54                    | 0.95   0.35                     | 0.93   0.64 |               | $\rho = 0.9$                          |
| BIC              | 0.94   0.67                | 0.94   0.54                    | 0.95   0.35                     | 0.93   0.64 |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.08   0.04                | 0.04   0.02                    | 0.02   0.01                     | 0.87   0.52 | 0.19   0.05   |                                       |
| CV.13C<br>CV.min | 0.56   0.28                | 0.04   0.02                    | 0.02   0.01                     | 0.92   0.60 | 0.56   0.25   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.56   0.24                | 0.28   0.11                    | 0.10   0.04                     | 0.92   0.00 | 0.30   0.23   | $\rho = 0.9$                          |
| AIC              | 0.94   0.65                | 0.04   0.50                    | 0.94   0.35                     | 0.93   0.62 |               | $\rho = 0.9$                          |
| BIC              | 0.94   0.65                | 0.94   0.52                    | 0.95   0.33                     | 0.93   0.02 |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           |                            |                                |                                 |             | 0.28   0.01   |                                       |
|                  | 0.03   0.00<br>0.43   0.06 | $0.02 \mid 0.00$               | 0.02   0.00<br>0.10   0.01      | 0.94   0.26 | 0.28   0.01   | $\frac{1}{2}$ ad(u)/ $\sigma = 0.5$   |
| CV.min           |                            | 0.20   0.01                    |                                 | 0.96   0.32 | 0.38   0.00   | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.54   0.06                | 0.94   0.17                    | 0.97   0.14                     | 0.91   0.16 |               | $\rho = 0$                            |
| AIC              | 0.97   0.37                | 0.97   0.24                    | 0.98   0.15                     | 0.96   0.34 |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC              | 0.97   0.36                | 0.97   0.23                    | 0.98   0.15                     | 0.96   0.34 | 0.21   0.01   |                                       |
| CV.1se           | 0.02   0.00                | 0.02   0.00                    | 0.01   0.00                     | 0.94   0.23 | 0.31   0.01   | 1/ )/ 0.5                             |
| CV.min           | 0.43   0.05                | 0.18   0.01                    | 0.10   0.01                     | 0.96   0.30 | 0.58   0.05   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 0.56   0.05                | 0.92   0.15                    | 0.98   0.13                     | 0.91   0.15 |               | $\rho = 0.5$                          |
| AIC              | 0.97   0.34                | 0.97   0.23                    | 0.98   0.15                     | 0.97   0.32 |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC              | 0.97   0.34                | 0.97   0.23                    | 0.98   0.14                     | 0.97   0.32 | 0.21   0.01   |                                       |
| CV.1se           | 0.02   0.00                | 0.02   0.00                    | 0.01   0.00                     | 0.94   0.21 | 0.31   0.01   | 1/ )/                                 |
| CV.min           | 0.46   0.05                | 0.21   0.01                    | 0.10   0.01                     | 0.96   0.28 | 0.61   0.06   | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.58   0.05                | 0.92   0.15                    | 0.98   0.12                     | 0.92   0.14 |               | $\rho = 0.9$                          |
| AIC              | 0.97   0.33                | 0.98   0.22                    | 0.98   0.14                     | 0.97   0.30 |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC              | 0.97   0.33                | 0.98   0.22                    | 0.98   0.14                     | 0.97   0.30 |               | - Oracle 20.0                         |

Table 119: FDR | Sensitivity for n=100, continuous design, sparse covariates, and decay 10.

|                   | lasso            | $GL \gamma = 1$  | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                     |
|-------------------|------------------|------------------|---------------------------------|------------------|---------------|-------------------------------------|
| CV.1se            | 0.42   0.64      | 0.26   0.63      | 0.05   0.42                     | 0.72   0.81      | 0.16   0.64   |                                     |
| CV.min            | $0.78 \mid 0.87$ | $0.64 \mid 0.85$ | $0.18 \mid 0.64$                | $0.85 \mid 0.87$ | 0.44   0.81   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.63   0.79      | 0.34   0.73      | $0.65 \mid 0.81$                | $0.69 \mid 0.79$ |               | $\rho = 0$                          |
| AIC               | 0.91   0.92      | 0.90   0.92      | $0.88 \mid 0.88$                | $0.89 \mid 0.88$ |               | ā - · - 10 0                        |
| BIC               | 0.91   0.92      | $0.90 \mid 0.92$ | $0.88 \mid 0.88$                | $0.81 \mid 0.85$ |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.11   0.07      | 0.11   0.09      | 0.03   0.08                     | 0.85   0.34      | 0.10   0.16   |                                     |
| CV.min            | 0.69   0.26      | 0.57   0.24      | 0.16   0.16                     | 0.93   0.44      | 0.39   0.29   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.66   0.24      | 0.22   0.15      | 0.61   0.35                     | 0.84   0.29      |               | $\rho = 0.5$                        |
| AIC               | 0.95   0.57      | 0.94   0.57      | 0.94   0.48                     | 0.94   0.48      |               | = 10.0                              |
| BIC               | 0.95   0.57      | 0.94   0.56      | 0.94   0.48                     | 0.83   0.42      |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.12   0.10      | 0.09   0.10      | 0.04   0.11                     | 0.64   0.24      | 0.04   0.12   |                                     |
| CV.min            | 0.71   0.15      | 0.61   0.14      | 0.23   0.13                     | 0.86   0.42      | 0.32   0.15   | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.72   0.14      | 0.21   0.11      | 0.02   0.10                     | 0.82   0.31      | '             | $\rho = 0.9$                        |
| AIC               | 0.97   0.28      | 0.97   0.26      | 0.97   0.23                     | 0.90   0.56      |               |                                     |
| BIC               | 0.93   0.27      | 0.95   0.26      | 0.97   0.23                     | 0.34   0.13      |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.11   0.10      | 0.07   0.07      | 0.02   0.04                     | 0.84   0.55      | 0.11   0.09   |                                     |
| CV.min            | 0.61   0.38      | 0.39   0.25      | 0.12   0.10                     | 0.91   0.61      | 0.51   0.34   | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 0.60   0.36      | 0.14   0.14      | 0.92   0.41                     | 0.77   0.47      | ı             | $\rho = 0$                          |
| AIC               | 0.94   0.66      | 0.94   0.57      | 0.94   0.42                     | 0.93   0.63      |               | ,                                   |
| BIC               | 0.94   0.65      | 0.94   0.57      | 0.94   0.42                     | 0.92   0.63      |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.05   0.02      | 0.05   0.02      | 0.02   0.02                     | 0.89   0.24      | 0.15   0.04   |                                     |
| CV.min            | 0.54   0.12      | 0.40   0.09      | 0.15   0.05                     | 0.95   0.31      | 0.46   0.11   | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 0.63   0.13      | 0.13   0.05      | 0.91   0.22                     | 0.88   0.19      |               | $\rho = 0.5$                        |
| AIC               | 0.96   0.39      | 0.97   0.34      | 0.97   0.26                     | 0.96   0.35      |               | ,                                   |
| BIC               | 0.96   0.38      | 0.97   0.34      | 0.97   0.25                     | 0.94   0.34      |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.07   0.06      | 0.07   0.07      | 0.03   0.08                     | 0.51   0.12      | 0.04   0.08   |                                     |
| CV.min            | 0.66   0.12      | 0.56   0.11      | 0.20   0.10                     | 0.89   0.20      | 0.28   0.11   | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 0.68   0.12      | 0.16   0.10      | 0.03   0.09                     | 0.84   0.14      | 0.20   0.11   | $\rho = 0.9$                        |
| AIC               | 0.98   0.24      | 0.98   0.22      | 0.98   0.18                     | 0.95   0.41      |               | ,                                   |
| BIC               | 0.97   0.24      | 0.98   0.22      | 0.98   0.18                     | 0.38   0.12      |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.04   0.01      | 0.02   0.00      | 0.01   0.00                     | 0.93   0.25      | 0.27   0.01   |                                     |
| CV.min            | 0.43   0.07      | 0.24   0.03      | 0.12   0.01                     | 0.96   0.31      | 0.58   0.07   | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 0.54   0.08      | 0.19   0.03      | 0.97   0.15                     | 0.90   0.17      |               | $\rho = 0$                          |
| AIC               | 0.97   0.36      | 0.97   0.27      | 0.98   0.17                     | 0.96   0.33      |               | ,                                   |
| BIC               | 0.97   0.35      | 0.97   0.26      | 0.98   0.17                     | 0.96   0.33      |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.03   0.00      | 0.03   0.00      | 0.01   0.00                     | 0.93   0.13      | 0.29   0.01   |                                     |
| CV.min            | 0.43   0.03      | 0.29   0.02      | 0.14   0.01                     | 0.97   0.18      | 0.60   0.03   | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 0.57   0.04      | 0.08   0.01      | 0.98   0.11                     | 0.93   0.09      | 0.00   0.02   | $\rho = 0.5$                        |
| AIC               | 0.98   0.23      | 0.98   0.19      | 0.98   0.11                     | 0.98   0.21      |               |                                     |
| BIC               | 0.98   0.23      | 0.98   0.18      | 0.98   0.13                     | 0.98   0.21      |               | $\bar{s}_{Oracle} = 10.0$           |
| CV.1se            | 0.03   0.01      | 0.03   0.01      | 0.01   0.01                     | 0.58   0.07      | 0.18   0.02   |                                     |
| CV.rise<br>CV.min | 0.48   0.06      | 0.39   0.05      | 0.16   0.03                     | 0.93   0.13      | 0.51   0.06   | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 0.46   0.00      | 0.37   0.03      | 0.69   0.09                     | 0.89   0.10      | 0.51   0.00   | $\rho = 0.9$                        |
| AIC               | 0.98   0.21      | 0.10   0.03      | 0.09   0.09                     | 0.89   0.10      |               |                                     |
| BIC               | 0.98   0.21      | 0.98   0.18      | 0.98   0.14                     | 0.67   0.23      |               | $\bar{s}_{Oracle} = 10.0$           |
| DIC               | 0.70   0.21      | 0.30   0.18      | 0.20   0.14                     | 0.07   0.13      |               |                                     |

Table 120: FDR | Sensitivity for n=100, continuous design, sparse covariates, and decay 50.

|                   | lasso            | $GL \gamma = 1$            | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |   |
|-------------------|------------------|----------------------------|---------------------------------|------------------|---------------|---|
| CV.1se            | 0.41   0.65      | 0.23   0.61                | 0.05   0.26                     | 0.73   0.91      | 0.28   0.71   |   |
| CV.min            | 0.78   0.93      | 0.59   0.90                | 0.17   0.56                     | 0.84   0.94      | 0.61   0.91   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.63   0.87      | 0.33   0.83                | $0.76 \mid 0.89$                | $0.68 \mid 0.88$ |               | $\rho = 0$  |
| AIC               | 0.91   0.97      | 0.90   0.97                | 0.87   0.90                     | $0.89 \mid 0.95$ |               | = -100  |
| BIC               | 0.91   0.97      | 0.90   0.97                | 0.87   0.90                     | 0.86   0.94      |               | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se            | 0.07   0.04      | 0.06   0.04                | 0.02   0.03                     | 0.86   0.39      | 0.15   0.07   |   |
| CV.min            | 0.60   0.23      | 0.44   0.17                | 0.15   0.08                     | 0.93   0.49      | 0.49   0.22   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.63   0.22      | 0.14   0.09                | 0.91   0.36                     | 0.83   0.32      |               | $\rho = 0.5$  |
| AIC               | 0.95   0.60      | 0.94   0.56                | 0.95   0.40                     | 0.94   0.53      |               | _ 10.0  |
| BIC               | 0.95   0.60      | 0.94   0.55                | 0.95   0.40                     | 0.93   0.52      |               | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se            | 0.26   0.10      | 0.23   0.11                | 0.13   0.12                     | 0.69   0.19      | 0.12   0.14   |   |
| CV.min            | 0.78   0.20      | 0.73   0.17                | 0.33   0.15                     | 0.90 0.26        | 0.34   0.18   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.77   0.19      | 0.32   0.14                | 0.18   0.14                     | 0.84   0.21      | '             | $\rho = 0.9$  |
| AIC               | 0.97   0.32      | 0.97   0.29                | 0.97   0.23                     | 0.95   0.43      |               | ,   |
| BIC               | 0.97   0.32      | 0.97   0.29                | 0.97   0.23                     | 0.61 0.19        |               | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se            | 0.10   0.07      | 0.05   0.04                | 0.01   0.02                     | 0.84   0.58      | 0.15   0.07   |   |
| CV.min            | 0.58   0.37      | 0.29   0.17                | 0.11   0.06                     | 0.91   0.66      | 0.54   0.34   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.57   0.33      | 0.16   0.12                | 0.93   0.38                     | 0.77   0.49      | 0.0 1   0.0 1 | $\rho = 0$  |
| AIC               | 0.94   0.69      | 0.94   0.57                | 0.95   0.39                     | 0.93   0.67      |               | ,   |
| BIC               | 0.94   0.69      | 0.94   0.57                | 0.94   0.39                     | 0.92   0.67      |               | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se            | 0.04   0.01      | 0.03   0.01                | 0.02   0.01                     | 0.91   0.26      | 0.19   0.02   |   |
| CV.min            | 0.48   0.10      | 0.32   0.06                | 0.13   0.02                     | 0.95   0.34      | 0.55   0.09   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.57   0.10      | 0.12   0.03                | 0.96   0.19                     | 0.88   0.20      | 0.00          | $\rho = 0.5$  |
| AIC               | 0.96   0.40      | 0.97   0.34                | 0.97   0.22                     | 0.96   0.37      |               | ,   |
| BIC               | 0.96   0.40      | 0.97   0.34                | 0.97   0.22                     | 0.96   0.37      |               | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se            | 0.09   0.03      | 0.09   0.03                | 0.05   0.03                     | 0.68   0.13      | 0.17   0.05   |   |
| CV.rise<br>CV.min | 0.60   0.12      | 0.54   0.10                | 0.24   0.07                     | 0.92   0.20      | 0.50   0.11   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.68   0.12      | 0.16   0.05                | 0.46   0.10                     | 0.88   0.16      | 0.50   0.11   | $\rho = 0.9$  |
| AIC               | 0.98   0.28      | 0.10   0.03                | 0.48   0.19                     | 0.96   0.32      |               | $\rho = 0.5$  |
| BIC               | 0.97   0.28      | 0.98   0.24                | 0.97   0.19                     | 0.68   0.17      |               | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se            | 0.03   0.01      | 0.02   0.00                | 0.02   0.00                     | 0.93   0.25      | 0.25   0.01   |   |
| CV.1sc<br>CV.min  | 0.03   0.01      | 0.02   0.00                | 0.02   0.00                     | 0.96   0.32      | 0.55   0.06   | $sd(\mu)/\sigma = 0.5$  |
| AICc              | 0.55   0.07      | 0.21   0.02                | 0.11   0.01                     | 0.90   0.17      | 0.55   0.00   | $\rho = 0$  |
| AIC               | 0.97   0.36      | 0.97   0.09                | 0.97   0.14                     | 0.96   0.34      |               | ,   |
| BIC               | 0.97   0.36      | 0.97   0.25                | 0.98   0.16                     | 0.96   0.34      |               | $\bar{s}_{Oracle} = 10.0$   |
| CV.1se            | 0.02   0.00      | 0.02   0.00                | 0.98   0.13                     | 0.93   0.13      | 0.28   0.01   |   |
|                   | '                | 0.02   0.00                |                                 | 0.93   0.13      | '             | $ad(u)/\sigma = 0.5$  |
| CV.min<br>AICc    | 0.44   0.03      |                            | 0.13   0.00                     | 0.97   0.19      | 0.59   0.03   | $\begin{array}{c c} \operatorname{sd}(\mu)/\sigma = 0.5\\ \rho = 0.5 \end{array}$ |
|                   | 0.56   0.03      | 0.12   0.01<br>0.98   0.18 | 0.98   0.10<br>0.98   0.12      | ,                |               | $\rho = 0.5$  |
| AIC               | 0.98   0.24      | 0.98   0.18                |                                 | 0.98   0.21      |               | $\bar{s}_{Oracle} = 10.0$   |
| BIC               | 0.98   0.23      |                            | 0.98   0.12                     | 0.98   0.21      | 0.20   0.01   |   |
| CV.1se            | $0.03 \mid 0.00$ | $0.02 \mid 0.00$           | $0.02 \mid 0.00$                | 0.62   0.05      | 0.30   0.01   | ad()/= 0.5  |
| CV.min            | 0.45   0.03      | 0.33   0.02                | $0.15 \mid 0.01$                | 0.94   0.11      | 0.61   0.03   | $sd(\mu)/\sigma = 0.5$  |
| AIC               | 0.60   0.04      | $0.08 \mid 0.00$           | 0.95   0.11                     | $0.91 \mid 0.08$ |               | $\rho = 0.9$  |
| AIC               | 0.98   0.21      | 0.98   0.17                | 0.98   0.13                     | 0.98   0.20      |               | $\bar{s}_{Oracle} = 10.0$   |
| BIC               | 0.98   0.21      | 0.98   0.17                | 0.98   0.13                     | 0.84   0.13      |               |   |

Table 121: FDR | Sensitivity for n=100, continuous design, sparse covariates, and decay 100.

|                   | lasso                     | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|-------------------|---------------------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.41   0.66               | 0.22   0.61                    | 0.04   0.25                     | 0.73   0.91      | 0.29   0.72   |                                       |
| CV.min            | 0.78   0.94               | $0.58 \mid 0.89$               | $0.17 \mid 0.52$                | $0.84 \mid 0.94$ | 0.62   0.91   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.63   0.87               | 0.33   0.84                    | $0.78 \mid 0.89$                | $0.69 \mid 0.89$ |               | $\rho = 0$                            |
| AIC               | 0.91   0.97               | $0.90 \mid 0.97$               | $0.87 \mid 0.90$                | $0.89 \mid 0.95$ |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC               | 0.91   0.97               | $0.90 \mid 0.97$               | $0.87 \mid 0.90$                | $0.86 \mid 0.95$ |               | SOracle - 10.0                        |
| CV.1se            | 0.07   0.04               | 0.06   0.04                    | 0.02   0.02                     | 0.86   0.39      | 0.16   0.06   |                                       |
| CV.min            | 0.59   0.23               | 0.43   0.17                    | $0.14 \mid 0.07$                | 0.93   0.50      | 0.50   0.22   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | $0.62 \mid 0.22$          | 0.14   0.09                    | 0.91   0.36                     | $0.83 \mid 0.33$ |               | $\rho = 0.5$                          |
| AIC               | 0.95   0.60               | 0.94   0.55                    | 0.95   0.39                     | $0.94 \mid 0.54$ |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC               | $0.95 \mid 0.60$          | 0.94   0.55                    | 0.95   0.39                     | 0.93   0.52      |               | $s_{Oracle} = 10.0$                   |
| CV.1se            | 0.27   0.10               | 0.24   0.11                    | 0.13   0.11                     | 0.69   0.19      | 0.14   0.14   |                                       |
| CV.min            | 0.79   0.20               | 0.73   0.17                    | 0.33   0.15                     | 0.89   0.26      | 0.37   0.18   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.77   0.20               | 0.33   0.14                    | 0.20   0.15                     | 0.84   0.22      | •             | $\rho = 0.9$                          |
| AIC               | 0.97   0.32               | 0.97   0.29                    | 0.97   0.23                     | 0.95   0.42      |               | _ 10.0                                |
| BIC               | 0.97   0.32               | 0.97   0.29                    | 0.97   0.23                     | 0.64   0.20      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se            | 0.10   0.07               | 0.04   0.04                    | 0.02   0.02                     | 0.84   0.59      | 0.14   0.07   |                                       |
| CV.min            | 0.58   0.37               | 0.28   0.16                    | 0.10   0.06                     | 0.91   0.66      | 0.54   0.34   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.57   0.33               | 0.18   0.12                    | 0.93   0.37                     | 0.77   0.49      | ı             | $\rho = 0$                            |
| AIC               | 0.94   0.70               | 0.94   0.56                    | 0.95   0.39                     | 0.93   0.67      |               | ,                                     |
| BIC               | 0.94   0.69               | 0.94   0.56                    | 0.94   0.39                     | 0.93   0.67      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se            | 0.04   0.01               | 0.03   0.01                    | 0.02   0.01                     | 0.91   0.26      | 0.25   0.02   |                                       |
| CV.min            | 0.47   0.09               | 0.30   0.05                    | 0.13   0.02                     | 0.95   0.34      | 0.56   0.09   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.57   0.10               | 0.11   0.02                    | 0.96   0.19                     | 0.88   0.20      | 0.00          | $\rho = 0.5$                          |
| AIC               | 0.96   0.40               | 0.97   0.34                    | 0.97   0.21                     | 0.96   0.37      |               | ,                                     |
| BIC               | 0.96   0.40               | 0.97   0.33                    | 0.97   0.21                     | 0.96   0.37      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se            | 0.09   0.02               | 0.10   0.02                    | 0.05   0.03                     | 0.70   0.13      | 0.22   0.05   |                                       |
| CV.rise<br>CV.min | 0.59   0.11               | 0.53   0.09                    | 0.25   0.06                     | 0.92   0.20      | 0.54   0.11   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.68   0.12               | 0.17   0.04                    | 0.56   0.12                     | 0.88   0.16      | 0.51   0.11   | $\rho = 0.9$                          |
| AIC               | 0.97   0.28               | 0.98   0.24                    | 0.98   0.12                     | 0.96   0.31      |               | $\rho = 0.3$                          |
| BIC               | 0.97   0.28               | 0.98   0.24                    | 0.98   0.19                     | 0.69   0.18      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se            | 0.03   0.01               | 0.02   0.00                    | 0.02   0.00                     | 0.93   0.25      | 0.26   0.01   |                                       |
| CV.13C<br>CV.min  | 0.42   0.06               | 0.02   0.00                    | 0.10   0.01                     | 0.96   0.32      | 0.57   0.06   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.56   0.07               | 0.56   0.10                    | 0.97   0.14                     | 0.90   0.17      | 0.57   0.00   | $\rho = 0$                            |
| AIC               | 0.97   0.36               | 0.97   0.25                    | 0.98   0.14                     | 0.96   0.34      |               | $\rho = 0$                            |
| BIC               | 0.97   0.36               | 0.97   0.23                    | 0.98   0.15                     | 0.96   0.34      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se            | 0.02   0.00               | 0.02   0.00                    | 0.01   0.00                     | 0.93   0.12      | 0.30   0.00   |                                       |
| CV.1se<br>CV.min  | '                         | 0.02   0.00                    | 0.01   0.00                     |                  | 0.61   0.03   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.43   0.03   0.56   0.03 | 0.25   0.01                    |                                 | $0.97 \mid 0.18$ | 0.01   0.03   | $\rho = 0.5$                          |
|                   |                           | ,                              | $0.98 \mid 0.10$                | $0.93 \mid 0.08$ |               | $\rho = 0.5$                          |
| AIC               | $0.98 \mid 0.23$          | 0.98   0.18                    | 0.98   0.12                     | $0.98 \mid 0.21$ |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC               | 0.98   0.23               | 0.98   0.18                    | 0.98   0.11                     | 0.98   0.21      | 0.20   0.01   |                                       |
| CV.1se            | $0.02 \mid 0.00$          | $0.02 \mid 0.00$               | 0.02   0.00                     | 0.62   0.05      | 0.28   0.01   | ad()/= 0.5                            |
| CV.min            | 0.45   0.03               | 0.33   0.02                    | $0.14 \mid 0.01$                | 0.94   0.11      | 0.59   0.03   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.60   0.03               | $0.07 \mid 0.00$               | 0.97   0.11                     | $0.91 \mid 0.07$ |               | $\rho = 0.9$                          |
| AIC               | 0.98   0.21               | 0.98   0.17                    | 0.98   0.13                     | 0.98   0.20      |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC               | 0.98   0.21               | 0.98   0.17                    | 0.98   0.13                     | 0.83   0.13      |               |                                       |

Table 122: FDR | Sensitivity for n=100, continuous design, sparse covariates, and decay 200.

|                  | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|------------------|-------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se           | 0.41   0.65 | 0.21   0.61                    | 0.04   0.25                     | 0.73   0.91      | 0.29   0.72   |                                       |
| CV.min           | 0.79   0.94 | 0.58   0.90                    | 0.16   0.54                     | $0.84 \mid 0.95$ | 0.61   0.91   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.63   0.87 | 0.32   0.84                    | $0.79 \mid 0.90$                | $0.69 \mid 0.89$ |               | $\rho = 0$                            |
| AIC              | 0.91   0.98 | $0.90 \mid 0.97$               | $0.87 \mid 0.91$                | $0.89 \mid 0.95$ |               | ā - 100                               |
| BIC              | 0.91   0.97 | $0.89 \mid 0.97$               | $0.87 \mid 0.91$                | $0.86 \mid 0.95$ |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.07   0.04 | 0.06   0.04                    | 0.02   0.03                     | 0.86   0.39      | 0.16   0.06   |                                       |
| CV.min           | 0.59   0.23 | 0.42   0.16                    | 0.14   0.07                     | 0.93   0.50      | 0.49   0.21   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.62   0.22 | 0.14   0.09                    | 0.91   0.35                     | 0.83   0.33      |               | $\rho = 0.5$                          |
| AIC              | 0.95   0.60 | 0.94   0.55                    | 0.95   0.38                     | 0.94   0.54      |               | = 10.0                                |
| BIC              | 0.95   0.60 | 0.94   0.54                    | 0.95   0.38                     | 0.92   0.52      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.28   0.10 | 0.24   0.11                    | 0.13   0.11                     | 0.69   0.20      | 0.14   0.14   |                                       |
| CV.min           | 0.79   0.20 | 0.72   0.17                    | 0.33   0.15                     | 0.89   0.26      | 0.37   0.18   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.77   0.20 | 0.34   0.14                    | 0.23   0.15                     | 0.84   0.22      | '             | $\rho = 0.9$                          |
| AIC              | 0.97   0.32 | 0.97   0.29                    | 0.97   0.23                     | 0.95   0.41      |               |                                       |
| BIC              | 0.97   0.32 | 0.97   0.29                    | 0.97   0.23                     | 0.64   0.21      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.10   0.07 | 0.04   0.04                    | 0.01   0.02                     | 0.84   0.59      | 0.15   0.07   |                                       |
| CV.min           | 0.58   0.38 | 0.28   0.16                    | 0.11 0.06                       | 0.91   0.66      | 0.53   0.35   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.56   0.33 | 0.19   0.13                    | 0.93   0.37                     | 0.77   0.49      | ı             | $\rho = 0$                            |
| AIC              | 0.94   0.70 | 0.94   0.56                    | 0.95   0.39                     | 0.93   0.67      |               | ,                                     |
| BIC              | 0.94   0.70 | 0.94   0.56                    | 0.94   0.38                     | 0.92   0.67      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.04   0.01 | 0.03   0.01                    | 0.02   0.01                     | 0.90   0.26      | 0.23   0.02   |                                       |
| CV.min           | 0.48   0.10 | 0.30   0.05                    | 0.13   0.02                     | 0.95   0.34      | 0.56   0.09   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.58   0.10 | 0.10   0.02                    | 0.96   0.19                     | 0.88   0.20      | 0.00          | $\rho = 0.5$                          |
| AIC              | 0.96   0.41 | 0.97   0.34                    | 0.97   0.21                     | 0.96   0.37      |               | ,                                     |
| BIC              | 0.96   0.40 | 0.97   0.33                    | 0.97   0.21                     | 0.96   0.37      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.09   0.02 | 0.09   0.02                    | 0.05   0.03                     | 0.70   0.13      | 0.22   0.05   |                                       |
| CV.min           | 0.59   0.11 | 0.53   0.10                    | 0.25   0.06                     | 0.92   0.20      | 0.53   0.11   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.68   0.12 | 0.17   0.04                    | 0.58   0.12                     | 0.88   0.17      | 0.00          | $\rho = 0.9$                          |
| AIC              | 0.97   0.28 | 0.98   0.24                    | 0.98   0.20                     | 0.96   0.31      |               | ,                                     |
| BIC              | 0.97   0.28 | 0.98   0.24                    | 0.97   0.20                     | 0.72   0.18      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.03   0.01 | 0.02   0.00                    | 0.01   0.00                     | 0.93   0.25      | 0.25   0.01   |                                       |
| CV.min           | 0.42   0.06 | 0.20   0.02                    | 0.10   0.01                     | 0.96   0.32      | 0.56   0.06   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 0.55   0.07 | 0.58   0.11                    | 0.97   0.14                     | 0.90   0.17      | 0.00          | $\rho = 0$                            |
| AIC              | 0.97   0.36 | 0.97   0.24                    | 0.98   0.15                     | 0.96   0.34      |               | ,                                     |
| BIC              | 0.97   0.36 | 0.97   0.24                    | 0.98   0.15                     | 0.96   0.34      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.02   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.93   0.12      | 0.30   0.00   |                                       |
| CV.min           | 0.43   0.03 | 0.25   0.01                    | 0.13   0.00                     | 0.97   0.18      | 0.62   0.03   | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.56   0.03 | 0.16   0.01                    | 0.98   0.10                     | 0.93   0.08      | 0.02   0.03   | $\rho = 0.5$                          |
| AIC              | 0.98   0.23 | 0.98   0.18                    | 0.98   0.11                     | 0.98   0.21      |               |                                       |
| BIC              | 0.98   0.23 | 0.98   0.17                    | 0.98   0.11                     | 0.98   0.21      |               | $\bar{s}_{Oracle} = 10.0$             |
| CV.1se           | 0.03   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.61   0.05      | 0.28   0.01   |                                       |
| CV.1se<br>CV.min | 0.05   0.00 | 0.02   0.00                    | 0.01   0.00                     | 0.01   0.03      | 0.60   0.03   | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.43   0.03 | 0.08   0.00                    | 0.13   0.01                     | 0.93   0.10      | 0.00   0.03   | $\rho = 0.9$                          |
| AICC             | 0.00   0.03 | 0.08   0.00                    | 0.97   0.11                     | 0.91   0.07      |               |                                       |
|                  | 0.98   0.20 | 0.98   0.17                    | 0.98   0.13                     | 0.98   0.20      |               | $\bar{s}_{Oracle} = 10.0$             |
| BIC              | 0.90   0.20 | 0.90   0.17                    | 0.90   0.12                     | 0.63   0.12      |               |                                       |

Table 123: FDR | Sensitivity for n=1000, binary design, dense covariates, and decay 10.

|        | lasso            | $GL \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|--------|------------------|-----------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se | 0.36   0.74      | 0.20   0.71     | 0.01   0.60                     | 0.23   0.65      | 0.01   0.57   |                                       |
| CV.min | $0.72 \mid 0.85$ | 0.64   0.82     | $0.22 \mid 0.73$                | 0.54   0.72      | 0.20   0.71   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | $0.70 \mid 0.84$ | 0.63   0.82     | 0.36   0.76                     | 0.52   0.72      |               | $\rho = 0$                            |
| AIC    | 0.95   0.95      | 0.95   0.95     | 0.95   0.94                     | 0.53   0.72      |               | <u></u>                               |
| BIC    | 0.22   0.71      | 0.14   0.69     | $0.01 \mid 0.61$                | 0.17   0.63      |               | $\bar{s}_{Oracle} = 33.3$             |
| CV.1se | 0.41   0.74      | 0.25   0.71     | 0.02   0.60                     | 0.28   0.65      | 0.01   0.57   |                                       |
| CV.min | 0.74   0.84      | 0.66   0.82     | 0.25   0.72                     | 0.56   0.72      | 0.21   0.71   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.72   0.84      | 0.65   0.82     | 0.39   0.77                     | 0.54   0.71      |               | $\rho = 0.5$                          |
| AIC    | 0.95   0.96      | 0.95   0.95     | 0.95   0.94                     | 0.55   0.71      |               | - 22.2                                |
| BIC    | 0.24   0.70      | 0.15   0.68     | 0.01   0.60                     | 0.20   0.62      |               | $\bar{s}_{Oracle} = 33.3$             |
| CV.1se | 0.45   0.74      | 0.28   0.71     | 0.03   0.60                     | 0.30   0.64      | 0.01   0.58   |                                       |
| CV.min | 0.75   0.84      | 0.68   0.82     | 0.28   0.72                     | 0.57   0.71      | 0.23   0.71   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.73   0.83      | 0.66   0.81     | 0.40   0.76                     | 0.55   0.70      | '             | $\rho = 0.9$                          |
| AIC    | 0.95   0.96      | 0.95   0.96     | 0.95   0.94                     | 0.56   0.71      |               |                                       |
| BIC    | 0.27   0.69      | 0.17   0.68     | 0.02   0.60                     | 0.22   0.61      |               | $\bar{s}_{Oracle} = 33.1$             |
| CV.1se | 0.27   0.64      | 0.13   0.59     | 0.01   0.47                     | 0.45   0.67      | 0.01   0.46   |                                       |
| CV.min | 0.72   0.79      | 0.61   0.76     | 0.14   0.61                     | 0.81 0.81        | 0.26   0.65   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.72   0.79      | 0.63   0.77     | 0.34   0.67                     | $0.77 \mid 0.79$ | '             | $\rho = 0$                            |
| AIC    | 0.97   0.95      | 0.97   0.95     | 0.97   0.93                     | 0.85   0.83      |               | ,                                     |
| BIC    | 0.19   0.61      | 0.10   0.58     | 0.00   0.45                     | 0.16   0.57      |               | $\bar{s}_{Oracle} = 26.3$             |
| CV.1se | 0.31   0.62      | 0.16   0.58     | 0.01   0.47                     | 0.50   0.67      | 0.01   0.46   |                                       |
| CV.min | 0.74   0.78      | 0.64   0.74     | 0.15   0.60                     | 0.82   0.80      | 0.24   0.62   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.73   0.78      | 0.65   0.75     | 0.37   0.67                     | 0.78   0.77      |               | $\rho = 0.5$                          |
| AIC    | 0.97   0.95      | 0.97   0.95     | 0.96   0.93                     | 0.86   0.82      |               | ,                                     |
| BIC    | 0.21   0.59      | 0.12   0.56     | 0.01   0.45                     | 0.19   0.56      |               | $\bar{s}_{Oracle} = 26.4$             |
| CV.1se | 0.35   0.63      | 0.19   0.58     | 0.02   0.47                     | 0.51   0.66      | 0.01   0.46   |                                       |
| CV.min | 0.75   0.79      | 0.66   0.75     | 0.18   0.60                     | 0.81   0.79      | 0.27   0.63   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.74   0.79      | 0.67   0.76     | 0.39   0.68                     | 0.79   0.77      | 0.27   0.00   | $\rho = 0.9$                          |
| AIC    | 0.97   0.95      | 0.97   0.95     | 0.96   0.93                     | 0.85   0.82      |               | ,                                     |
| BIC    | 0.23   0.59      | 0.13   0.56     | 0.01   0.45                     | 0.21   0.56      |               | $\bar{s}_{Oracle} = 26.1$             |
| CV.1se | 0.12   0.38      | 0.06   0.34     | 0.01   0.26                     | 0.62   0.62      | 0.01   0.27   |                                       |
| CV.min | 0.70   0.66      | 0.54   0.59     | 0.14   0.43                     | 0.88   0.79      | 0.38   0.53   | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 0.73   0.69      | 0.60   0.63     | 0.22   0.43                     | 0.85   0.76      | 0.00   0.00   | $\rho = 0$                            |
| AIC    | 0.98   0.94      | 0.98   0.94     | 0.98   0.91                     | 0.94   0.88      |               | ,                                     |
| BIC    | 0.13   0.40      | 0.06   0.36     | 0.00   0.18                     | 0.17   0.44      |               | $\bar{s}_{Oracle} = 19.7$             |
| CV.1se | 0.14   0.36      | 0.08   0.33     | 0.01   0.26                     | 0.66   0.62      | 0.01   0.26   |                                       |
| CV.min | 0.72   0.66      | 0.59   0.59     | 0.14   0.42                     | 0.89   0.79      | 0.36   0.51   | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 0.75   0.68      | 0.64   0.63     | 0.26   0.45                     | 0.85   0.75      | 0.50   0.51   | $\rho = 0.5$                          |
| AIC    | 0.98   0.95      | 0.98   0.94     | 0.98   0.92                     | 0.95   0.88      |               |                                       |
| BIC    | 0.13   0.37      | 0.07   0.34     | 0.00   0.18                     | 0.19   0.41      |               | $\bar{s}_{Oracle} = 19.4$             |
| CV.1se | 0.16   0.36      | 0.09   0.32     | 0.02   0.24                     | 0.65   0.60      | 0.02   0.26   |                                       |
| CV.min | 0.74   0.65      | 0.61   0.58     | 0.16   0.40                     | $0.89 \mid 0.77$ | 0.37   0.50   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 0.74   0.03      | 0.66   0.62     | 0.10   0.40                     | 0.86   0.73      | 0.57   0.50   | $\rho = 0.9$                          |
| AIC    | 0.76   0.06      | 0.00   0.02     | 0.28   0.44                     | 0.86   0.75      |               | ,                                     |
| BIC    | 0.98   0.93      | 0.98   0.94     | 0.98   0.92                     | 0.21   0.40      |               | $\bar{s}_{Oracle} = 19.7$             |
| Біс    | 0.14   0.33      | 0.07   0.32     | 0.00   0.17                     | 0.21   0.40      |               |                                       |

Table 124: FDR | Sensitivity for n=1000, binary design, dense covariates, and decay 50.

|                   | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|-------------------|-------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.49   0.76 | 0.36   0.71                    | 0.07   0.56                     | 0.43   0.66      | 0.15   0.61   |                                       |
| CV.min            | 0.64   0.83 | 0.56   0.80                    | 0.19   0.65                     | 0.57   0.74      | 0.39   0.74   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.55   0.79 | 0.48   0.77                    | 0.43   0.75                     | 0.53   0.71      |               | $\rho = 0$                            |
| AIC               | 0.84   0.94 | 0.84   0.94                    | 0.84   0.91                     | 0.63   0.77      |               | 124.2                                 |
| BIC               | 0.22   0.59 | 0.13   0.56                    | 0.02   0.47                     | 0.22   0.54      |               | $\bar{s}_{Oracle} = 124.2$            |
| CV.1se            | 0.52   0.76 | 0.39   0.71                    | 0.08   0.56                     | 0.47   0.66      | 0.13   0.60   |                                       |
| CV.min            | 0.66   0.84 | 0.58   0.80                    | 0.21   0.65                     | 0.59   0.73      | 0.38   0.73   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.57   0.78 | 0.50   0.77                    | 0.44   0.76                     | 0.55   0.71      | ,             | $\rho = 0.5$                          |
| AIC               | 0.84   0.94 | 0.84 0.94                      | 0.84   0.92                     | 0.65   0.77      |               | ,                                     |
| BIC               | 0.23   0.57 | 0.15   0.55                    | 0.02   0.47                     | 0.25   0.53      |               | $\bar{s}_{Oracle} = 123.8$            |
| CV.1se            | 0.54   0.76 | 0.41   0.71                    | 0.10   0.56                     | 0.48   0.65      | 0.16   0.60   |                                       |
| CV.min            | 0.67   0.84 | 0.59   0.80                    | 0.24   0.65                     | 0.60   0.73      | 0.39   0.73   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.58   0.78 | 0.51   0.77                    | 0.45   0.75                     | 0.56   0.70      |               | $\rho = 0.9$                          |
| AIC               | 0.84   0.94 | 0.84 0.94                      | 0.84   0.91                     | 0.65 0.76        |               | ,                                     |
| BIC               | 0.25   0.56 | 0.16   0.55                    | 0.03   0.47                     | 0.27   0.52      |               | $\bar{s}_{Oracle} = 123.6$            |
| CV.1se            | 0.43   0.58 | 0.27   0.50                    | 0.07   0.34                     | 0.52   0.62      | 0.26   0.50   |                                       |
| CV.min            | 0.66   0.73 | 0.54   0.66                    | 0.20   0.46                     | 0.68   0.73      | 0.57   0.68   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.60   0.69 | 0.55   0.67                    | 0.62   0.69                     | 0.62   0.69      | 0.07   0.00   | $\rho = 0$                            |
| AIC               | 0.90   0.94 | 0.90   0.92                    | 0.90   0.90                     | 0.79   0.82      |               |                                       |
| BIC               | 0.08   0.24 | 0.06   0.29                    | 0.01   0.12                     | 0.17   0.38      |               | $\bar{s}_{Oracle} = 90.2$             |
| CV.1se            | 0.46   0.57 | 0.31   0.49                    | 0.08   0.34                     | 0.55   0.61      | 0.23   0.46   |                                       |
| CV.nin            | 0.67   0.73 | 0.56   0.66                    | 0.21   0.46                     | 0.69   0.72      | 0.55   0.66   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.61   0.68 | 0.56   0.66                    | 0.62   0.69                     | 0.64   0.68      | 0.55   0.00   | $\rho = 0.5$                          |
| AIC               | 0.90   0.94 | 0.90   0.93                    | 0.90   0.90                     | 0.80   0.82      |               | ,                                     |
| BIC               | 0.06   0.17 | 0.07   0.26                    | 0.01   0.12                     | 0.18   0.35      |               | $\bar{s}_{Oracle} = 90.2$             |
| CV.1se            | 0.48   0.57 | 0.34   0.50                    | 0.10   0.33                     | 0.56   0.61      | 0.26   0.47   |                                       |
| CV.rise<br>CV.min | 0.48   0.37 | 0.58   0.67                    | 0.24   0.46                     | 0.69   0.71      | 0.56   0.66   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.62   0.69 | 0.57   0.67                    | 0.63   0.69                     | 0.65   0.68      | 0.50   0.00   | $\rho = 0.9$                          |
| AIC               | 0.90   0.94 | 0.90   0.93                    | 0.90   0.90                     | 0.80   0.81      |               | $\rho = 0.3$                          |
| BIC               | 0.06   0.16 | 0.08   0.24                    | 0.01   0.10                     | 0.20   0.34      |               | $\bar{s}_{Oracle} = 89.2$             |
| CV.1se            | 0.08   0.06 | 0.03   0.24                    | 0.01   0.10                     | 0.65   0.44      | 0.09   0.04   |                                       |
| CV.1sc<br>CV.min  | 0.61   0.41 | 0.03   0.02                    | 0.00   0.01                     | 0.80   0.64      | 0.59   0.40   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.64   0.43 | 0.63   0.43                    | 0.07   0.03                     | 0.76   0.57      | 0.57   0.40   | $\rho = 0$                            |
| AIC               | 0.94   0.92 | 0.94   0.90                    | 0.23   0.10                     | 0.90   0.81      |               | ,                                     |
| BIC               | 0.01   0.01 | 0.00   0.01                    | 0.00   0.00                     | 0.06   0.04      |               | $\bar{s}_{Oracle} = 56.2$             |
| CV.1se            | 0.07   0.04 | 0.03   0.02                    | 0.00   0.00                     | 0.67   0.42      | 0.08   0.03   |                                       |
|                   |             |                                |                                 |                  | 0.08   0.03   | $ad(u)/\sigma = 0.5$                  |
| CV.min            | 0.60   0.36 | 0.34   0.19                    | 0.08   0.04<br>0.29   0.20      | $0.81 \mid 0.61$ | 0.57   0.55   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.64   0.39 | 0.63   0.41                    |                                 | 0.77   0.55      |               | $\rho = 0.5$                          |
| AIC               | 0.94   0.92 | 0.94   0.91                    | 0.94   0.90                     | 0.90   0.81      |               | $\bar{s}_{Oracle} = 56.2$             |
| BIC               | 0.01   0.01 | 0.01   0.01                    | 0.00   0.00                     | 0.06   0.03      | 0.07   0.02   |                                       |
| CV.1se            | 0.07   0.03 | 0.03   0.01                    | $0.00 \mid 0.00$                | 0.67   0.41      | 0.07   0.03   | 1/ )/ 0.5                             |
| CV.min            | 0.61   0.36 | 0.37   0.18                    | $0.09 \mid 0.04$                | 0.81   0.60      | 0.58   0.34   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.66   0.40 | 0.64   0.41                    | 0.27   0.19                     | 0.77   0.54      |               | $\rho = 0.9$                          |
| AIC               | 0.94   0.92 | 0.94   0.91                    | 0.94   0.90                     | 0.90   0.80      |               | $\bar{s}_{Oracle} = 56.5$             |
| BIC               | 0.01   0.01 | 0.01   0.01                    | 0.00   0.00                     | 0.07   0.03      |               |                                       |

Table 125: FDR | Sensitivity for n=1000, binary design, dense covariates, and decay 100.

|                   | lasso            | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\;\gamma=10$ | marginal AL      | sparsenet MCP    |                                       |
|-------------------|------------------|--------------------------------|--------------------------|------------------|------------------|---------------------------------------|
| CV.1se            | $0.47 \mid 0.74$ | $0.36 \mid 0.68$               | 0.15   0.52              | $0.41 \mid 0.64$ | 0.38   0.70      |                                       |
| CV.min            | $0.58 \mid 0.82$ | $0.50 \mid 0.78$               | 0.26   0.62              | $0.51 \mid 0.71$ | $0.54 \mid 0.80$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.46   0.73      | $0.41 \mid 0.71$               | $0.41 \mid 0.71$         | $0.45 \mid 0.67$ |                  | $\rho = 0$                            |
| AIC               | 0.75   0.93      | $0.75 \mid 0.92$               | $0.75 \mid 0.89$         | $0.57 \mid 0.76$ |                  | $\bar{s}_{Oracle} = 208.7$            |
| BIC               | 0.06   0.20      | 0.09   0.38                    | 0.08   0.43              | 0.18   0.42      |                  | Oracle - 200.7                        |
| CV.1se            | $0.49 \mid 0.74$ | $0.39 \mid 0.68$               | 0.16   0.52              | $0.44 \mid 0.63$ | 0.36   0.68      |                                       |
| CV.min            | $0.59 \mid 0.82$ | $0.52 \mid 0.78$               | 0.27   0.62              | $0.52 \mid 0.71$ | $0.52 \mid 0.79$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | $0.48 \mid 0.72$ | $0.42 \mid 0.71$               | $0.40 \mid 0.71$         | $0.47 \mid 0.66$ |                  | $\rho = 0.5$                          |
| AIC               | $0.75 \mid 0.93$ | $0.75 \mid 0.93$               | $0.75 \mid 0.90$         | $0.58 \mid 0.76$ |                  | $\bar{s}_{Oracle} = 208.8$            |
| BIC               | 0.03   0.10      | 0.10   0.35                    | 0.09   0.43              | 0.20   0.39      |                  | Stracle - 200.0                       |
| CV.1se            | 0.50   0.74      | $0.40 \mid 0.68$               | 0.18   0.52              | 0.44   0.62      | 0.38   0.68      |                                       |
| CV.min            | 0.60   0.82      | $0.52 \mid 0.78$               | 0.29   0.62              | $0.53 \mid 0.70$ | $0.53 \mid 0.79$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.48   0.72      | 0.43   0.71                    | 0.41   0.70              | $0.47 \mid 0.65$ |                  | $\rho = 0.9$                          |
| AIC               | 0.75   0.93      | 0.75   0.93                    | 0.75   0.90              | $0.59 \mid 0.75$ |                  | $\bar{s}_{Oracle} = 209.4$            |
| BIC               | 0.03   0.08      | 0.11   0.33                    | 0.11   0.43              | 0.21   0.38      |                  | SOracle - 209.4                       |
| CV.1se            | 0.41   0.47      | 0.25   0.33                    | 0.06   0.10              | 0.51   0.56      | 0.40   0.47      |                                       |
| CV.min            | 0.60   0.67      | 0.47   0.54                    | 0.18   0.24              | 0.62   0.67      | 0.60   0.67      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.53   0.59      | 0.51   0.58                    | 0.61   0.61              | 0.56   0.61      |                  | $\rho = 0$                            |
| AIC               | 0.84   0.92      | 0.84   0.91                    | 0.85   0.89              | 0.74   0.80      |                  | 142.2                                 |
| BIC               | 0.00   0.01      | 0.01   0.02                    | 0.00   0.00              | 0.05   0.09      |                  | $\bar{s}_{Oracle} = 143.3$            |
| CV.1se            | 0.42   0.45      | 0.27   0.32                    | 0.06   0.09              | 0.53   0.54      | 0.41   0.44      |                                       |
| CV.min            | 0.62   0.66      | 0.49   0.54                    | 0.17   0.22              | 0.63   0.66      | 0.61   0.66      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.54   0.57      | 0.52   0.57                    | 0.61   0.61              | 0.58   0.60      | ·                | $\rho = 0.5$                          |
| AIC               | 0.84   0.93      | 0.84   0.91                    | 0.85   0.89              | 0.75   0.79      |                  | _ 144.0                               |
| BIC               | 0.00   0.01      | 0.01   0.01                    | 0.00 0.00                | 0.05   0.06      |                  | $\bar{s}_{Oracle} = 144.0$            |
| CV.1se            | 0.44   0.45      | 0.30   0.32                    | 0.06   0.07              | 0.54   0.53      | 0.42   0.43      |                                       |
| CV.min            | 0.62   0.66      | 0.51   0.54                    | 0.19   0.22              | 0.63   0.65      | 0.62   0.66      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.55   0.56      | 0.53   0.57                    | 0.61   0.61              | 0.59 0.59        | '                | $\rho = 0.9$                          |
| AIC               | 0.84   0.93      | 0.84   0.91                    | 0.85   0.89              | 0.75   0.79      |                  |                                       |
| BIC               | 0.00   0.00      | 0.00 0.01                      | 0.00   0.00              | 0.05   0.06      |                  | $\bar{s}_{Oracle} = 143.6$            |
| CV.1se            | 0.04   0.01      | 0.01   0.00                    | 0.00   0.00              | 0.67   0.33      | 0.14   0.01      |                                       |
| CV.min            | 0.54   0.23      | 0.20   0.05                    | 0.06   0.01              | 0.79   0.53      | 0.54   0.23      | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.60   0.27      | 0.64   0.33                    | 0.15   0.09              | 0.75   0.44      | ·                | $\rho = 0$                            |
| AIC               | 0.92   0.91      | 0.92 0.89                      | 0.92   0.90              | 0.88   0.76      |                  | ′                                     |
| BIC               | 0.01   0.00      | 0.00 0.00                      | 0.00   0.00              | 0.05   0.01      |                  | $\bar{s}_{Oracle} = 77.9$             |
| CV.1se            | 0.03   0.01      | 0.00   0.00                    | 0.00   0.00              | 0.68   0.31      | 0.15   0.01      |                                       |
| CV.min            | 0.51   0.18      | 0.19   0.04                    | 0.06   0.01              | 0.80   0.51      | 0.51   0.17      | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.59   0.23      | 0.61   0.30                    | 0.17   0.10              | 0.76   0.43      |                  | $\rho = 0.5$                          |
| AIC               | 0.92   0.92      | 0.92   0.90                    | 0.92   0.90              | 0.89   0.77      |                  |                                       |
| BIC               | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00              | 0.06   0.01      |                  | $\bar{s}_{Oracle} = 78.0$             |
| CV.1se            | 0.02   0.01      | 0.01   0.00                    | 0.00   0.00              | 0.69   0.29      | 0.14   0.01      |                                       |
| CV.rise<br>CV.min | 0.50   0.17      | 0.19   0.04                    | 0.07   0.01              | 0.80   0.49      | 0.52   0.17      | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.60   0.23      | 0.62   0.29                    | 0.16   0.09              | 0.76   0.41      | 0.02   0.17      | $\rho = 0.9$                          |
| AIC               | 0.92   0.91      | 0.92   0.89                    | 0.92   0.90              | 0.89   0.76      |                  |                                       |
| BIC               | 0.01   0.00      | 0.00   0.00                    | $0.02 \mid 0.00$         | 0.07   0.01      |                  | $\bar{s}_{Oracle} = 77.5$             |
| DIC               | 0.01   0.00      | 0.00   0.00                    | 0.00   0.00              | 0.07   0.01      |                  |                                       |

Table 126: FDR | Sensitivity for n=1000, binary design, dense covariates, and decay 200.

|                  | las  | so   | $GL \gamma$ | $\gamma = 1$ | GL $\gamma$ | = 10 | margii | nal AL | sparsenet MCP                        |                                       |
|------------------|------|------|-------------|--------------|-------------|------|--------|--------|--------------------------------------|---------------------------------------|
| CV.1se           | 0.44 | 0.72 | 0.35        | 0.62         | 0.22        | 0.39 | 0.39   | 0.62   | 0.46   0.75                          |                                       |
| CV.min           | 0.53 | 0.82 | 0.46        | 0.75         | 0.33        | 0.55 | 0.46   | 0.70   | 0.55   0.84                          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.39 | 0.65 | 0.37        | 0.64         | 0.42        | 0.66 | 0.39   | 0.62   |                                      | $\rho = 0$                            |
| AIC              | 0.67 | 0.93 | 0.67        | 0.92         | 0.67        | 0.88 | 0.52   | 0.77   |                                      | 202.1                                 |
| BIC              | 0.00 | 0.00 | 0.00        | 0.01         | 0.13        | 0.23 | 0.03   | 0.04   |                                      | $\bar{s}_{Oracle} = 293.1$            |
| CV.1se           | 0.45 | 0.71 | 0.37        | 0.61         | 0.22        | 0.38 | 0.41   | 0.60   | 0.46   0.74                          |                                       |
| CV.min           | 0.54 | 0.82 | 0.47        | 0.75         | 0.33        | 0.54 | 0.47   | 0.69   | 0.55   0.84                          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.40 | 0.63 | 0.38        | 0.64         | 0.42        | 0.66 | 0.41   | 0.61   | ·                                    | $\rho = 0.5$                          |
| AIC              | 0.67 | 0.93 | 0.67        | 0.92         | 0.67        | 0.89 | 0.53   | 0.76   |                                      | - 202.7                               |
| BIC              | 0.00 | 0.00 | 0.00        | 0.00         | 0.11        | 0.19 | 0.02   | 0.03   |                                      | $\bar{s}_{Oracle} = 293.7$            |
| CV.1se           | 0.46 | 0.72 | 0.38        | <u> </u>     | 0.23        | 0.36 |        | 0.59   | 0.47   0.74                          |                                       |
| CV.min           | 0.54 |      |             | 0.75         | 0.34        |      |        | 0.68   | 0.56   0.84                          | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.40 |      |             | 0.63         | 0.42        |      |        | 0.59   |                                      | $\rho = 0.9$                          |
| AIC              | 0.67 |      |             | 0.92         | 0.67        | 0.89 |        | 0.76   |                                      | , , , , , , , , , , , , , , , , , , , |
| BIC              | 0.00 |      |             | 0.00         | 0.11        | 0.17 |        | 0.02   |                                      | $\bar{s}_{Oracle} = 293.3$            |
| CV.1se           | 0.35 |      |             | 0.08         | 0.00        | 0.00 |        | 0.44   | 0.36   0.29                          |                                       |
| CV.min           | 0.54 |      |             | 0.28         | 0.05        | 0.02 |        | 0.57   | 0.55   0.55                          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.46 |      |             | 0.45         | 0.60        | 0.51 |        | 0.48   | 0.55   0.55                          | $\rho = 0$                            |
| AIC              | 0.77 |      |             | 0.89         | 0.78        | 0.88 |        | 0.75   |                                      | ,                                     |
| BIC              |      |      |             | 0.00         | 0.00        | 0.00 | 0.02   |        |                                      | $\bar{s}_{Oracle} = 217.0$            |
| CV.1se           | 0.33 |      |             | 0.05         | 0.00        | 0.00 |        | 0.43   | 0.34   0.24                          |                                       |
| CV.13C<br>CV.min | 0.55 |      |             | 0.03         | 0.04        | 0.00 |        | 0.56   | $0.54 \mid 0.24$<br>$0.55 \mid 0.52$ | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.47 |      |             | 0.44         | 0.60        | 0.52 |        | 0.30   | 0.55   0.52                          | $\rho = 0.5$                          |
| AIC              | 0.47 |      |             | 0.44         | 0.78        | 0.32 |        | 0.47   |                                      | , , , , , , , , , , , , , , , , , , , |
| BIC              |      |      |             | 0.00         | 0.00        | 0.00 | 0.02   |        |                                      | $\bar{s}_{Oracle} = 214.8$            |
| CV.1se           | 0.34 |      |             | 0.05         | 0.00        | 0.00 |        | 0.01   | 0.35   0.23                          |                                       |
| CV.1se<br>CV.min | 0.54 |      |             | 0.03         | 0.00        | 0.00 |        | 0.42   | 0.55   0.52                          | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.33 |      |             | 0.24         | 0.60        | 0.51 |        | 0.35   | 0.33   0.32                          | $\rho = 0.9$                          |
| AICC             | 0.46 |      |             | 0.43         | 0.00        | 0.88 |        | 0.74   |                                      | ,                                     |
| BIC              |      | 0.00 |             | 0.00         | 0.78        | 0.00 | 0.09   |        |                                      | $\bar{s}_{Oracle} = 215.0$            |
|                  |      |      |             |              |             |      |        |        | 0.22   0.01                          |                                       |
| CV.1se<br>CV.min | 0.03 | 0.00 | 0.00        | 0.00         | 0.00        | 0.00 |        | 0.24   | 0.22   0.01                          | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
|                  |      |      |             |              | 0.07        |      |        | 0.43   | 0.34   0.12                          |                                       |
| AICc             |      |      |             | 0.27         | 0.07        | 0.04 |        | 0.35   |                                      | $\rho = 0$                            |
| AIC              | 0.91 |      |             | 0.89         | 0.91        | 0.91 | 0.88   |        |                                      | $\bar{s}_{Oracle} = 90.7$             |
| BIC              | 0.01 | 0.00 |             | 0.00         | 0.02        | 0.02 |        | 0.00   | 0.24   0.00                          |                                       |
| CV.1se           | 0.02 |      |             | 0.00         |             | 0.00 | 0.73   |        | 0.24   0.00                          | 1/ )/ 0.5                             |
| CV.min           | 0.47 |      | 0.15        |              | 0.07        |      | 0.81   |        | 0.52   0.09                          | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.59 |      |             | 0.24         | 0.07        | 0.04 |        | 0.33   |                                      | $\rho = 0.5$                          |
| AIC              | 0.91 |      |             | 0.89         | 0.91        | 0.91 | 0.88   |        |                                      | $\bar{s}_{Oracle} = 91.4$             |
| BIC              | 0.01 |      |             | 0.00         | 0.01        | 0.01 |        | 0.00   | 0.24   0.00                          | 0.4000                                |
| CV.1se           | 0.01 |      |             | 0.00         | 0.00        | 0.00 | 0.72   |        | 0.24   0.00                          | 1/ )/                                 |
| CV.min           | 0.47 |      | 0.16        |              | 0.06        | 0.00 |        | 0.40   | 0.51   0.08                          | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.58 |      |             | 0.24         | 0.07        | 0.04 |        | 0.32   |                                      | $\rho = 0.9$                          |
| AIC              | 0.91 |      |             | 0.89         | 0.91        | 0.90 | 0.88   |        |                                      | $\bar{s}_{Oracle} = 89.5$             |
| BIC              | 0.01 | 0.00 | 0.00        | 0.00         | 0.01        | 0.01 | 0.09   | 0.00   |                                      | -01466 57.5                           |

Table 127: FDR | Sensitivity for n=1000, continuous design, dense covariates, and decay 10.

|                   | lasso            | $GL \gamma = 1$  | $\operatorname{GL} \gamma = 10$      | marginal AL      | sparsenet MCP |                                       |
|-------------------|------------------|------------------|--------------------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.36   0.74      | 0.21   0.71      | 0.02   0.60                          | 0.24   0.65      | 0.00   0.57   |                                       |
| CV.min            | $0.72 \mid 0.85$ | 0.64   0.83      | $0.22 \mid 0.72$                     | 0.55   0.73      | 0.20   0.71   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | $0.70 \mid 0.84$ | 0.60   0.82      | 0.10   0.67                          | 0.52   0.72      |               | $\rho = 0$                            |
| AIC               | 0.95   0.95      | 0.95   0.95      | 0.95   0.94                          | 0.53   0.72      |               | <u></u>                               |
| BIC               | 0.22   0.70      | 0.12   0.68      | 0.00   0.57                          | 0.18   0.63      |               | $\bar{s}_{Oracle} = 33.2$             |
| CV.1se            | 0.72   0.70      | 0.61   0.66      | 0.17   0.56                          | 0.51   0.51      | 0.04   0.55   |                                       |
| CV.min            | 0.85   0.81      | $0.81 \mid 0.77$ | $0.53 \mid 0.67$                     | $0.60 \mid 0.55$ | 0.25   0.63   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.82   0.78      | 0.78   0.75      | 0.44   0.65                          | 0.60   0.55      |               | $\rho = 0.5$                          |
| AIC               | 0.94   0.95      | 0.94   0.95      | 0.94   0.94                          | 0.60   0.55      |               | _ 22.0                                |
| BIC               | 0.49   0.59      | 0.36   0.57      | 0.05   0.49                          | 0.49   0.51      |               | $\bar{s}_{Oracle} = 32.9$             |
| CV.1se            | 0.87   0.65      | 0.85   0.60      | 0.73   0.50                          | 0.04   0.37      | 0.48   0.50   |                                       |
| CV.min            | 0.90   0.76      | 0.89   0.73      | 0.81   0.60                          | 0.06   0.39      | 0.66   0.57   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.89   0.72      | 0.87   0.68      | $0.78 \mid 0.57$                     | 0.06   0.39      | ,             | $\rho = 0.9$                          |
| AIC               | 0.90   0.79      | 0.90   0.79      | 0.88   0.77                          | 0.06   0.39      |               | - 20.4                                |
| BIC               | 0.80   0.43      | 0.78   0.40      | 0.49   0.31                          | 0.06   0.39      |               | $\bar{s}_{Oracle} = 30.4$             |
| CV.1se            | 0.27   0.64      | 0.13   0.59      | 0.01   0.48                          | 0.47   0.68      | 0.01   0.47   |                                       |
| CV.min            | 0.72   0.79      | 0.61   0.76      | 0.15   0.61                          | 0.81 0.81        | 0.26   0.65   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.72   0.79      | 0.57   0.75      | 0.03   0.52                          | $0.77 \mid 0.79$ | 1             | $\rho = 0$                            |
| AIC               | 0.97   0.95      | 0.97   0.95      | 0.97   0.93                          | 0.85   0.83      |               | ,                                     |
| BIC               | 0.19   0.61      | 0.07   0.57      | 0.00   0.40                          | 0.16   0.58      |               | $\bar{s}_{Oracle} = 26.2$             |
| CV.1se            | 0.66   0.55      | 0.53   0.51      | 0.12   0.42                          | 0.76   0.57      | 0.07   0.44   |                                       |
| CV.min            | 0.85   0.72      | 0.81   0.68      | 0.43   0.54                          | 0.86   0.67      | 0.33   0.55   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.84   0.70      | 0.79   0.66      | 0.31   0.51                          | 0.85   0.65      |               | $\rho = 0.5$                          |
| AIC               | 0.96   0.96      | 0.96   0.95      | 0.96   0.94                          | 0.87   0.67      |               | ,                                     |
| BIC               | 0.41   0.44      | 0.29   0.41      | 0.02   0.32                          | 0.51   0.43      |               | $\bar{s}_{Oracle} = 25.8$             |
| CV.1se            | 0.68   0.31      | 0.80   0.34      | 0.77   0.33                          | 0.32   0.44      | 0.61   0.35   |                                       |
| CV.min            | 0.90   0.59      | 0.90   0.56      | 0.84   0.45                          | 0.53   0.54      | 0.76   0.45   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.91   0.56      | 0.89   0.51      | 0.77   0.39                          | 0.53   0.54      | 0.70   0.10   | $\rho = 0.9$                          |
| AIC               | 0.95   0.86      | 0.95   0.88      | 0.94   0.88                          | 0.53   0.54      |               | ,                                     |
| BIC               | 0.08   0.05      | 0.01   0.04      | 0.01   0.05                          | 0.34   0.45      |               | $\bar{s}_{Oracle} = 23.3$             |
| CV.1se            | 0.12   0.38      | 0.06   0.34      | 0.01   0.26                          | 0.63   0.64      | 0.01   0.27   |                                       |
| CV.nin            | 0.70   0.67      | 0.55   0.60      | 0.14   0.43                          | 0.89   0.81      | 0.37   0.54   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.73   0.69      | 0.43   0.57      | 0.01   0.22                          | 0.85   0.77      | 0.07   0.0 .  | $\rho = 0$                            |
| AIC               | 0.98   0.95      | 0.98   0.94      | 0.98   0.91                          | 0.94   0.88      |               | ,                                     |
| BIC               | 0.13   0.41      | 0.03   0.33      | 0.00   0.09                          | 0.17   0.44      |               | $\bar{s}_{Oracle} = 19.2$             |
| CV.1se            | 0.16   0.11      | 0.19   0.15      | 0.07   0.14                          | 0.80   0.42      | 0.10   0.22   |                                       |
| CV.min            | 0.81   0.46      | 0.78   0.44      | 0.35   0.30                          | 0.92   0.61      | 0.44   0.37   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.84   0.50      | 0.71   0.41      | 0.04   0.13                          | 0.90   0.57      | 0.11   0.57   | $\rho = 0.5$                          |
| AIC               | 0.98   0.95      | 0.98   0.95      | 0.98   0.93                          | 0.94   0.74      |               | ·                                     |
| BIC               | 0.10   0.11      | 0.04   0.09      | 0.00   0.05                          | 0.17   0.12      |               | $\bar{s}_{Oracle} = 19.0$             |
| CV.1se            | 0.00   0.07      | 0.00   0.07      | 0.00   0.07                          | 0.45   0.28      | 0.01   0.07   |                                       |
| CV.rise<br>CV.min | 0.57   0.09      | 0.45   0.08      | 0.16   0.07                          | 0.82   0.64      | 0.35   0.12   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.70   0.10      | 0.43   0.08      | 0.10   0.07                          | 0.82   0.04      | 0.55   0.12   | $\rho = 0.9$                          |
| AIC               | 0.76   0.16      | 0.20   0.07      | 0.00   0.07                          | 0.81   0.04      |               | ,                                     |
| BIC               | 0.90   0.80      | 0.97   0.90      | $0.97 \mid 0.88$<br>$0.00 \mid 0.07$ | 0.83   0.08      |               | $\bar{s}_{Oracle} = 16.4$             |
| Біс               | 0.09   0.07      | 0.01   0.07      | 0.00   0.07                          | 0.13   0.12      |               |                                       |

Table 128: FDR | Sensitivity for n=1000, continuous design, dense covariates, and decay 50.

|                  | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP    |                                       |
|------------------|------------------|--------------------------------|---------------------------------|------------------|------------------|---------------------------------------|
| CV.1se           | 0.50   0.76      | 0.36   0.71                    | 0.07   0.56                     | 0.44   0.67      | 0.15   0.62      |                                       |
| CV.min           | $0.65 \mid 0.84$ | $0.56 \mid 0.81$               | $0.19 \mid 0.65$                | $0.58 \mid 0.74$ | 0.39   0.74      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.55   0.79      | $0.47 \mid 0.77$               | $0.29 \mid 0.70$                | $0.53 \mid 0.72$ |                  | $\rho = 0$                            |
| AIC              | $0.84 \mid 0.94$ | $0.84 \mid 0.94$               | $0.84 \mid 0.91$                | $0.63 \mid 0.77$ |                  | $\bar{s}_{Oracle} = 122.8$            |
| BIC              | 0.21   0.59      | $0.11 \mid 0.55$               | 0.01   0.43                     | $0.22 \mid 0.55$ |                  | SOracle - 122.6                       |
| CV.1se           | 0.68   0.74      | 0.62   0.70                    | 0.33   0.56                     | 0.65   0.58      | 0.24   0.55      |                                       |
| CV.min           | $0.74 \mid 0.84$ | $0.70 \mid 0.80$               | $0.47 \mid 0.66$                | $0.69 \mid 0.65$ | $0.42 \mid 0.64$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | $0.68 \mid 0.74$ | 0.63   0.72                    | $0.48 \mid 0.68$                | $0.67 \mid 0.62$ |                  | $\rho = 0.5$                          |
| AIC              | $0.84 \mid 0.95$ | 0.84   0.94                    | $0.83 \mid 0.93$                | $0.70 \mid 0.67$ |                  | _ 122.5                               |
| BIC              | 0.25   0.23      | 0.35   0.39                    | $0.15 \mid 0.41$                | 0.46   0.35      |                  | $\bar{s}_{Oracle} = 122.5$            |
| CV.1se           | 0.74   0.74      | 0.71   0.70                    | 0.60   0.58                     | 0.56   0.17      | 0.54   0.54      |                                       |
| CV.min           | 0.77   0.83      | 0.75   0.80                    | 0.64   0.67                     | 0.61   0.21      | 0.59   0.61      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.73   0.72      | 0.71   0.70                    | 0.62   0.65                     | 0.61   0.20      |                  | $\rho = 0.9$                          |
| AIC              | 0.77   0.83      | 0.77   0.84                    | 0.74   0.84                     | 0.61   0.21      |                  | 110.5                                 |
| BIC              | 0.05   0.01      | 0.01   0.01                    | 0.00   0.01                     | 0.47   0.14      |                  | $\bar{s}_{Oracle} = 119.5$            |
| CV.1se           | 0.43   0.58      | 0.27   0.50                    | 0.07   0.33                     | 0.52   0.62      | 0.26   0.49      |                                       |
| CV.min           | 0.66   0.73      | 0.54   0.66                    | 0.19   0.45                     | 0.68   0.73      | 0.57   0.68      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.60   0.69      | 0.50   0.65                    | 0.32   0.51                     | 0.62 0.69        | '                | $\rho = 0$                            |
| AIC              | 0.90   0.93      | 0.90   0.92                    | 0.90   0.90                     | 0.79 0.82        |                  | ,                                     |
| BIC              | 0.07   0.24      | 0.03   0.23                    | 0.00   0.01                     | 0.17   0.38      |                  | $\bar{s}_{Oracle} = 90.2$             |
| CV.1se           | 0.62   0.41      | 0.60   0.41                    | 0.33   0.28                     | 0.71   0.48      | 0.38   0.37      |                                       |
| CV.min           | 0.76   0.66      | 0.72   0.62                    | 0.48   0.42                     | 0.77   0.60      | 0.54   0.49      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.72   0.57      | 0.69 0.57                      | 0.59   0.56                     | 0.75 0.55        | 1                | $\rho = 0.5$                          |
| AIC              | 0.90   0.95      | 0.90   0.94                    | 0.90   0.92                     | 0.82   0.75      |                  | ,                                     |
| BIC              | 0.01   0.01      | 0.00 0.01                      | 0.00   0.00                     | 0.09 0.04        |                  | $\bar{s}_{Oracle} = 89.7$             |
| CV.1se           | 0.06   0.04      | 0.18   0.10                    | 0.18   0.10                     | 0.65   0.18      | 0.61   0.30      |                                       |
| CV.min           | 0.59   0.20      | 0.63   0.35                    | 0.43   0.24                     | 0.73   0.29      | 0.72   0.43      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.67   0.16      | 0.32   0.14                    | 0.21   0.16                     | 0.73   0.28      | ***- ****        | $\rho = 0.9$                          |
| AIC              | 0.87   0.88      | 0.86   0.88                    | 0.86   0.85                     | 0.73   0.29      |                  | ,                                     |
| BIC              | 0.06   0.01      | 0.01   0.01                    | 0.00   0.01                     | 0.11   0.03      |                  | $\bar{s}_{Oracle} = 86.2$             |
| CV.1se           | 0.09   0.06      | 0.03   0.02                    | 0.00   0.00                     | 0.65   0.45      | 0.07   0.05      |                                       |
| CV.min           | 0.61   0.41      | 0.36   0.23                    | 0.07   0.05                     | 0.81   0.64      | 0.59   0.40      | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.63   0.43      | 0.30   0.21                    | 0.00   0.00                     | 0.76   0.57      |                  | $\rho = 0$                            |
| AIC              | 0.94   0.92      | 0.94   0.90                    | 0.94   0.90                     | 0.90   0.81      |                  | ,                                     |
| BIC              | 0.01   0.01      | 0.00   0.00                    | 0.00   0.00                     | 0.06   0.04      |                  | $\bar{s}_{Oracle} = 55.9$             |
| CV.1se           | 0.01   0.00      | 0.00   0.00                    | 0.00   0.00                     | 0.68   0.16      | 0.16   0.01      |                                       |
| CV.min           | 0.44   0.07      | 0.31   0.04                    | 0.10   0.01                     | 0.85   0.38      | 0.47   0.07      | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.63   0.13      | 0.11   0.02                    | 0.00   0.00                     | 0.84   0.32      | 0.17   0.07      | $\rho = 0.5$                          |
| AIC              | 0.94   0.94      | 0.94   0.93                    | 0.94   0.91                     | 0.91   0.74      |                  | ,                                     |
| BIC              | 0.02   0.00      | 0.00   0.00                    | 0.00   0.00                     | 0.09   0.01      |                  | $\bar{s}_{Oracle} = 55.6$             |
| CV.1se           | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00                     | 0.14   0.03      | 0.00   0.01      |                                       |
| CV.1sc<br>CV.min | 0.54   0.04      | 0.44   0.03                    | 0.00   0.01                     | 0.14   0.03      | 0.00   0.01      | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 0.66   0.05      | 0.12   0.02                    | 0.00   0.02                     | 0.82   0.10      | 0.17   0.02      | $\rho = 0.9$                          |
| AIC              | 0.00   0.03      | 0.12   0.02                    | 0.00   0.02                     | 0.84   0.29      |                  | ,                                     |
| BIC              | 0.95   0.88      | 0.93   0.87                    | 0.94   0.83                     | 0.04   0.29      |                  | $\bar{s}_{Oracle} = 52.3$             |
| БІС              | 0.00   0.02      | 0.01   0.02                    | 0.00   0.01                     | 0.03   0.03      |                  |                                       |

Table 129: FDR | Sensitivity for n=1000, continuous design, dense covariates, and decay 100.

|                   | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL                          | sparsenet MCP    |  |
|-------------------|-------------|--------------------------------|---------------------------------|--------------------------------------|------------------|--|
| CV.1se            | 0.47   0.74 | 0.36   0.68                    | 0.15   0.52                     | 0.41   0.64                          | 0.38   0.70      |  |
| CV.min            | 0.58   0.82 | 0.50   0.77                    | 0.26   0.61                     | $0.51 \mid 0.71$                     | $0.54 \mid 0.80$ | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc              | 0.46   0.73 | 0.40   0.70                    | 0.35   0.67                     | $0.45 \mid 0.67$                     |                  | $\rho = 0$   |
| AIC               | 0.75   0.93 | 0.75   0.92                    | 0.75   0.89                     | $0.57 \mid 0.76$                     |                  | $\bar{s}_{Oracle} = 209.8$   |
| BIC               | 0.06   0.21 | 0.08   0.34                    | 0.08   0.41                     | 0.19   0.42                          |                  | SOracle - 209.6  |
| CV.1se            | 0.60   0.72 | 0.55   0.67                    | 0.38   0.55                     | 0.58   0.52                          | 0.37   0.55      |  |
| CV.min            | 0.66   0.82 | 0.61   0.79                    | 0.46   0.65                     | 0.62   0.62                          | 0.44   0.62      | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc              | 0.58   0.66 | 0.54   0.66                    | 0.44   0.65                     | 0.59   0.56                          |                  | $\rho = 0.5$   |
| AIC               | 0.75   0.94 | 0.75   0.94                    | 0.74   0.92                     | 0.65 0.69                            |                  | 200.4  |
| BIC               | 0.01   0.00 | 0.00   0.00                    | 0.07   0.12                     | 0.05   0.02                          |                  | $\bar{s}_{Oracle} = 209.4$   |
| CV.1se            | 0.65   0.72 | 0.62   0.68                    | 0.53   0.57                     | 0.57   0.13                          | 0.50   0.51      |  |
| CV.min            | 0.68   0.83 | 0.66 0.80                      | 0.56   0.68                     | 0.61   0.21                          | 0.53   0.59      | $\operatorname{sd}(\mu)/\sigma = 2$  |
| AICc              | 0.63   0.62 | 0.61   0.65                    | 0.54   0.65                     | 0.61   0.20                          | ,                | $\rho = 0.9$   |
| AIC               | 0.69 0.84   |                                | 0.65   0.83                     | 0.61   0.22                          |                  | - 205.7  |
| BIC               | 0.05   0.01 | 0.01 0.01                      | 0.00   0.01                     | 0.06   0.01                          |                  | $\bar{s}_{Oracle} = 205.7$   |
| CV.1se            | 0.41   0.47 |                                | 0.06   0.11                     | 0.51   0.56                          | 0.40   0.47      |  |
| CV.min            | 0.61   0.67 |                                | 0.18   0.25                     | 0.62   0.67                          | 0.61   0.67      | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc              | 0.53   0.58 |                                | 0.48   0.49                     | 0.56   0.61                          |                  | $\rho = 0$   |
| AIC               | 0.84   0.92 |                                | 0.85   0.89                     | 0.74   0.80                          |                  | ,  |
| BIC               | 0.00   0.01 | 0.00   0.00                    | 0.00   0.00                     | 0.06   0.09                          |                  | $\bar{s}_{Oracle} = 143.5$   |
| CV.1se            | 0.17   0.06 |                                | 0.01   0.00                     | 0.65   0.34                          | 0.23   0.09      |  |
| CV.rise<br>CV.min | 0.61   0.39 |                                | 0.11   0.03                     | 0.71   0.49                          | 0.55   0.33      | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc              | 0.61   0.31 | 0.52   0.34                    | 0.53   0.45                     | 0.69   0.42                          | 0.55   0.55      | $\rho = 0.5$   |
| AIC               | 0.84   0.94 |                                | 0.84   0.90                     | 0.78   0.74                          |                  | ,  |
| BIC               | 0.01   0.00 |                                | 0.00   0.00                     | 0.06   0.01                          |                  | $\bar{s}_{Oracle} = 143.5$   |
| CV.1se            | 0.00   0.00 |                                | 0.00   0.00                     | 0.38   0.05                          | 0.01   0.01      |  |
| CV.13C            | 0.48   0.02 |                                | 0.08   0.01                     | 0.71   0.19                          | 0.21   0.04      | $\operatorname{sd}(\mu)/\sigma = 1$  |
| AICc              | 0.58   0.03 |                                | 0.00   0.01                     | 0.71   0.19                          | 0.21   0.04      | $\rho = 0.9$   |
| AIC               | 0.81   0.87 |                                | 0.81   0.83                     | 0.71   0.20                          |                  | ·  |
| BIC               | 0.06   0.01 | 0.01   0.00                    | 0.00   0.01                     | 0.07   0.01                          |                  | $\bar{s}_{Oracle} = 139.4$   |
| CV.1se            | 0.04   0.01 | 0.01   0.01                    | 0.00   0.01                     | 0.67   0.34                          | 0.09   0.01      |  |
| CV.1se<br>CV.min  | 0.53   0.23 |                                | 0.06   0.00                     | 0.79   0.53                          | 0.54   0.23      | $sd(\mu)/\sigma = 0.5$   |
| AICc              | 0.55   0.25 |                                | 0.00   0.01                     | 0.79   0.33                          | 0.34   0.23      | $\begin{array}{c c} \operatorname{sd}(\mu)/\sigma = 0.3 \\ \rho = 0 \end{array}$ |
| AICC              | 0.00   0.27 | 0.14   0.07                    | 0.92   0.90                     | $0.73 \mid 0.43$<br>$0.88 \mid 0.77$ |                  | $\rho = 0$   |
| BIC               |             |                                |                                 | 0.05   0.01                          |                  | $\bar{s}_{Oracle} = 77.7$  |
|                   | 0.01   0.00 | <u> </u>                       | 0.08   0.07                     | <u> </u>                             | 0.25   0.00      |  |
| CV.1se            |             |                                | $0.00 \mid 0.00$                | 0.64   0.09                          | 0.25   0.00      | -1()/- 0.5   |
| CV.min            | 0.38   0.03 |                                | 0.08   0.00                     | 0.84   0.28                          | 0.48   0.03      | $sd(\mu)/\sigma = 0.5$   |
| AICc              | 0.57   0.06 |                                | 0.00   0.00                     | 0.83   0.23                          |                  | $\rho = 0.5$   |
| AIC               | 0.92   0.92 |                                | 0.92   0.90                     | 0.89   0.70                          |                  | $\bar{s}_{Oracle} = 77.7$  |
| BIC               | 0.02   0.00 |                                | 0.00   0.00                     | 0.10   0.00                          | 0.05   0.01      |  |
| CV.1se            | 0.00   0.00 |                                | 0.00   0.00                     | 0.07   0.01                          | 0.05   0.01      | 1/ )/  |
| CV.min            | 0.49   0.03 |                                | 0.14   0.01                     | 0.81   0.07                          | 0.32   0.02      | $sd(\mu)/\sigma = 0.5$   |
| AICc              | 0.64   0.04 |                                | 0.01   0.01                     | 0.82   0.08                          |                  | $\rho = 0.9$   |
| AIC               | 0.92   0.87 |                                | 0.92   0.82                     | 0.85   0.18                          |                  | $\bar{s}_{Oracle} = 73.5$  |
| BIC               | 0.04   0.01 | 0.01   0.01                    | 0.00   0.00                     | 0.11   0.01                          |                  | J. Wester 1. 1. 1.   |

Table 130: FDR | Sensitivity for n=1000, continuous design, dense covariates, and decay 200.

|                   | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$      | marginal AL      | sparsenet MCP    |                                     |
|-------------------|------------------|--------------------------------|--------------------------------------|------------------|------------------|-------------------------------------|
| CV.1se            | 0.45   0.73      | 0.35   0.62                    | 0.22   0.38                          | 0.39   0.62      | 0.46   0.74      |                                     |
| CV.min            | 0.53   0.82      | 0.46   0.75                    | 0.33   0.54                          | $0.46 \mid 0.70$ | $0.55 \mid 0.84$ | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.39   0.64      | 0.36   0.63                    | $0.40 \mid 0.64$                     | 0.39   0.62      |                  | $\rho = 0$                          |
| AIC               | 0.67   0.93      | 0.67   0.91                    | $0.67 \mid 0.88$                     | 0.52   0.77      |                  | ā 203 2                             |
| BIC               | $0.00 \mid 0.00$ | $0.00 \mid 0.00$               | 0.28   0.43                          | 0.02   0.04      |                  | $\bar{s}_{Oracle} = 293.2$          |
| CV.1se            | 0.51   0.58      | 0.44   0.48                    | 0.04   0.05                          | 0.51   0.40      | 0.49   0.57      |                                     |
| CV.min            | 0.57   0.79      | 0.53   0.71                    | 0.16   0.15                          | 0.54   0.53      | 0.58   0.80      | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.47   0.36      | 0.47   0.52                    | 0.46   0.63                          | 0.51   0.43      |                  | $\rho = 0.5$                        |
| AIC               | 0.67   0.94      | 0.66   0.93                    | 0.66   0.91                          | 0.59   0.70      |                  | = 202.1                             |
| BIC               | 0.00   0.00      | 0.00   0.00                    | 0.01   0.02                          | 0.04   0.00      |                  | $\bar{s}_{Oracle} = 293.1$          |
| CV.1se            | 0.19   0.20      | 0.17   0.18                    | 0.00   0.00                          | 0.30   0.04      | 0.10   0.09      |                                     |
| CV.min            | 0.53   0.50      | 0.47   0.44                    | 0.08   0.02                          | 0.57   0.16      | 0.34   0.31      | $\operatorname{sd}(\mu)/\sigma = 2$ |
| AICc              | 0.47   0.03      | 0.16   0.08                    | 0.51   0.63                          | 0.56   0.16      | ,                | $\rho = 0.9$                        |
| AIC               | 0.62   0.86      | 0.61   0.85                    | 0.59   0.83                          | 0.57   0.30      |                  | - 202.2                             |
| BIC               | 0.05   0.00      | 0.01   0.00                    | 0.00   0.00                          | 0.06   0.01      |                  | $\bar{s}_{Oracle} = 292.2$          |
| CV.1se            | 0.35   0.28      | 0.12   0.07                    | 0.00   0.00                          | 0.48   0.45      | 0.36   0.29      |                                     |
| CV.min            | 0.55   0.55      | 0.34   0.27                    | 0.04   0.02                          | 0.57   0.57      | 0.55   0.55      | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 0.46   0.41      | 0.47   0.42                    | 0.37   0.32                          | 0.51   0.48      | 1                | $\rho = 0$                          |
| AIC               | 0.77   0.91      | 0.77   0.88                    | 0.78   0.88                          | 0.69   0.75      |                  | '                                   |
| BIC               | 0.00   0.00      | 0.00   0.00                    | 0.06   0.06                          | 0.02   0.01      |                  | $\bar{s}_{Oracle} = 215.4$          |
| CV.1se            | 0.02   0.00      | 0.01   0.00                    | 0.00   0.00                          | 0.58   0.19      | 0.14   0.00      |                                     |
| CV.min            | 0.39   0.08      | 0.21   0.03                    | 0.06   0.00                          | 0.65   0.36      | 0.40   0.09      | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 0.48   0.10      | 0.12   0.04                    | 0.21   0.16                          | 0.63   0.27      | 01.10   0107     | $\rho = 0.5$                        |
| AIC               | 0.77   0.92      | 0.77   0.90                    | 0.77   0.89                          | 0.72   0.70      |                  | ,                                   |
| BIC               | 0.01   0.00      | 0.00   0.00                    | 0.00   0.00                          | 0.05   0.00      |                  | $\bar{s}_{Oracle} = 215.2$          |
| CV.1se            | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00                          | 0.10   0.01      | 0.01   0.00      |                                     |
| CV.min            | 0.44   0.02      | 0.36   0.01                    | 0.10   0.01                          | 0.66   0.07      | 0.24   0.01      | $\operatorname{sd}(\mu)/\sigma = 1$ |
| AICc              | 0.53   0.03      | 0.10   0.01                    | 0.00   0.00                          | 0.67   0.09      | 0.2.   0.01      | $\rho = 0.9$                        |
| AIC               | 0.75   0.85      | 0.75   0.84                    | 0.75   0.80                          | 0.69   0.33      |                  | ,                                   |
| BIC               | 0.04   0.00      | 0.01   0.00                    | 0.00   0.00                          | 0.09   0.01      |                  | $\bar{s}_{Oracle} = 211.7$          |
| CV.1se            | 0.02   0.00      | 0.00   0.00                    | 0.00   0.00                          | 0.72   0.25      | 0.16   0.00      |                                     |
| CV.min            | 0.50   0.12      | 0.14   0.01                    | 0.07   0.00                          | 0.81   0.43      | 0.52   0.12      | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 0.60   0.15      | 0.09   0.03                    | 0.00   0.00                          | 0.77   0.35      | 0.02   0.12      | $\rho = 0$                          |
| AIC               | 0.91   0.90      | 0.91   0.89                    | 0.91   0.91                          | 0.88   0.72      |                  | '                                   |
| BIC               | 0.01   0.00      | 0.00   0.00                    | 0.65   0.64                          | 0.07   0.00      |                  | $\bar{s}_{Oracle} = 91.3$           |
| CV.1se            | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00                          | 0.64   0.06      | 0.28   0.00      |                                     |
| CV.rise<br>CV.min | 0.38   0.02      | 0.20   0.00                    | 0.08   0.00                          | 0.84   0.22      | 0.50   0.02      | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 0.58   0.04      | 0.03   0.00                    | 0.00   0.00                          | 0.83   0.18      | 0.50   0.02      | $\rho = 0.5$                        |
| AIC               | 0.91   0.91      | 0.91   0.89                    | 0.91   0.90                          | 0.89   0.66      |                  |                                     |
| BIC               | 0.02   0.00      | $0.01 \mid 0.00$               | 0.02   0.02                          | 0.11   0.00      |                  | $\bar{s}_{Oracle} = 90.9$           |
| CV.1se            | 0.02   0.00      | 0.00   0.00                    | 0.02   0.02                          | 0.07   0.00      | 0.19   0.00      |                                     |
| CV.1sc<br>CV.min  | 0.42   0.02      | 0.00   0.00                    | 0.00   0.00                          | 0.82   0.05      | 0.19   0.00      | $sd(\mu)/\sigma = 0.5$              |
| AICc              | 0.59   0.03      | 0.07   0.00                    | $0.13 \mid 0.01$<br>$0.00 \mid 0.00$ | 0.82   0.03      | 0.77   0.01      | $\rho = 0.9$                        |
| AIC               | 0.91   0.85      | 0.07   0.00                    | 0.00   0.00                          | 0.85   0.00      |                  |                                     |
| BIC               | 0.91   0.83      | 0.91   0.82                    | $0.91 \mid 0.82$<br>$0.00 \mid 0.00$ | 0.83   0.13      |                  | $\bar{s}_{Oracle} = 87.0$           |
| БІС               | 0.02   0.00      | 0.01   0.00                    | 0.00   0.00                          | 0.10   0.01      |                  |                                     |

Table 131: FDR | Sensitivity for n=1000, binary design, sparse covariates, and decay 10.

|                  | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$       | marginal AL                          | sparsenet MCP |  |
|------------------|------------------|--------------------------------|---------------------------------------|--------------------------------------|---------------|--|
| CV.1se           | 0.33   0.26      | 0.19   0.24                    | 0.01   0.20                           | 0.22   0.22                          | 0.01   0.19   |  |
| CV.min           | 0.67   0.33      | 0.59   0.31                    | 0.20   0.24                           | 0.51   0.26                          | 0.19   0.24   | $\operatorname{sd}(\mu)/\sigma = 2$        |
| AICc             | 0.65   0.33      | 0.58   0.31                    | 0.34   0.27                           | 0.48   0.26                          |               | $\rho = 0$                                 |
| AIC              | 0.88   0.72      | 0.88   0.72                    | $0.88 \mid 0.69$                      | 0.49   0.26                          |               | $\bar{s}_{Oracle} = 100.0$                 |
| BIC              | 0.20   0.24      | 0.13   0.23                    | 0.01   0.20                           | 0.16   0.21                          |               | <i>SOracle</i> – 100.0                     |
| CV.1se           | 0.38   0.26      | 0.23   0.24                    | 0.02   0.20                           | 0.26   0.22                          | 0.01   0.19   |  |
| CV.min           | 0.69   0.34      | 0.62   0.31                    | 0.23   0.24                           | 0.53   0.26                          | 0.19   0.24   | $\operatorname{sd}(\mu)/\sigma = 2$        |
| AICc             | 0.67   0.33      | 0.60   0.31                    | 0.37   0.27                           | 0.51   0.25                          | •             | $\rho = 0.5$                               |
| AIC              | 0.88   0.72      | 0.88   0.72                    | 0.88   0.69                           | 0.51   0.25                          |               | - 100.0                                    |
| BIC              | 0.23   0.23      | 0.14   0.23                    | 0.01   0.20                           | 0.19   0.20                          |               | $\bar{s}_{Oracle} = 100.0$                 |
| CV.1se           | 0.41   0.26      | 0.26   0.24                    | 0.03   0.20                           | 0.28   0.21                          | 0.01   0.19   |  |
| CV.min           | 0.70   0.34      | 0.63   0.31                    | 0.26   0.24                           | 0.53   0.25                          | 0.21   0.24   | $\operatorname{sd}(\mu)/\sigma = 2$        |
| AICc             | 0.68   0.33      | 0.61   0.30                    | 0.38   0.27                           | 0.51 0.25                            | '             | $\rho = 0.9$                               |
| AIC              | 0.88   0.71      | 0.88   0.71                    | 0.88   0.69                           | 0.52 0.25                            |               | ,  |
| BIC              | 0.25   0.23      | 0.16   0.22                    | 0.02   0.20                           | 0.21   0.20                          |               | $\bar{s}_{Oracle} = 100.0$                 |
| CV.1se           | 0.25   0.17      | 0.12   0.15                    | 0.01   0.12                           | 0.42   0.19                          | 0.01   0.12   |  |
| CV.min           | 0.66   0.25      | 0.56   0.22                    | 0.14   0.16                           | 0.74   0.28                          | 0.24   0.17   | $\operatorname{sd}(\mu)/\sigma = 1$        |
| AICc             | 0.66   0.25      | 0.59   0.23                    | 0.32   0.20                           | 0.71   0.26                          | 0.21   0.17   | $\rho = 0$                                 |
| AIC              | 0.89   0.79      | 0.89   0.79                    | 0.89   0.76                           | $0.71 \mid 0.20$<br>$0.79 \mid 0.32$ |               | ,  |
| BIC              | 0.18   0.16      | 0.09   0.15                    | 0.00   0.12                           | 0.15   0.15                          |               | $\bar{s}_{Oracle} = 100.0$                 |
| CV.1se           | 0.10   0.10      | 0.05   0.15                    | 0.00   0.12                           | 0.46   0.19                          | 0.01   0.12   |  |
| CV.1sc<br>CV.min | 0.29   0.17      | 0.13   0.13                    | 0.01   0.12                           | 0.76   0.28                          | 0.01   0.12   | $\operatorname{sd}(\mu)/\sigma = 1$        |
| AICc             | 0.68   0.25      | 0.60   0.23                    | 0.14   0.10                           | 0.70   0.26                          | 0.22   0.17   | $\rho = 0.5$                               |
| AIC              | 0.89   0.23      | 0.89   0.79                    | 0.34   0.20                           | 0.72   0.20                          |               | $\rho = 0.5$                               |
| BIC              |                  | 0.89   0.79                    | 0.00   0.12                           | ,                                    |               | $\bar{s}_{Oracle} = 100.0$                 |
|                  | 0.20   0.15      | <u> </u>                       | <u>'</u>                              | 0.17   0.15                          | 0.01   0.12   |  |
| CV.1se           | 0.33   0.17      | 0.17   0.15                    | 0.02   0.12                           | 0.47   0.19                          | 0.01   0.12   | _1()/_ 1                                   |
| CV.min           | 0.69   0.25      | 0.61   0.22                    | 0.17   0.16                           | 0.75   0.28                          | 0.25   0.17   | $\operatorname{sd}(\mu)/\sigma = 1$        |
| AICc             | 0.69   0.25      | 0.62   0.23                    | 0.36   0.20                           | 0.72   0.26                          |               | $\rho = 0.9$                               |
| AIC              | 0.89   0.79      | 0.89   0.78                    | 0.89   0.76                           | 0.79   0.31                          |               | $\bar{s}_{Oracle} = 100.0$                 |
| BIC              | 0.21   0.15      | 0.12   0.14                    | 0.01   0.11                           | 0.19   0.14                          | 0.04   0.07   |  |
| CV.1se           | 0.11   0.07      | 0.05   0.06                    | 0.01   0.05                           | 0.56   0.14                          | 0.01   0.05   | 1/ )/                                      |
| CV.min           | 0.64   0.15      | 0.50   0.13                    | 0.13   0.08                           | 0.81   0.26                          | 0.35   0.11   | $sd(\mu)/\sigma = 0.5$                     |
| AICc             | 0.67   0.17      | 0.55   0.14                    | 0.20   0.11                           | 0.78   0.22                          |               | $\rho = 0$                                 |
| AIC              | 0.90   0.85      | 0.90   0.84                    | 0.90   0.83                           | 0.87   0.42                          |               | $\bar{s}_{Oracle} = 100.0$                 |
| BIC              | 0.12   0.08      | 0.05   0.07                    | 0.00   0.03                           | 0.16   0.08                          |               | -Oracle                                    |
| CV.1se           | 0.13   0.07      | 0.07   0.06                    | 0.01   0.05                           | 0.61   0.14                          | 0.01   0.05   |  |
| CV.min           | 0.67   0.15      | 0.54   0.13                    | 0.14   0.08                           | 0.82   0.25                          | 0.33   0.10   | $\int \operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 0.69   0.17      | 0.59   0.14                    | 0.23   0.11                           | $0.78 \mid 0.22$                     |               | $\rho = 0.5$                               |
| AIC              | $0.90 \mid 0.85$ | $0.90 \mid 0.84$               | $0.90 \mid 0.83$                      | $0.87 \mid 0.42$                     |               | $\bar{s}_{Oracle} = 100.0$                 |
| BIC              | 0.12   0.07      | $0.06 \mid 0.06$               | $0.00 \mid 0.03$                      | 0.18   0.08                          |               | SUracle = 100.0                            |
| CV.1se           | 0.15   0.07      | 0.08   0.06                    | 0.02   0.04                           | 0.60   0.14                          | 0.02   0.05   |  |
| CV.min           | 0.68   0.15      | 0.56   0.13                    | 0.15   0.08                           | 0.81   0.25                          | 0.34   0.10   | $sd(\mu)/\sigma = 0.5$                     |
| AICc             | $0.70 \mid 0.17$ | 0.60   0.14                    | 0.26   0.11                           | 0.79   0.21                          |               | $\rho = 0.9$                               |
| AIC              | 0.90   0.85      | 0.90   0.84                    | 0.90   0.83                           | 0.86   0.41                          |               | ē <b>–</b> 100 0                           |
| BIC              | 0.13   0.07      | 0.06   0.06                    | 0.00   0.03                           | 0.19   0.08                          |               | $\bar{s}_{Oracle} = 100.0$                 |
|                  | <u> </u>         | <u> </u>                       | · · · · · · · · · · · · · · · · · · · | <u> </u>                             |               |  |

Table 132: FDR | Sensitivity for n=1000, binary design, sparse covariates, and decay 50.

|                  | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|------------------|------------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se           | 0.50   0.86      | 0.36   0.82                    | 0.07   0.69                     | 0.44   0.77      | 0.11   0.72   |                                       |
| CV.min           | 0.66   0.92      | $0.57 \mid 0.89$               | 0.19   0.78                     | $0.59 \mid 0.83$ | 0.36   0.84   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.58   0.89      | 0.50   0.88                    | 0.40   0.85                     | 0.55   0.81      |               | $\rho = 0$                            |
| AIC              | $0.87 \mid 0.97$ | $0.87 \mid 0.96$               | 0.87   0.94                     | $0.64 \mid 0.85$ |               | _ 100.0                               |
| BIC              | 0.24   0.72      | 0.14   0.70                    | 0.02   0.60                     | 0.23   0.66      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.54   0.86      | 0.40   0.82                    | 0.07   0.68                     | 0.47   0.76      | 0.10   0.71   |                                       |
| CV.min           | 0.68   0.92      | 0.59   0.90                    | 0.20   0.78                     | 0.61   0.82      | 0.34   0.83   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.59   0.88      | 0.53   0.87                    | 0.42   0.86                     | 0.57   0.81      |               | $\rho = 0.5$                          |
| AIC              | 0.87   0.97      | 0.87   0.97                    | 0.87   0.95                     | 0.67   0.85      |               | 100.0                                 |
| BIC              | 0.26   0.70      | 0.16   0.69                    | 0.03   0.60                     | 0.26   0.64      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.55   0.86      | 0.42   0.82                    | 0.09   0.69                     | 0.48   0.75      | 0.13   0.72   |                                       |
| CV.min           | 0.69   0.92      | 0.60   0.90                    | 0.23   0.78                     | 0.61   0.82      | 0.36   0.83   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc             | 0.60   0.88      | 0.53   0.87                    | 0.42   0.85                     | 0.57   0.80      | ,             | $\rho = 0.9$                          |
| AIC              | 0.87   0.97      | 0.87   0.97                    | 0.87   0.95                     | 0.67   0.85      |               | - 100.0                               |
| BIC              | 0.28   0.70      | 0.18   0.68                    | 0.04   0.60                     | 0.28   0.64      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.41   0.53      | 0.26   0.45                    | 0.07   0.31                     | 0.50   0.56      | 0.24   0.44   |                                       |
| CV.min           | 0.64   0.67      | 0.52   0.60                    | 0.19 0.42                       | 0.66 0.67        | 0.54   0.62   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.58   0.64      | 0.53   0.61                    | 0.60   0.63                     | 0.61   0.63      | 1             | $\rho = 0$                            |
| AIC              | 0.89 0.92        | 0.89 0.91                      | 0.89 0.89                       | 0.78   0.77      |               | ,                                     |
| BIC              | 0.08   0.24      | 0.06 0.27                      | 0.01   0.12                     | 0.17   0.35      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.45   0.52      | 0.30   0.45                    | 0.08   0.31                     | 0.54   0.56      | 0.21   0.41   |                                       |
| CV.min           | 0.66   0.67      | 0.55   0.60                    | 0.20   0.42                     | 0.68   0.66      | 0.52   0.59   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.60   0.63      | 0.55 0.60                      | 0.60   0.63                     | 0.63   0.63      | 1             | $\rho = 0.5$                          |
| AIC              | 0.89 0.92        | 0.89 0.92                      | 0.89 0.89                       | 0.79 0.77        |               | ,                                     |
| BIC              | 0.06   0.18      | 0.07   0.24                    | 0.01   0.12                     | 0.18   0.32      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.47   0.52      | 0.33   0.45                    | 0.10   0.30                     | 0.54   0.55      | 0.24   0.42   |                                       |
| CV.min           | 0.66   0.67      | 0.56   0.60                    | 0.22   0.41                     | 0.68   0.65      | 0.53   0.59   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc             | 0.61   0.62      | 0.56   0.60                    | 0.59   0.62                     | 0.63   0.62      | 0.00   0.00   | $\rho = 0.9$                          |
| AIC              | 0.89   0.93      | 0.89   0.91                    | 0.89   0.89                     | 0.79   0.76      |               | ,                                     |
| BIC              | 0.07   0.16      | 0.08   0.23                    | 0.01   0.11                     | 0.20   0.31      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.08   0.03      | 0.03   0.01                    | 0.00   0.00                     | 0.59   0.28      | 0.07   0.03   |                                       |
| CV.min           | 0.56   0.26      | 0.31   0.13                    | 0.07   0.03                     | 0.75   0.44      | 0.55   0.25   | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.59   0.27      | 0.58   0.28                    | 0.21   0.12                     | 0.71   0.38      | *****         | $\rho = 0$                            |
| AIC              | 0.90   0.90      | 0.90   0.89                    | 0.90   0.89                     | 0.85   0.67      |               | ,                                     |
| BIC              | 0.01   0.00      | 0.01   0.01                    | 0.00   0.00                     | 0.05   0.03      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.07   0.02      | 0.03   0.01                    | 0.00   0.00                     | 0.62   0.27      | 0.08   0.02   |                                       |
| CV.min           | 0.56   0.23      | 0.33   0.12                    | 0.07   0.02                     | 0.76   0.43      | 0.54   0.22   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc             | 0.59   0.25      | 0.58   0.26                    | 0.27   0.15                     | 0.72   0.37      | 0.51   0.22   | $\rho = 0.5$                          |
| AIC              | 0.90   0.90      | 0.90   0.89                    | 0.90   0.89                     | 0.86   0.68      |               | ,                                     |
| BIC              | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00                     | 0.05   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se           | 0.07   0.02      | 0.03   0.01                    | 0.00   0.00                     | 0.62   0.26      | 0.08   0.01   |                                       |
| CV.1sc<br>CV.min | 0.58   0.23      | 0.05   0.01                    | 0.00   0.00                     | 0.02   0.20      | 0.55   0.22   | $sd(\mu)/\sigma = 0.5$                |
| AICc             | 0.56   0.25      | 0.60   0.26                    | 0.09   0.02                     | 0.70   0.42      | 0.55   0.22   | $\rho = 0.9$                          |
| AIC              | 0.01   0.23      | 0.90   0.89                    | 0.20   0.14                     | 0.72   0.30      |               | ,                                     |
| BIC              | 0.90   0.90      | 0.90   0.89                    | 0.90   0.89                     | 0.06   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
| ыс               | 0.01   0.00      | 0.01   0.00                    | 0.00   0.00                     | 0.00   0.02      |               |                                       |

Table 133: FDR | Sensitivity for n=1000, binary design, sparse covariates, and decay 100.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
|---|
| AICc  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| BIC 0.30   0.93   0.19   0.93   0.03   0.87   0.29   0.87   Soracle = 100.0    CV.1se 0.57   0.98   0.41   0.98   0.09   0.94   0.49   0.93   0.08   0.94    CV.min 0.69   0.99   0.59   0.99   0.19   0.97   0.61   0.96   0.21   0.97    AICc 0.60   0.99   0.51   0.99   0.28   0.98   0.56   0.95    AIC 0.87   1.00   0.87   1.00   0.87   0.99   0.69   0.97    BIC 0.33   0.92   0.22   0.93   0.04   0.88   0.32   0.86    CV.1se 0.58   0.99   0.43   0.98   0.11   0.94   0.50   0.93   0.11   0.95    CV.min 0.70   0.99   0.59   0.99   0.21   0.97   0.61   0.95   0.23   0.97    BIC 0.34   0.92   0.24   0.93   0.05   0.88   0.34   0.85    CV.1se 0.43   0.66   0.28   0.55   0.09   0.31   0.51   0.71   0.38   0.65    CV.min 0.64   0.82   0.51   0.74   0.22   0.49   0.64   0.81   0.62   0.81    AICc 0.89   0.95   0.89   0.93   0.89   0.91   0.78   0.89    BIC 0.00   0.02   0.02   0.09   0.00   0.01   0.10   0.27    CV.lse 0.46   0.65   0.82   0.55   0.10   0.30   0.54   0.70   0.40   0.63    CV.min 0.66   0.82   0.55   0.74   0.23   0.49   0.66   0.80   0.63   0.81    AICc 0.58   0.76   0.54   0.75   0.59   0.75   0.59   0.75    AIC 0.89   0.95   0.89   0.93   0.89   0.91   0.78   0.89    BIC 0.00   0.01   0.01   0.05   0.00   0.01   0.10   0.27    CV.lse 0.48   0.65   0.34   0.75   0.59   0.75   0.59   0.75    AIC 0.89   0.95   0.89   0.93   0.89   0.91   0.79   0.89    BIC 0.00   0.01   0.01   0.05   0.00   0.01   0.09   0.20    CV.lse 0.48   0.65   0.34   0.55   0.74   0.25   0.47   0.66   0.80   0.63   0.81    AICc 0.59   0.76   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80    AICc 0.59   0.76   0.55   0.75   0.60   0.75   0.61   0.75   0.61   0.75    AICc 0.59   0.76   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80    AICc 0.55   0.76   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80    AICc 0.55   0.76   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80    AICc 0.55   0.26   0.59   0.30   0.01   0.00   0.00   0.00   0.00   0.00   0.00    CV.lse 0.44   0.02   0.01   0.01   0.04   0.00   0.05  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| BIC 0.33   0.92   0.22   0.93   0.04   0.88   0.32   0.86   Soracle = 100.0    CV.Ise 0.58   0.99   0.43   0.98   0.11   0.94   0.50   0.93   0.11   0.95    CV.min 0.70   0.99   0.59   0.99   0.21   0.97   0.61   0.95   0.23   0.97   sd(μ)/σ = 2    AICc 0.60   0.99   0.52   0.99   0.29   0.97   0.57   0.94   ρ = 0.9    AIC 0.87   1.00   0.87   1.00   0.87   0.99   0.69   0.97    BIC 0.34   0.92   0.24   0.93   0.05   0.88   0.34   0.85    CV.Ise 0.43   0.66   0.28   0.55   0.09   0.31   0.51   0.71   0.38   0.65    CV.min 0.64   0.82   0.51   0.74   0.22   0.49   0.64   0.81   0.62   0.81   sd(μ)/σ = 1    AICc 0.57   0.77   0.52   0.75   0.59   0.75   0.59   0.77   ρ = 0    AIC 0.89   0.95   0.89   0.93   0.89   0.91   0.78   0.89    BIC 0.00   0.02   0.02   0.09   0.00   0.01   0.10   0.27    CV.Ise 0.46   0.65   0.31   0.55   0.10   0.30   0.54   0.70   0.40   0.63    CV.min 0.65   0.82   0.53   0.74   0.23   0.49   0.66   0.80   0.63   0.81   sd(μ)/σ = 1    AICc 0.58   0.76   0.54   0.75   0.59   0.76   0.60   0.76    AIC 0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.89    BIC 0.00   0.01   0.01   0.05   0.00   0.01   0.09   0.20    CV.Ise 0.48   0.65   0.34   0.54   0.12   0.29   0.55   0.69   0.41   0.62    CV.min 0.66   0.82   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80   sd(μ)/σ = 1    AICc 0.59   0.76   0.55   0.75   0.60   0.75   0.61   0.75    AIC 0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.88    BIC 0.00   0.01   0.01   0.04   0.00   0.01   0.09   0.17    CV.Ise 0.48   0.65   0.34   0.54   0.12   0.29   0.55   0.69   0.41   0.62    CV.min 0.66   0.82   0.55   0.75   0.60   0.75   0.61   0.75    AIC 0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.88    BIC 0.00   0.01   0.01   0.04   0.00   0.01   0.09   0.17    CV.Ise 0.04   0.02   0.01   0.00   0.00   0.00   0.09   0.17    CV.Ise 0.04   0.02   0.01   0.00   0.00   0.00   0.09   0.17    CV.Ise 0.04   0.02   0.01   0.00   0.00   0.00   0.09   0.17    CV.Ise 0.04   0.02   0.01   0.00   0.00   0.00   0.00   0.00   0.00   0.00   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| AICc  |
| AIC 0.87   1.00   0.87   1.00   0.87   0.99   0.69   0.97   BIC   0.34   0.92   0.24   0.93   0.05   0.88   0.34   0.85   0.34   0.85   0.34   0.85   0.06   0.28   0.55   0.09   0.31   0.51   0.71   0.38   0.65   0.62   0.81   $sd(\mu)/\sigma = 1$   AICc   0.57   0.77   0.52   0.75   0.59   0.75   0.59   0.77   0.77   0.52   0.75   0.59   0.75   0.59   0.77   0.70   0.40   0.63   0.81   0.65   0.80   0.93   0.89   0.91   0.78   0.89   0.81   0.65   0.80   0.81   0.65   0.80   0.93   0.89   0.91   0.78   0.89   0.80   0.64   0.81   0.65   0.82   0.53   0.74   0.23   0.49   0.66   0.80   0.63   0.81   $sd(\mu)/\sigma = 1$   AICc   0.58   0.76   0.54   0.75   0.59   0.76   0.60   0.76   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.60   0.75   0.61   0.75   0.60   0.75   0   |
| BIC 0.34   0.92   0.24   0.93   0.05   0.88   0.34   0.85   Soracle = 100.0    CV.1se 0.43   0.66   0.28   0.55   0.09   0.31   0.51   0.71   0.38   0.65    CV.min 0.64   0.82   0.51   0.74   0.22   0.49   0.64   0.81   0.62   0.81   sd(μ)/σ = 1    AICc 0.57   0.77   0.52   0.75   0.59   0.75   0.59   0.77   ρ = 0    AIC 0.89   0.95   0.89   0.93   0.89   0.91   0.78   0.89    BIC 0.00   0.02   0.02   0.09   0.00   0.01   0.10   0.27    CV.1se 0.46   0.65   0.31   0.55   0.10   0.30   0.54   0.70   0.40   0.63    CV.min 0.65   0.82   0.53   0.74   0.23   0.49   0.66   0.80   0.63   0.81   sd(μ)/σ = 1    AICc 0.58   0.76   0.54   0.75   0.59   0.76   0.60   0.76   ρ = 0.5    AIC 0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.89    BIC 0.00   0.01   0.01   0.05   0.00   0.01   0.09   0.20    CV.1se 0.48   0.65   0.34   0.54   0.12   0.29   0.55   0.69   0.41   0.62    CV.min 0.66   0.82   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80   sd(μ)/σ = 1    AICc 0.59   0.76   0.55   0.75   0.60   0.75   0.61   0.75   ρ = 0.9    AIC 0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.88    BIC 0.00   0.01   0.01   0.04   0.00   0.01   0.09   0.17    CV.1se 0.04   0.02   0.01   0.00   0.00   0.00   0.59   0.30   0.08   0.01    CV.1se 0.04   0.02   0.01   0.00   0.00   0.00   0.59   0.30   0.08   0.01    CV.1se 0.04   0.02   0.01   0.00   0.00   0.00   0.59   0.30   0.08   0.01    CV.nin 0.51   0.24   0.20   0.06   0.05   0.01   0.74   0.49   0.50   0.23   sd(μ)/σ = 0.5    AICc 0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   0.49   0.50   0.23   sd(μ)/σ = 0.5    AICc 0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   0.69   0.55   0.59   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.50   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.55   0.  |
| CV.1se   0.43   0.66   0.28   0.55   0.09   0.31   0.51   0.71   0.38   0.65   0.62   0.81   Sd(μ)/σ = 1   AICc   0.57   0.77   0.52   0.75   0.59   0.75   0.59   0.77   0.52   0.76   0.89   0.91   0.78   0.89   0.91   0.78   0.89   0.91   0.78   0.89   0.91   0.78   0.89   0.91   0.65   0.82   0.53   0.74   0.23   0.49   0.66   0.80   0.63   0.81   Sd(μ)/σ = 1   AICc   0.58   0.76   0.54   0.75   0.59   0.76   0.60   0.76   0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.89   0.89   0.81   Sd(μ)/σ = 1   AICc   0.58   0.76   0.54   0.75   0.59   0.76   0.60   0.76   0.63   0.81   Sd(μ)/σ = 1   AICc   0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.89   BIC   0.00   0.01   0.01   0.05   0.00   0.01   0.09   0.20   Soracle = 100.0   Soracle = 100.0   CV.1se   0.48   0.65   0.34   0.54   0.12   0.29   0.55   0.69   0.41   0.62   CV.min   0.66   0.82   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80   Sd(μ)/σ = 1   AICc   0.59   0.76   0.55   0.75   0.60   0.75   0.61   0.75   0.64   0.80   Soracle = 100.0   AIC   0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.88   BIC   0.00   0.01   0.01   0.04   0.00   0.01   0.09   0.17   Soracle = 100.0   Soracle = 100.0   CV.1se   0.04   0.02   0.01   0.04   0.00   0.01   0.09   0.17   Soracle = 100.0   Soracle = 100.0   AIC   0.55   0.26   0.59   0.30   0.14   0.09   0.41   0.49   0.50   0.23   Sd(μ)/σ = 0.5   AICc   0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   0.49   0.50   0.23   Sd(μ)/σ = 0.5   AICc   0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   0.49   0.50   0.23   Sd(μ)/σ = 0.5   AICc   0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   0.49   0.50   0.23   Sd(μ)/σ = 0.5   AICc   0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   0.49   0.50   0.23   Sd(μ)/σ = 0.5   AICc   0.55   0.26   0.59   0.30   0.14   0.09   0.85   0.73   Soracle = 100.0   AICc   0.90   0.91   0.90   0.89   0.90   0.90   0.85   0.73   Soracle = 100.0   AICc   0.90   0.91   0.90   0.89   0.90   0.90   0.85   0.73   Soracle = 100.0   AICc   0.90   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| AICc  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |
| AIC   |
| BIC 0.00   0.02   0.09   0.00   0.01   0.10   0.27   $s_{Oracle} = 100.0$   CV.1se 0.46   0.65   0.31   0.55   0.10   0.30   0.54   0.70   0.40   0.63   0.81   $sd(\mu)/\sigma = 1$   AICc 0.58   0.76   0.54   0.75   0.59   0.76   0.60   0.76   0.63   0.81   $sd(\mu)/\sigma = 1$   AIC 0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.89   0.20   $s_{Oracle} = 100.0$   CV.1se   0.48   0.65   0.34   0.54   0.12   0.29   0.55   0.69   0.41   0.62   $s_{Oracle} = 100.0$   CV.min   0.66   0.82   0.55   0.74   0.25   0.47   0.66   0.79   0.64   0.80   $sd(\mu)/\sigma = 1$   AICc   0.59   0.76   0.55   0.75   0.60   0.75   0.61   0.75   0.64   0.80   $sd(\mu)/\sigma = 1$   AIC   0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.88   $so(\mu)/\sigma = 1$   AIC   0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.88   $so(\mu)/\sigma = 1$   AIC   0.89   0.95   0.89   0.94   0.89   0.91   0.79   0.88   $so(\mu)/\sigma = 1$   AIC   0.80   0.01   0.04   0.00   0.01   0.09   0.17   $so(\mu)/\sigma = 1$   CV.1se   0.04   0.02   0.01   0.04   0.00   0.01   0.09   0.17   $so(\mu)/\sigma = 1$   AIC   0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   $so(\mu)/\sigma = 0.5$   AIC   0.55   0.26   0.59   0.30   0.14   0.09   0.69   0.41   $so(\mu)/\sigma = 0.5$   AIC   0.90   0.91   0.90   0.89   0.90   0.90   0.85   0.73   $so(\mu)/\sigma = 0.5$   |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| AICc  |
| AIC   |
| BIC $0.00 \mid 0.01$ $0.01 \mid 0.05$ $0.00 \mid 0.01$ $0.09 \mid 0.20$ $s_{Oracle} = 100.0$ CV.1se $0.48 \mid 0.65$ $0.34 \mid 0.54$ $0.12 \mid 0.29$ $0.55 \mid 0.69$ $0.41 \mid 0.62$ CV.min $0.66 \mid 0.82$ $0.55 \mid 0.74$ $0.25 \mid 0.47$ $0.66 \mid 0.79$ $0.64 \mid 0.80$ $sd(\mu)/\sigma = 1$ AICc $0.59 \mid 0.76$ $0.55 \mid 0.75$ $0.60 \mid 0.75$ $0.61 \mid 0.75$ $\rho = 0.9$ AIC $0.89 \mid 0.95$ $0.89 \mid 0.94$ $0.89 \mid 0.91$ $0.79 \mid 0.88$ $s_{Oracle} = 100.0$ BIC $0.00 \mid 0.01$ $0.01 \mid 0.04$ $0.00 \mid 0.01$ $0.09 \mid 0.17$ $s_{Oracle} = 100.0$ CV.1se $0.04 \mid 0.02$ $0.01 \mid 0.00$ $0.00 \mid 0.01$ $0.09 \mid 0.17$ $s_{Oracle} = 100.0$ CV.min $0.51 \mid 0.24$ $0.20 \mid 0.06$ $0.05 \mid 0.01$ $0.74 \mid 0.49$ $0.50 \mid 0.23$ $sd(\mu)/\sigma = 0.5$ AICc $0.55 \mid 0.26$ $0.59 \mid 0.30$ $0.14 \mid 0.09$ $0.69 \mid 0.41$ $\rho = 0$ AIC $0.90 \mid 0.91$ $0.90 \mid 0.89$ $0.90 \mid 0.90$ $0.85 \mid 0.73$ $0.85 \mid 0.73$   |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |
| BIC         0.00   0.01         0.04   0.04         0.00   0.01         0.09   0.17 $s_{Oracle} = 100.0$ CV.1se         0.04   0.02         0.01   0.00         0.00   0.00         0.59   0.30         0.08   0.01           CV.min         0.51   0.24         0.20   0.06         0.05   0.01         0.74   0.49         0.50   0.23 $sd(\mu)/\sigma = 0.5$ AICc         0.55   0.26         0.59   0.30         0.14   0.09         0.69   0.41 $\rho = 0$ AIC         0.90   0.91         0.90   0.89         0.90   0.90         0.85   0.73 $\bar{\rho} = 0$  |
| CV.1se       0.04   0.02       0.01   0.00       0.00   0.00       0.59   0.30       0.08   0.01         CV.min       0.51   0.24       0.20   0.06       0.05   0.01       0.74   0.49       0.50   0.23 $sd(\mu)/\sigma = 0.5$ AICc       0.55   0.26       0.59   0.30       0.14   0.09       0.69   0.41 $\rho = 0$ AIC       0.90   0.91       0.90   0.89       0.90   0.90       0.85   0.73  |
| CV.min 0.51   0.24 0.20   0.06 0.05   0.01 0.74   0.49 0.50   0.23   $sd(\mu)/\sigma = 0.5$ AICc 0.55   0.26 0.59   0.30 0.14   0.09 0.69   0.41 $\rho = 0$ AIC 0.90   0.91 0.90   0.89 0.90   0.90 0.85   0.73   $\bar{\rho} = 0$  |
| AICc $0.55 \mid 0.26  0.59 \mid 0.30  0.14 \mid 0.09  0.69 \mid 0.41$<br>AIC $0.90 \mid 0.91  0.90 \mid 0.89  0.90 \mid 0.90  0.85 \mid 0.73$   |
| AIC 0.90   0.91 0.90   0.89 0.90   0.90 0.85   0.73   |
|   |
| 210 0.00 0.00 0.00 0.00 0.00 0.00   |
| CV.1se 0.04   0.01   0.00   0.00   0.00   0.00   0.62   0.29   0.08   0.01  |
| CV.min 0.48   0.20 0.19   0.05 0.04   0.01 0.75   0.47 0.48   0.19 $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc $0.55 \mid 0.23  0.58 \mid 0.28  0.17 \mid 0.10  0.71 \mid 0.40$   |
| AIC 0.90 0.91 0.90 0.89 0.90 0.90 0.85 0.73   |
| BIC $0.00 \mid 0.00 \mid 0.0$ |
| CV.1se 0.03   0.01   0.01   0.00   0.00   0.02   0.27   0.10   0.01   |
| CV.min 0.51   0.19 0.21   0.05 0.06   0.01 0.75   0.46 0.50   0.19 $\operatorname{sd}(\mu)/\sigma = 0.5$  |
| AICc $0.57 \mid 0.23  0.59 \mid 0.28  0.16 \mid 0.09  0.71 \mid 0.39$ $\rho = 0.9$  |
| AIC 0.90   0.91 0.90   0.89 0.90   0.90 0.85   0.72   |
| BIC $0.90 \mid 0.90 \mid 0.89 \mid 0.90 \mid 0.9$ |

Table 134: FDR | Sensitivity for n=1000, binary design, sparse covariates, and decay 200.

| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | lasso            | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\;\gamma=10$ | marginal AL      | sparsenet MCP |                                       |
|---|--------|------------------|--------------------------------|--------------------------|------------------|---------------|---------------------------------------|
| AICC  | CV.1se |                  | 0.35   1.00                    | 0.06   0.99              | 0.46   0.98      | 0.04   0.98   |                                       |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   | CV.min |                  | 0.54   1.00                    | 0.13   1.00              | $0.58 \mid 0.99$ | 0.13   0.99   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   | AICc   | 0.58   1.00      | 0.46   1.00                    | 0.11   0.99              | $0.53 \mid 0.98$ |               | $\rho = 0$                            |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   | AIC    | 0.87   1.00      | 0.87   1.00                    | $0.87 \mid 0.99$         | $0.68 \mid 0.99$ |               | ā - · - 100 0                         |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   | BIC    | 0.34   0.99      | 0.20   0.99                    | 0.03   0.96              | 0.33   0.95      |               | <i>SOracle</i> – 100.0                |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.1se | 0.58   1.00      | 0.39   1.00                    | 0.06   0.99              | 0.49   0.97      | 0.04   0.99   |                                       |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.min | 0.70   1.00      | 0.56   1.00                    | 0.13   1.00              | $0.60 \mid 0.98$ | 0.13   1.00   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | AICc   | 0.60   1.00      | 0.48   1.00                    | 0.11   0.99              | $0.56 \mid 0.98$ |               | $\rho = 0.5$                          |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   | AIC    | 0.87   1.00      | 0.87   1.00                    | $0.87 \mid 0.99$         | $0.70 \mid 0.99$ |               | = -100.0                              |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | $0.37 \mid 0.98$ | 0.23   0.99                    | $0.03 \mid 0.97$         | 0.36   0.94      |               | $s_{Oracle} = 100.0$                  |
| AICC 0.61   1.00 0.49   1.00 0.12   0.99 0.57   0.98   $\rho = 0.9$   AIC 0.87   1.00 0.87   1.00 0.87   0.99   0.70   0.99   $\bar{s}_{Oracle} = 100.0$   $\bar{s}_{Oracle} = 100.0$ | CV.1se | 0.59   1.00      | 0.41   1.00                    | 0.09   0.99              | 0.51   0.97      | 0.07   0.99   |                                       |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.min | 0.70   1.00      | 0.57   1.00                    | 0.16   1.00              | 0.61   0.98      | 0.15   1.00   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| BIC 0.39   0.98   0.25   0.99   0.04   0.97   0.38   0.94   Soracle = 100.0    CV.1se   | AICc   | 0.61   1.00      | 0.49   1.00                    | 0.12   0.99              | 0.57   0.98      |               | $\rho = 0.9$                          |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $   | AIC    | 0.87   1.00      | 0.87   1.00                    | $0.87 \mid 0.99$         | $0.70 \mid 0.99$ |               | = -100.0                              |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | BIC    | 0.39   0.98      | 0.25   0.99                    | 0.04   0.97              | 0.38   0.94      |               | $s_{Oracle} = 100.0$                  |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.1se | 0.43   0.72      | 0.27   0.57                    | 0.09   0.25              | 0.51   0.77      | 0.41   0.72   |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min | 0.63   0.87      | 0.49   0.79                    | 0.21   0.48              | 0.64   0.86      | 0.63   0.87   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | AICc   | 0.56   0.82      | 0.52   0.81                    | $0.60 \mid 0.80$         | 0.58   0.82      | ,             |                                       |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   | AIC    | 0.89   0.96      | 0.89 0.94                      | 0.89   0.91              | ,                |               |                                       |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   | BIC    | 0.00   0.00      | 0.01   0.04                    | 0.00   0.01              | ,                |               | $s_{Oracle} = 100.0$                  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.1se | 0.46   0.70      | 0.30   0.57                    | 0.09   0.22              |                  | 0.43   0.70   |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min |                  |                                | '                        |                  |               | $\operatorname{sd}(\mu)/\sigma = 1$   |
| $\begin{array}{ c c c c c c c c c c c c c c c c c c c$  | AICc   | 0.58   0.81      | 0.54   0.81                    | 0.59   0.81              | 0.60   0.81      | ,             |                                       |
| $\begin{array}{ c c c c c c c c c c c c c c c c c c c$  | AIC    | 0.89   0.96      | 0.89 0.95                      | 0.89   0.92              | ,                |               | - 100.0                               |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   | BIC    | 0.00   0.00      | 0.00   0.02                    | 0.00   0.00              | 0.04   0.09      |               | $s_{Oracle} = 100.0$                  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.1se | 0.48   0.70      | 0.33   0.56                    | 0.09   0.20              | 0.55   0.74      | 0.45   0.69   |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | CV.min | 0.66   0.87      | 0.53   0.79                    | 0.23   0.43              | ,                |               | $\operatorname{sd}(\mu)/\sigma = 1$   |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |                  |                                |                          | ,                | '             |                                       |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   | AIC    | 0.89   0.96      | 0.89 0.94                      | 0.89   0.92              | ,                |               | _ 100.0                               |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   |        | '                |                                |                          | ,                |               | $s_{Oracle} = 100.0$                  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        |                  |                                | <u>'</u>                 |                  | 0.09   0.01   |                                       |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   |        |                  |                                | '                        |                  |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$   | AICc   | 0.54   0.25      | 0.60   0.32                    | 0.09   0.06              | ,                | '             |                                       |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$   |        | 0.90   0.91      | 0.90   0.89                    | 0.90   0.90              | ,                |               | - 100.0                               |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00              | ,                |               | $s_{Oracle} = 100.0$                  |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  | CV.1se | 0.03   0.01      | 0.00   0.00                    | 0.00   0.00              | 0.62   0.29      | 0.10   0.01   |                                       |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        | '                |                                | '                        | '                | 0.45   0.17   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$  |        |                  | ,                              | ,                        |                  | '             |                                       |
| BIC         0.00   0.00         0.00   0.00         0.00   0.00         0.05   0.01 $s_{Oracle} = 100.0$ CV.1se         0.03   0.01         0.00   0.00         0.00   0.00         0.63   0.27         0.12   0.01           CV.min         0.47   0.17         0.17   0.03         0.05   0.01         0.75   0.47         0.47   0.16 $sd(\mu)/\sigma = 0.5$   |        |                  | ,                              | ,                        |                  |               |                                       |
|   |        |                  | ,                              | '                        |                  |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.min $0.47 \mid 0.17 \mid 0.03  0.05 \mid 0.01  0.75 \mid 0.47  0.47 \mid 0.16    sd(\mu)/\sigma = 0.5$   |        |                  |                                |                          |                  | 0.12   0.01   |                                       |
|   |        |                  | ,                              | ,                        |                  |               | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| r viv   |        |                  |                                | ,                        |                  | 1             |                                       |
| AIC 0.90   0.91 0.90   0.89 0.90   0.90 0.85   0.74   |        | '                |                                | ,                        |                  |               |                                       |
| BIC 0.01   0.00   0.00   0.00   0.00   0.00   0.00   0.01   $\bar{s}_{Oracle} = 100.0$  |        |                  |                                | ,                        |                  |               | $s_{Oracle} = 100.0$                  |

Table 135: FDR | Sensitivity for n=1000, continuous design, sparse covariates, and decay 10.

|        | lasso            | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|--------|------------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se | 0.33   0.26      | 0.20   0.24                    | 0.02   0.20                     | 0.22   0.22      | 0.00   0.19   |                                       |
| CV.min | 0.67   0.33      | 0.59   0.31                    | 0.20   0.24                     | 0.51   0.26      | 0.19   0.24   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | $0.65 \mid 0.33$ | $0.56 \mid 0.30$               | $0.09 \mid 0.22$                | $0.48 \mid 0.26$ |               | $\rho = 0$                            |
| AIC    | $0.88 \mid 0.72$ | $0.88 \mid 0.72$               | $0.88 \mid 0.69$                | 0.49   0.26      |               | $\bar{s}_{Oracle} = 100.0$            |
| BIC    | 0.21   0.23      | 0.11   0.22                    | 0.00   0.18                     | 0.17   0.21      |               | SOracle = 100.0                       |
| CV.1se | 0.68   0.27      | 0.57   0.24                    | 0.16   0.18                     | 0.47   0.18      | 0.04   0.18   |                                       |
| CV.min | 0.79   0.36      | 0.75   0.32                    | 0.49   0.24                     | 0.56   0.20      | 0.23   0.21   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.77   0.34      | $0.72 \mid 0.30$               | 0.41   0.23                     | 0.56   0.20      |               | $\rho = 0.5$                          |
| AIC    | $0.88 \mid 0.66$ | $0.88 \mid 0.66$               | $0.87 \mid 0.65$                | 0.56   0.20      |               | ā - · - 100 0                         |
| BIC    | 0.46   0.20      | 0.34   0.19                    | 0.04   0.16                     | 0.46   0.18      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.81   0.28      | 0.79   0.25                    | 0.68   0.18                     | 0.03   0.11      | 0.45   0.16   |                                       |
| CV.min | 0.83   0.37      | 0.82   0.34                    | 0.75   0.24                     | 0.06   0.12      | 0.61   0.20   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.82   0.33      | 0.81   0.30                    | 0.72   0.22                     | 0.06   0.12      |               | $\rho = 0.9$                          |
| AIC    | 0.84   0.39      | 0.84   0.39                    | 0.81   0.35                     | 0.06   0.12      |               | - 100 O                               |
| BIC    | 0.74   0.17      | 0.72   0.15                    | 0.45   0.10                     | 0.05   0.12      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.25   0.17      | 0.12   0.15                    | 0.01   0.12                     | 0.43   0.19      | 0.01   0.12   |                                       |
| CV.min | 0.66   0.25      | 0.56   0.22                    | 0.14   0.16                     | 0.75   0.28      | 0.23   0.17   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.66   0.25      | 0.52   0.21                    | 0.03   0.13                     | 0.71   0.26      | ,             | $\rho = 0$                            |
| AIC    | 0.89   0.79      | 0.89   0.79                    | 0.89   0.76                     | 0.79   0.32      |               | 100.0                                 |
| BIC    | 0.18   0.16      | 0.07   0.14                    | 0.00   0.10                     | 0.15   0.15      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.61   0.16      | 0.49   0.14                    | 0.11   0.11                     | 0.70   0.18      | 0.06   0.11   |                                       |
| CV.min | 0.79   0.26      | 0.75   0.23                    | 0.40   0.15                     | 0.80   0.25      | 0.30   0.14   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.78   0.25      | 0.73   0.21                    | 0.28   0.14                     | 0.79   0.24      | ,             | $\rho = 0.5$                          |
| AIC    | 0.89   0.75      | 0.89   0.75                    | 0.89   0.72                     | 0.80   0.26      |               | _ 100.0                               |
| BIC    | 0.38   0.12      | 0.27   0.11                    | 0.02   0.08                     | 0.47   0.12      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.63   0.11      | 0.74   0.12                    | 0.71   0.10                     | 0.30   0.10      | 0.57   0.09   |                                       |
| CV.min | 0.83   0.24      | 0.83   0.22                    | 0.77   0.14                     | 0.49 0.13        | 0.70   0.13   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.84   0.23      | 0.82 0.19                      | 0.71   0.12                     | 0.49 0.13        | 1             | $\rho = 0.9$                          |
| AIC    | 0.87   0.48      | 0.87 0.49                      | 0.87   0.47                     | 0.49 0.13        |               | ,                                     |
| BIC    | 0.08   0.01      | 0.01   0.01                    | 0.01   0.01                     | 0.32 0.10        |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.11   0.07      | 0.05   0.06                    | 0.01   0.05                     | 0.57   0.15      | 0.01   0.05   |                                       |
| CV.min | 0.64   0.16      | 0.50   0.13                    | 0.12   0.08                     | 0.81   0.26      | 0.34   0.11   | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 0.67   0.17      | 0.40   0.12                    | 0.00   0.04                     | 0.78   0.22      | '             | $\rho = 0$                            |
| AIC    | 0.90   0.85      | 0.90   0.84                    | 0.90   0.83                     | 0.87   0.41      |               | ,                                     |
| BIC    | 0.12   0.08      | 0.03   0.06                    | 0.00   0.02                     | 0.15 0.08        |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.14   0.02      | 0.17   0.03                    | 0.06   0.03                     | 0.73   0.11      | 0.09   0.04   |                                       |
| CV.min | 0.74   0.12      | 0.71   0.11                    | 0.33   0.06                     | 0.84   0.22      | 0.41   0.07   | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 0.77   0.14      | 0.65   0.10                    | 0.04   0.02                     | 0.83   0.19      | 1             | $\rho = 0.5$                          |
| AIC    | 0.90   0.83      | 0.90   0.82                    | 0.90   0.80                     | 0.87   0.33      |               |                                       |
| BIC    | 0.09   0.02      | 0.04   0.02                    | 0.00   0.01                     | 0.16   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.00   0.01      | 0.00   0.01                    | 0.00   0.01                     | 0.41   0.05      | 0.01   0.01   |                                       |
| CV.min | 0.52   0.02      | 0.41   0.01                    | 0.14   0.01                     | 0.75   0.14      | 0.32   0.03   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 0.64   0.03      | 0.18   0.01                    | 0.00   0.01                     | 0.74   0.14      | 0.02   0.03   | $\rho = 0.9$                          |
| AIC    | 0.88   0.58      | 0.89   0.60                    | 0.89   0.57                     | 0.76   0.15      |               |                                       |
| BIC    | 0.08   0.01      | 0.01   0.01                    | 0.00   0.01                     | 0.12   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
|        | 0.00   0.01      | 0.01   0.01                    | 0.00   0.01                     | 0.12   0.02      |               |                                       |

Table 136: FDR | Sensitivity for n=1000, continuous design, sparse covariates, and decay 50.

|                   | lasso            | $\operatorname{GL} \gamma = 1$ | $\mathrm{GL}\;\gamma=10$ | marginal AL      | sparsenet MCP |                                       |
|-------------------|------------------|--------------------------------|--------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.51   0.86      | 0.36   0.82                    | 0.07   0.69              | 0.44   0.77      | 0.11   0.72   |                                       |
| CV.min            | 0.67   0.91      | $0.57 \mid 0.89$               | $0.19 \mid 0.78$         | $0.59 \mid 0.83$ | 0.36   0.84   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.58   0.89      | $0.49 \mid 0.87$               | $0.23 \mid 0.78$         | $0.55 \mid 0.81$ |               | $\rho = 0$                            |
| AIC               | $0.87 \mid 0.97$ | $0.87 \mid 0.96$               | $0.87 \mid 0.94$         | $0.64 \mid 0.85$ |               | $\bar{s}_{Oracle} = 100.0$            |
| BIC               | 0.24   0.72      | 0.12   0.68                    | 0.01   0.54              | $0.24 \mid 0.66$ |               | SOracle = 100.0                       |
| CV.1se            | 0.70   0.84      | 0.63   0.80                    | 0.33   0.68              | 0.67   0.67      | 0.24   0.67   |                                       |
| CV.min            | $0.77 \mid 0.91$ | $0.72 \mid 0.89$               | $0.48 \mid 0.78$         | 0.71   0.73      | 0.42   0.76   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | $0.70 \mid 0.84$ | $0.66 \mid 0.83$               | $0.47 \mid 0.79$         | $0.69 \mid 0.71$ |               | $\rho = 0.5$                          |
| AIC               | $0.86 \mid 0.97$ | $0.86 \mid 0.97$               | $0.86 \mid 0.96$         | $0.72 \mid 0.74$ |               | - 100 O                               |
| BIC               | 0.32   0.35      | 0.38   0.50                    | 0.16   0.51              | $0.49 \mid 0.44$ |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.76   0.82      | 0.73   0.78                    | 0.61   0.67              | 0.57   0.20      | 0.54   0.63   |                                       |
| CV.min            | 0.79   0.89      | 0.77   0.88                    | 0.66   0.77              | 0.61   0.24      | 0.60   0.70   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.75   0.80      | 0.73   0.79                    | 0.64   0.74              | 0.61   0.24      | •             | $\rho = 0.9$                          |
| AIC               | 0.79   0.89      | 0.78   0.90                    | 0.76   0.91              | 0.61   0.24      |               | 100.0                                 |
| BIC               | 0.06   0.01      | 0.01   0.01                    | 0.02   0.03              | 0.48   0.17      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.41   0.53      | 0.26   0.45                    | 0.07   0.30              | 0.50   0.56      | 0.24   0.44   |                                       |
| CV.min            | 0.64   0.67      | 0.52   0.60                    | 0.18   0.41              | 0.66   0.67      | 0.54   0.62   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.58   0.63      | 0.49   0.59                    | 0.28   0.46              | 0.60   0.63      | '             | $\rho = 0$                            |
| AIC               | 0.89   0.92      | 0.89 0.91                      | 0.89 0.89                | 0.78   0.77      |               | ,                                     |
| BIC               | 0.08   0.23      | 0.04   0.22                    | 0.00   0.02              | 0.17   0.34      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.63   0.39      | 0.59   0.39                    | 0.33   0.26              | 0.70   0.44      | 0.36   0.34   |                                       |
| CV.min            | 0.75   0.61      | 0.71   0.57                    | 0.47   0.39              | 0.76   0.55      | 0.53   0.45   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.71   0.53      | 0.68   0.52                    | 0.57   0.51              | 0.74   0.51      | '             | $\rho = 0.5$                          |
| AIC               | 0.89   0.93      | 0.89 0.93                      | 0.89   0.90              | 0.81 0.70        |               | ,                                     |
| BIC               | 0.01   0.01      | 0.00 0.01                      | 0.00   0.00              | 0.09 0.04        |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.07   0.04      | 0.22   0.12                    | 0.22   0.11              | 0.64   0.16      | 0.63   0.28   |                                       |
| CV.min            | 0.61   0.23      | 0.64   0.35                    | 0.48   0.26              | 0.72   0.25      | 0.71   0.40   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.67   0.17      | 0.35   0.15                    | 0.26   0.18              | 0.72   0.25      |               | $\rho = 0.9$                          |
| AIC               | 0.85   0.83      | 0.85   0.83                    | 0.84   0.80              | 0.72   0.26      |               | ,                                     |
| BIC               | 0.06   0.01      | 0.01   0.01                    | 0.00   0.01              | 0.12   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.08   0.03      | 0.03   0.01                    | 0.00   0.00              | 0.60   0.29      | 0.07   0.03   |                                       |
| CV.min            | 0.56   0.26      | 0.33   0.14                    | 0.07   0.03              | 0.75   0.44      | 0.55   0.25   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.59   0.27      | 0.28   0.13                    | 0.00   0.00              | 0.71   0.38      |               | $\rho = 0$                            |
| AIC               | 0.90   0.90      | 0.90   0.89                    | 0.90   0.89              | 0.85   0.67      |               | ,                                     |
| BIC               | 0.01   0.00      | 0.00   0.00                    | 0.00   0.00              | 0.05   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00              | 0.65   0.11      | 0.16   0.00   |                                       |
| CV.min            | 0.42   0.04      | 0.30   0.03                    | 0.10   0.01              | 0.81   0.28      | 0.45   0.04   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.59   0.08      | 0.10   0.01                    | 0.00   0.00              | 0.79   0.23      | 0.15   0.01   | $\rho = 0.5$                          |
| AIC               | 0.90   0.91      | 0.90   0.90                    | 0.90   0.89              | 0.87   0.63      |               |                                       |
| BIC               | 0.01   0.00      | 0.00   0.00                    | 0.00   0.00              | 0.08   0.01      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.00   0.00      | 0.00   0.00                    | 0.00   0.00              | 0.13   0.01      | 0.00   0.00   |                                       |
| CV.rise<br>CV.min | 0.52   0.02      | 0.40   0.02                    | 0.10   0.01              | 0.77   0.11      | 0.16   0.01   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.62   0.02      | 0.40   0.02                    | 0.00   0.01              | 0.77   0.11      | 0.10   0.01   | $\rho = 0.9$                          |
| AIC               | 0.89   0.80      | 0.88   0.78                    | 0.89   0.75              | 0.79   0.12      |               |                                       |
| BIC               | 0.05   0.00      | 0.01   0.01                    | 0.00   0.01              | 0.00   0.20      |               | $\bar{s}_{Oracle} = 100.0$            |
| DIC               | 0.05   0.01      | 0.01   0.01                    | 0.00   0.01              | 0.09   0.01      |               |                                       |

Table 137: FDR | Sensitivity for n=1000, continuous design, sparse covariates, and decay 100.

|        | lasso                                   | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP    |                                       |
|--------|---|--------------------------------|---------------------------------|------------------|------------------|---------------------------------------|
| CV.1se | 0.54   0.98                             | 0.38   0.98                    | 0.08   0.93                     | 0.46   0.94      | 0.07   0.93      |                                       |
| CV.min | $0.68 \mid 0.99$                        | $0.56 \mid 0.99$               | $0.17 \mid 0.97$                | $0.58 \mid 0.96$ | 0.23   0.97      | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.58   0.99                             | $0.47 \mid 0.99$               | $0.10 \mid 0.94$                | $0.54 \mid 0.95$ |                  | $\rho = 0$                            |
| AIC    | 0.87   1.00                             | $0.87 \mid 0.99$               | $0.87 \mid 0.98$                | $0.67 \mid 0.97$ |                  | $\bar{s}_{Oracle} = 100.0$            |
| BIC    | 0.31   0.93                             | 0.17   0.93                    | $0.03 \mid 0.85$                | $0.29 \mid 0.88$ |                  | SOracle = 100.0                       |
| CV.1se | 0.72   0.98                             | 0.65   0.98                    | 0.36   0.96                     | 0.68   0.84      | 0.28   0.96      |                                       |
| CV.min | 0.78   1.00                             | 0.72   0.99                    | $0.48 \mid 0.99$                | $0.72 \mid 0.90$ | $0.41 \mid 0.98$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | $0.70 \mid 0.98$                        | $0.65 \mid 0.98$               | $0.38 \mid 0.97$                | $0.70 \mid 0.87$ |                  | $\rho = 0.5$                          |
| AIC    | 0.87   1.00                             | 0.87   1.00                    | 0.86   1.00                     | $0.74 \mid 0.91$ |                  | $\bar{s}_{Oracle} = 100.0$            |
| BIC    | 0.01   0.01                             | 0.02   0.04                    | $0.26 \mid 0.89$                | 0.10   0.09      |                  | <i>SOracle</i> – 100.0                |
| CV.1se | 0.76   0.98                             | 0.72   0.97                    | 0.58   0.95                     | 0.63   0.25      | 0.52   0.94      |                                       |
| CV.min | $0.80 \mid 0.99$                        | $0.77 \mid 0.99$               | $0.63 \mid 0.98$                | $0.67 \mid 0.35$ | $0.57 \mid 0.97$ | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc   | 0.74   0.96                             | $0.71 \mid 0.97$               | $0.57 \mid 0.96$                | $0.66 \mid 0.34$ |                  | $\rho = 0.9$                          |
| AIC    | $0.80 \mid 0.99$                        | $0.79 \mid 1.00$               | $0.77 \mid 1.00$                | $0.66 \mid 0.35$ |                  | - 100 O                               |
| BIC    | $0.09 \mid 0.02$                        | 0.03   0.01                    | $0.01 \mid 0.02$                | 0.14   0.03      |                  | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.43   0.66                             | 0.28   0.55                    | 0.09   0.31                     | 0.51   0.71      | 0.38   0.64      |                                       |
| CV.min | 0.64   0.82                             | 0.51   0.74                    | 0.22   0.49                     | 0.65   0.81      | 0.62   0.81      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.56   0.77                             | 0.48   0.72                    | 0.42   0.64                     | 0.59   0.77      |                  | $\rho = 0$                            |
| AIC    | 0.89   0.95                             | 0.89 0.93                      | 0.89   0.90                     | 0.78   0.89      |                  |                                       |
| BIC    | 0.00   0.02                             | 0.00   0.03                    | 0.00   0.00                     | 0.10   0.27      |                  | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.41   0.27                             | 0.42   0.30                    | 0.06   0.05                     | 0.69   0.49      | 0.43   0.35      |                                       |
| CV.min | 0.71   0.67                             | 0.67   0.64                    | 0.25   0.20                     | 0.74   0.64      | 0.60   0.58      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.68   0.54                             | 0.65   0.60                    | 0.60   0.66                     | 0.72   0.57      | ·                | $\rho = 0.5$                          |
| AIC    | 0.89   0.96                             | 0.88   0.96                    | 0.89   0.93                     | 0.82   0.83      |                  | - 100.0                               |
| BIC    | 0.01   0.00                             | 0.00   0.00                    | 0.00   0.00                     | 0.05   0.01      |                  | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.01   0.01                             | 0.02   0.01                    | 0.00   0.01                     | 0.52   0.11      | 0.11   0.07      |                                       |
| CV.min | 0.55   0.05                             | 0.48   0.09                    | 0.14   0.02                     | 0.73   0.26      | 0.41   0.21      | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc   | 0.63   0.05                             | 0.17   0.03                    | 0.04   0.04                     | 0.73   0.28      | ·                | $\rho = 0.9$                          |
| AIC    | 0.85   0.93                             | 0.85   0.93                    | 0.84   0.90                     | 0.74   0.36      |                  | _ 100.0                               |
| BIC    | 0.07   0.01                             | 0.02   0.01                    | 0.00   0.01                     | 0.08   0.01      |                  | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.05   0.01                             | 0.01   0.00                    | 0.00   0.00                     | 0.60   0.30      | 0.07   0.01      |                                       |
| CV.min | 0.51   0.24                             | 0.20   0.07                    | 0.04   0.01                     | 0.74   0.49      | 0.51   0.24      | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 0.56   0.26                             | 0.18   0.09                    | 0.00   0.00                     | 0.69   0.41      | ,                | $\rho = 0$                            |
| AIC    | 0.90   0.91                             | 0.90   0.89                    | 0.90   0.90                     | 0.85   0.73      |                  |                                       |
| BIC    | 0.00   0.00                             | 0.00   0.00                    | 0.02   0.02                     | 0.04   0.01      |                  | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.00   0.00                             | 0.00   0.00                    | 0.00   0.00                     | 0.62   0.09      | 0.22   0.00      |                                       |
| CV.min | 0.36   0.03                             | 0.21   0.01                    | 0.07   0.00                     | 0.81 0.27        | 0.45   0.03      | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc   | 0.54   0.06                             | 0.05   0.00                    | 0.00   0.00                     | 0.79 0.21        | 1                | $\rho = 0.5$                          |
| AIC    | 0.90   0.92                             | 0.90   0.90                    | 0.90   0.90                     | 0.87 0.68        |                  |                                       |
| BIC    | 0.01   0.00                             | 0.00   0.00                    | 0.00   0.00                     | 0.07   0.00      |                  | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se | 0.00   0.00                             | 0.00   0.00                    | 0.00   0.00                     | 0.08   0.01      | 0.04   0.00      |                                       |
| CV.min | 0.51   0.02                             | 0.41   0.02                    | 0.13   0.01                     | 0.78   0.07      | 0.31   0.02      | $sd(\mu)/\sigma = 0.5$                |
| AICc   | 0.63   0.03                             | 0.11   0.01                    | 0.01   0.01                     | 0.79   0.08      | 1                | $\rho = 0.9$                          |
| AIC    | 0.89   0.84                             | 0.89   0.82                    | 0.89   0.80                     | 0.81   0.17      |                  |                                       |
| BIC    | 0.04   0.01                             | 0.01   0.01                    | 0.00   0.00                     | 0.10   0.01      |                  | $\bar{s}_{Oracle} = 100.0$            |
|        | ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | 2.22   0.01                    | 2.22   0.00                     | 2.22   0.02      |                  |                                       |

Table 138: FDR | Sensitivity for n=1000, continuous design, sparse covariates, and decay 200.

|                   | lasso       | $\operatorname{GL} \gamma = 1$ | $\operatorname{GL} \gamma = 10$ | marginal AL      | sparsenet MCP |                                       |
|-------------------|-------------|--------------------------------|---------------------------------|------------------|---------------|---------------------------------------|
| CV.1se            | 0.55   1.00 | 0.35   1.00                    | 0.06   0.99                     | 0.46   0.98      | 0.04   0.98   |                                       |
| CV.min            | 0.68   1.00 | 0.54   1.00                    | 0.13   1.00                     | $0.58 \mid 0.99$ | 0.14   0.99   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.58   1.00 | 0.44   1.00                    | $0.03 \mid 0.98$                | $0.53 \mid 0.98$ |               | $\rho = 0$                            |
| AIC               | 0.87   1.00 | 0.87   1.00                    | $0.87 \mid 0.99$                | $0.68 \mid 0.99$ |               | = - 100.0                             |
| BIC               | 0.34   0.98 | 0.18   0.98                    | 0.02   0.96                     | 0.33   0.95      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.73   1.00 | 0.64   1.00                    | 0.31   1.00                     | 0.68   0.90      | 0.11   1.00   |                                       |
| CV.min            | 0.78   1.00 | 0.71   1.00                    | 0.38   1.00                     | 0.73   0.94      | 0.19   1.00   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.71   1.00 | 0.63   1.00                    | 0.22   1.00                     | 0.70   0.92      |               | $\rho = 0.5$                          |
| AIC               | 0.87   1.00 | 0.87   1.00                    | 0.87   1.00                     | 0.76   0.95      |               | = 100.0                               |
| BIC               | 0.00   0.01 | 0.04   0.08                    | 0.20   0.99                     | 0.05   0.03      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.77   1.00 | 0.72   1.00                    | 0.56   1.00                     | 0.63   0.30      | 0.46   1.00   |                                       |
| CV.min            | 0.81   1.00 | 0.77   1.00                    | 0.60   1.00                     | 0.67   0.47      | 0.52   1.00   | $\operatorname{sd}(\mu)/\sigma = 2$   |
| AICc              | 0.74   0.99 | 0.70   1.00                    | 0.51   0.99                     | 0.67   0.46      | '             | $\rho = 0.9$                          |
| AIC               | 0.81   1.00 | 0.80   1.00                    | 0.79   1.00                     | 0.67   0.48      |               | 1000                                  |
| BIC               | 0.14   0.02 | 0.06   0.02                    | 0.14   0.28                     | 0.13   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.44   0.72 | 0.27   0.57                    | 0.09   0.25                     | 0.51   0.77      | 0.42   0.72   |                                       |
| CV.min            | 0.64   0.87 | 0.49   0.79                    | 0.22   0.48                     | 0.64   0.86      | 0.64   0.87   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.56   0.83 | 0.48   0.78                    | 0.43   0.67                     | 0.58   0.82      | 1             | $\rho = 0$                            |
| AIC               | 0.89   0.96 | 0.89   0.94                    | 0.89   0.91                     | 0.78   0.93      |               | ,                                     |
| BIC               | 0.00   0.01 | 0.00   0.00                    | 0.00   0.00                     | 0.05   0.14      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.24   0.14 | 0.22   0.15                    | 0.01   0.01                     | 0.68   0.49      | 0.28   0.18   |                                       |
| CV.min            | 0.65   0.60 | 0.56   0.53                    | 0.10   0.04                     | 0.74   0.66      | 0.61   0.57   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.63   0.46 | 0.61   0.62                    | 0.60   0.73                     | 0.71   0.59      | 0.00   0.00   | $\rho = 0.5$                          |
| AIC               | 0.88   0.97 | 0.88   0.97                    | 0.89   0.94                     | 0.82   0.88      |               | · '                                   |
| BIC               | 0.01   0.00 | 0.00   0.00                    | 0.00   0.00                     | 0.05   0.01      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.01   0.01 | 0.01   0.01                    | 0.01   0.01                     | 0.32   0.06      | 0.02   0.01   |                                       |
| CV.min            | 0.57   0.05 | 0.50   0.04                    | 0.16   0.02                     | 0.73   0.24      | 0.29   0.05   | $\operatorname{sd}(\mu)/\sigma = 1$   |
| AICc              | 0.64   0.05 | 0.20   0.02                    | 0.04   0.04                     | 0.73   0.26      | 0.25   0.05   | $\rho = 0.9$                          |
| AIC               | 0.85   0.96 | 0.85   0.96                    | 0.85   0.94                     | 0.75   0.47      |               | ,                                     |
| BIC               | 0.11   0.02 | 0.04   0.01                    | 0.01   0.01                     | 0.14   0.02      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.04   0.01 | 0.01   0.00                    | 0.00   0.00                     | 0.60   0.31      | 0.07   0.01   |                                       |
| CV.rise<br>CV.min | 0.48   0.22 | 0.15   0.04                    | 0.04   0.01                     | 0.73   0.50      | 0.49   0.22   | $\operatorname{sd}(\mu)/\sigma = 0.5$ |
| AICc              | 0.54   0.25 | 0.13   0.07                    | 0.00   0.00                     | 0.69   0.42      | 0.15   0.22   | $\rho = 0$                            |
| AIC               | 0.90   0.91 | 0.90   0.89                    | 0.90   0.90                     | 0.85   0.75      |               | ,                                     |
| BIC               | 0.00   0.00 | 0.00   0.00                    | 0.18   0.17                     | 0.04   0.01      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.00   0.00 | 0.00   0.00                    | 0.00   0.00                     | 0.60   0.08      | 0.24   0.00   |                                       |
| CV.13C            | 0.34   0.03 | 0.18   0.01                    | 0.00   0.00                     | 0.81   0.26      | 0.45   0.03   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.53   0.06 | 0.03   0.00                    | $0.00 \mid 0.00$                | 0.79   0.21      | 0.43   0.03   | $\rho = 0.5$                          |
| AIC               | 0.90   0.92 | 0.90   0.90                    | 0.90   0.90                     | 0.86   0.69      |               | ĺ ,                                   |
| BIC               | 0.02   0.00 | 0.00   0.00                    | 0.00   0.00                     | 0.07   0.00      |               | $\bar{s}_{Oracle} = 100.0$            |
| CV.1se            | 0.02   0.00 | 0.00   0.00                    | 0.00   0.00                     | 0.09   0.01      | 0.08   0.00   |                                       |
| CV.1se<br>CV.min  | 0.00   0.00 | 0.38   0.01                    | 0.00   0.00                     | 0.09   0.01      | 0.39   0.02   | $sd(\mu)/\sigma = 0.5$                |
| AICc              | 0.49   0.02 | 0.38   0.01                    | 0.14   0.01                     | 0.79   0.00      | 0.37   0.02   | $\rho = 0.9$                          |
| AICC              | 0.82   0.03 | '                              | 0.01   0.00                     | 0.79   0.07      |               | ,                                     |
|                   |             | 0.89   0.83                    | '                               |                  |               | $\bar{s}_{Oracle} = 100.0$            |
| BIC               | 0.04   0.01 | 0.01   0.00                    | 0.00   0.00                     | 0.11   0.01      |               |                                       |