Statistical Learning

List of problems for the second midterm

1) Compare irrepresentability and identifiability conditions for LASSO. Which properties are guaranteed by these conditions ?
2) Adaptive LASSO and Ridge: In the orthogonal case (X'X=I) calculate the value of the adaptive ridge or LASSO estimator for the specific coordinate of the beta vector. For the ridge regression: given the true value of this parameter calculate the bias, variance and the mean squared error of this adaptive estimator.
3) Bayesian interpretation of ridge and LASSO: given the tuning parameters for LASSO or ridge provide the respective prior distribution for the related Maximum A Posteriori Bayesian rule.
4) Given the tuning parameters for the spike and slab LASSO and the value of the sparsity parameter, calculate the probability that a given beta belongs to the spike (or the slab) component.
5) Define SLOPE. Describe SLOPE properties. How is it different from LASSO ?
6) Knockoffs: Given vector of values of W statistics calculate the respective critical value so that FDR is controlled at a given level, use this procedure to decide which variables are significant predictors of Y.
7) Given a covariance matrix for the 3-dimensional multivariate normal distribution be able to determine which pairs of variables are independent/conditionally independent. Be able to draw a respective graphical model.
8) Provide the definition of the precision matrix. How is it related to the gaussian graphical model ?
9) Formulate the graphical LASSO and graphical SLOPE algorithms.