Econ 7010 Midterm Formula Sheet

standard regression model: $\quad\quad\quad\quad\quad\quad \boldsymbol{y} = X\boldsymbol{\beta} + \boldsymbol{\epsilon}$

vector differentiation rules:
$$\frac{\partial\,(a'\boldsymbol{x})}{\partial\boldsymbol{x}} = a$$
$$\frac{\partial\,(\boldsymbol{x}'A\boldsymbol{x})}{\partial\boldsymbol{x}} = 2A\boldsymbol{x}$$

LS estimator: $\quad\quad\quad\quad\quad\quad\quad \boldsymbol{b} = \left(X'X\right)^{-1}X'\boldsymbol{y}$

residual vector: $\quad\quad\quad\quad\quad\quad \boldsymbol{e} = (\boldsymbol{y} - \hat{\boldsymbol{y}}) = \boldsymbol{y} - X\boldsymbol{b}$

estimator of error variance: $\quad\quad s^2 = (\boldsymbol{e}'\boldsymbol{e})\,/\,(n-k)$

covariance matrix for a random vector $\boldsymbol{x}$: $\quad \mathbb{V}(\boldsymbol{x}) = \mathbb{E}\left[(\boldsymbol{x} - \mathbb{E}(\boldsymbol{x}))(x - \mathbb{E}(\boldsymbol{x}))'\right]$

covariance matrix for errors: $\quad\quad \mathbb{V}(\boldsymbol{\epsilon}) = \sigma^2 I_n$

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"residual maker" matrix: $\quad\quad\quad M_X = I_n - X\left(X'X\right)^{-1}X'$

"fitted values maker" matrix $\quad\quad P_X = X\left(X'X\right)^{-1}X'$

deviations about means matrix: $\quad\quad M_{\boldsymbol{i}} = I_n - \frac{1}{n}\boldsymbol{i}\boldsymbol{i}'$

partitioned LS estimator: $\quad\quad\quad \boldsymbol{b}_1 = \left(X_1'M_2X_1\right)^{-1}X_1'M_2\boldsymbol{y}$

R-square: $\quad\quad\quad\quad\quad\quad\quad R^2 = \dfrac{\hat{\boldsymbol{y}}'M_i\hat{\boldsymbol{y}}}{\boldsymbol{y}'M_i\boldsymbol{y}} = 1 - \dfrac{\boldsymbol{e}'\boldsymbol{e}}{\boldsymbol{y}'M_i\boldsymbol{y}}$

adjusted R-square: $\quad\quad\quad\quad \bar{R}^2 = 1 - \dfrac{\boldsymbol{e}'\boldsymbol{e}/(n-k)}{\boldsymbol{y}'M_{\boldsymbol{i}}\boldsymbol{y}/(n-1)}$

mean squared error: $\quad\quad\quad\quad \mathrm{MSE}(\hat{\boldsymbol{\theta}}) = \mathbb{V}(\hat{\boldsymbol{\theta}}) + [\mathrm{Bias}(\hat{\boldsymbol{\theta}})]^2$

t-statistic: $\quad\quad\quad\quad\quad\quad\quad t_j = \dfrac{b_j - \beta_j}{\mathrm{s.\,e.}\,(b_j)} \sim t_{n-k}$

confidence interval: $\quad\quad\quad\quad b_j \pm t_c \times \mathrm{s.\,e.}\,(b_j)$