

STA 314, Review problems 3 (Lecture 4)

Multiple choice questions can have any number of correct answers (including zero).

1. Consider a linear model with 3 predictors, A, B, C . The following table gives the RSS for each combination of predictors in a linear model.

none	A	B	C	A,B	A,C	B,C	A,B,C
7	3	4	5	2	3	1.5	1

- (a) Which model with 2 predictors is selected by best subset selection?
- (b) Which model with 2 predictors is selected by forward stepwise selection?
- (c) Which model with one predictor is selected by backward stepwise selection?
- (d) Assume that additionally $\hat{\sigma}^2 = 0.6$. Which model will be selected by best subset selection with C_p ?
- (e) Assume that additionally $\hat{\sigma}^2 = 0.1$ and $n = 20$. Which model will be selected by best subset selection with BIC ?

2. Consider a linear model with 3 predictors, A, B, C . The following table gives the RSS for each combination of predictors in a linear model.

none	A	B	C	A,B	A,C	B,C	A,B,C
7	6	4	Z	X	1.5	3	1

What are possible values for X, Z (you should provide intervals)?

3. Comparing model selection based on AIC and BIC with $n = 1000$
- ☐ AIC will sometimes select models with fewer predictors.
 - ☐ BIC will sometimes select models with fewer predictors.
 - ☐ AIC and BIC will always select the same model.
4. Comparing model selection based on AIC and BIC
- ☐ There are cases when AIC will select models with fewer predictors.
 - ☐ Even if $\log n > 5$ there are cases when AIC will select models with fewer predictors.
 - ☐ BIC always select models with fewer predictors.
 - ☐ AIC and BIC will never select the same model.
5. Assume you have 5 predictors. Will best subset selection and forward stepwise selection always result in the same model with one predictor? Justify your answer.
6. Assume you have 5 predictors. Will best subset selection and backward stepwise selection always result in the same model with one predictor? Justify your answer.
7. Prove: if $n > 8$ then BIC will never select a model with fewer predictors than AIC (no matter if we use best subset, forward stepwise or backward stepwise to select candidate models).
8. Prove: for the formulas given in lectures AIC and C_p will always select the same model (no matter if we use best subset, forward stepwise or backward stepwise to select candidate models).