Full Name: Key

Quiz #3
BIOSTAT 705 Spring 2023

1. (2 pts) Backward procedure can be carried out when number of predictors in the model is larger than number of observations (ie, $p > n$)? (True or False)

2. (2 pts) Ridge regression is same as least-squares regression when tuning parameter $\lambda = 0$? (True or False)

3. (2 pts) LASSO shrinks the regression coefficient estimates towards zero, thus lasso performs variable selection? (True or False)

4. (3 pts) For model $Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \epsilon$, to test $H_0 : \beta_2 = \beta_3 = \beta_4 = 0$, we use partial F-test:

$$F = \frac{[\text{SSE}(x_1, x_2, x_3, x_4) - \text{SSE}(x_1)]/3}{\text{MSE}_{\text{full}}} \quad \text{(True or False)}$$

5. Below is a summary of variable selection:

Number of Observations: 20

Number in Model	R-Square	Adjusted R-Square	C(p)	AIC	BIC	SSE	Variables in Model
1	0.77	0.76	1.69	38.71	41.20	113.4	X2
1	0.71	0.70	6.32	43.36	44.92	143.1	X1
1	0.40	0.37	30.22	57.91	57.00	296.3	x4
1	0.02	-.03	59.70	67.78	65.76	485.3	X3
2	0.79	0.77	1.92	38.59	42.00	102.1	X1 x4
2	0.79	0.76	2.52	39.34	42.52	105.9	X1 X3
2	0.78	0.75	3.15	40.09	43.03	110.0	X1 X2
2	0.77	0.75	3.33	40.29	43.17	111.1	X2 X3
2	0.77	0.75	3.42	40.40	43.24	111.7	X2 x4
2	0.74	0.71	6.29	43.45	45.36	130.1	X3 x4
3	0.80	0.76	3.35	39.87	44.11	98.4	X1 X2 X3
3	0.80	0.76	3.63	40.22	44.31	100.2	X1 X2 x4
3	0.79	0.76	3.88	40.55	44.49	101.8	X1 X3 x4
3	0.78	0.74	5.04	41.96	45.29	109.3	X2 X3 x4
4	0.80	0.75	5.00	41.41	46.52	96.2	X1 X2 X3 x4

Min[$|1.69-2|$, $|1.92-3|$, $|3.35-4|$] = 0.31

Smallest as well as lowest BIC, very good R_a^2 and AIC.

a) (6 pts) Based on above, suggest a 'best' subset of variable(s) to be considered in a model. Write-down your selected regression model?

$Y = \beta_0 + \beta_2 X_2 + \epsilon$

b) (5 pts) Complete ANOVA table below for selected regression model in part (a):

Source	df	SS	MS	F
Regression	1	382	382	
Error	18	113.4	6.3	
Total	19	495.4		

$F = \frac{382}{6.3} = 60.6 \sim F(1,18)$

$SSR(X_2) = SST - SSE(X_2) = 495.4 - 113.4$