

STA 213 - Final Exam

Name _____

This exam consists of six (6) questions; all of them are worth ten points each (for a total of 60 possible points).

- Answer all six questions in the Examination Booklet.
- Answer each question on a separate page in the Examination Booklet.
- Clearly indicate the number of each question so that there is no confusion as to which answer belongs to which question.
- Make sure your name is on both this exam and the front cover of the Examination Booklet.

Question 1

In a study of the reproductive behaviour in the Mormon cricket (*Anabrus simplex*), a biologist collected a field sample of 39 females involved in active courtship. For each female he observed the number of mature eggs (an indicator of fecundity) and their body weight. An analysis of this data provided the following information:

<i>Regression Statistics</i>	
Multiple R	0.687925593
R Square	0.473241622
Adjusted R Square	0.459004909
Standard Error	22.60100061
Observations	39

ANOVA					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	16979.64244	16979.64	33.24093	1.30474E-06
Residual	37	18899.79345	510.8052		
Total	38	35879.4359			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	-72.05421804	19.72567748	-3.65281	0.000798	-112.0222368
body-wt	31.77926023	5.511974249	5.765495	1.3E-06	20.61093964

A. How would you mathematically define the relationship between body weight and fecundity for the Mormon cricket?

B. Interpret the relationship between body weight and fecundity in the Mormon cricket.

Question 2

The following ANOVA table from a statistical study is only partially completed.

Source of variation	SS	df	MS
Total	1123	53	
Groups		4	
Error	964		

- Complete the table.
- How many groups were there in the study?
- How many total observations were there in the study?
- Calculate the F statistic and determine if a null hypothesis would have been accepted or rejected (at $\alpha = .05$).

Question 3

The following analysis was done to determine if the density of grass in four fields resulted in different weight sizes for the gophers inhabiting those fields. Mean weight of gophers is provided in grams.

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
Field 1	13	4840	372.308	37.3974
Field 2	13	4596	353.538	118.936
Field 3	13	4619	355.308	79.5641
Field 4	13	4692	360.923	179.41

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	2795.3	3	931.763	8.97419	0.0005	2.7981
Within Groups	4983.7	48	103.827			
Total	7779	51				

Perform a multiple comparison test to determine which field had the largest gophers. Show your table of results, your hypothesis conclusion and interpret the results.

Question 4

What do you believe are the top five “rules” that must be followed when performing any statistical analysis or hypothesis test? Justify and explain your choices.

Question 5

You and another student are hired to do some basic forestry surveys for the summer. One day you are each required to count the number of trees within each species found along a transect to compare the tree composition of two adjacent forests. Your summarized data is presented as:

Forest A	No. trees
White spruce	160
Fir	120
Black spruce	80
Aspen	20
Poplar	20
Total	400

Forest B	No. trees
White spruce	145
Fir	128
Black spruce	73
Aspen	32
Poplar	22
Total	400

Perform a hypothesis test to determine if there is any significant difference in the species composition of the two forests. Show your calculations and interpret your results.

Question 6

An evil stats prof conducted an experiment in which he determined the time required for students in his stats class to run through a maze and collect a cheeseburger at the end. He has all of the students run through the maze under three different conditions:

- light; no shocks.
- light; electric shocks.
- darkness; no shocks.

Light/darkness refers to whether the lights in the maze are on or off. Shocks refers to when a student turns a corner and moves down a correct passage, in which case they receive a mild electric shock (nothing too serious).

The times required to run the maze (in seconds) are shown in the following table:

Time required to complete the maze and grab the burger

Light - no shocks	Light - electric shocks	Darkness – no shocks
23	170	229
12	182	126
29	286	140
12	103	260
5	330	330
47	55	310
18	49	45
30	31	248
8	132	280
45	150	140
36	165	160
27	206	192
29	200	159
33	270	62
24	298	180
17	100	32
11	162	54
25	126	149
6	229	201
34	140	173

The stats prof started an analysis to determine if there was a statistically significant difference in maze completion time under the various conditions but he was distracted by the leftover cheeseburgers. All he managed to calculate was:

- Group SS = 291,449.4
- Error SS = 275,925.2

Since you are already a brilliant student of statistics, you decided to help the prof by completing his analysis. Perform a hypothesis test and accompanying statistical analysis to determine if the maze completion times were influenced by the conditions in the maze. Show your calculations and interpret your results. (Assume $\alpha = .05$).