BUS 310, Exam #2A, Part II, Summer 2019 Name ____
Section ____

Instructions: This exam is in two parts: Part I is to be completed partly at home using the materials posted on Blackboard for Part I, and you will answer questions about that work in class below; Part II is to be completed entirely in class using your computer.

1. You may not use cell phones, and you may only access internet resources you are specifically directed to use: You may access your data file for Part I of the exam in Blackboard. You may access the data files posted to Blackboard for the Exam part II.
2. Be sure you are using the data file that matches the exam version you are given.
3. It is a violation of the honor code to communicate with other students in or out of the class during the exam, by any means. Students whose exams show evidence of coordination will be reported.
4. Show all work to support your reasoning. Primarily, this can be done in Excel. Deletion of evidence of your logical process can result in loss of credit. A significant amount of credit goes toward process, reasoning and interpretation.
5. When rounding, do not over-round. In general, do not report dollar amounts beyond the penny. Means should be rounded to one digit more than the original data; standard deviations to two digits more. Do not report fractions rounded to single digit expressions: $\frac{131}{256} \neq \frac{1}{2}$, and do not round decimals or percents to a single digit: $0.57846 \ldots \neq 60\% \; or \; 0.6$. Report a minimum of two digits, up to four, unless otherwise specified in the problem.
6. If a problem asks for an explanation, state the solution clearly, then interpret or explain in addition to stating the solution, not in place of. Explanations without solutions, just as solutions without explanations, will not be awarded full credit.

Part I: At Home

This part was completed at home. You can upload the Excel file for Part I to the Part I folder in Blackboard for use during the Exam period. However, this submission will **not** be graded in this location, it must be submitted to the "**to be graded** folder" to receive credit.

Part II: In Class

1. Use the work done at home to answer the Part I questions.
2. Open the file from the in-class portion of the final posted on Blackboard that corresponds to the version of the exam you have. This is Exam A.
3. Answer the questions corresponding to the data file, and any additional calculation in Excel required. Be sure to sign the honor code statement on the next page.
4. When you have finished answering questions on the exam, and all your answers have been recorded on the paper test for grading, upload **both** the take home Excel file **and** the in-class Excel file to the same in-class Exam folder in Blackboard for grading. Only those files submitted to the Submission/To-Be-Graded Folder will be graded. (If in doubt, put all work in one Excel file.)
5. Turn in your paper copy of the exam to your instructor.

Honor Code Statement:

I, ____ (print your name), agree to abide by the George Mason Honor Code and Academic Integrity Pledge: *To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University Community and with the desire for greater academic and personal achievement, I, a student member of the university community, pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.* Furthermore, I have read and I agree to follow the guidelines laid out in the instructions for this exam above. I also agree not to participate in the efforts of other students to circumvent these guidelines, or to assist in their violations of the code, and will report such efforts in a timely manner.

____ ____________________

Student Signature and G# Today's Date

Part I:

The following questions refer to problem #1 from Part I:

1. To what extent do the boxplots support the equal variance assumption of ANOVA? Explain. (8 points)

2. Using the data on Salary and History, conduct a one-way ANOVA test. Record null and alternative hypotheses, the F-statistic, and the P-value below. What do you conclude from this test in laymen's terms? (10 points)

The following questions refer to problems #2-4 from Part I:

3. Write the equation for your final multiple regression model here. State the variables used. (8 points)

4. State the R^2 value for your final model and interpret the meaning in context. (8 points)

5. Interpret the meaning of the Catalogs slope coefficient. (6 points)

6. Do any of the variables from your scatterplots appear to be nonlinear? Explain. (8 points)

7. Consider the residual graphs for your final equation stated in #3. Do there appear to be any problems with the model? Is the equal variance assumption satisfied? Explain. (8 points)

The following questions refer to problems #5 from Part I:

8. Record your χ^2 test of independence here. Clearly state the hypothesis, all key test statistics and the P-value. Interpret the results of the test in context. (10 points)

The following questions refer to problems #6 from Part I:

9. State the null and alternative hypothesis for the one-sample t-test. State the test-statistic and P-value. What is the conclusion of your test? (8 points)

The following questions refer to problems #7 from Part I:

10. Is the two-sample t-test you conducted a paired t-test or a pooled t-test? (6 points)

11. State the null and alternative hypotheses for your two-sample t-test. What was the test-statistic and P-value? Explain the meaning of your results. (10 points)

Calculations in Excel: (1) 20 points, (2-4) 50 points, (5-7) 40 points.

Part II:

12. Suppose that the alternative hypothesis of a one-sample test of means is $H_a: \mu > 45$. Is the hypothesis test one-tailed or two-tailed? (6 points)

13. Suppose that a two-tailed test of a population proportion has a test-statistic of $z = -2.84$. Find the P-value. Use that information to determine whether the null hypothesis would be rejected at the 5% significance level. (8 points)

Use the ANOVA table below to answer the questions that follow.

SUMMARY

Groups	Count	Sum	Average	Variance
National	10	98	9.8	4.177778
Competitor 1	10	113	11.3	4.011111
Competitor 2	10	126	12.6	4.044444

ANOVA

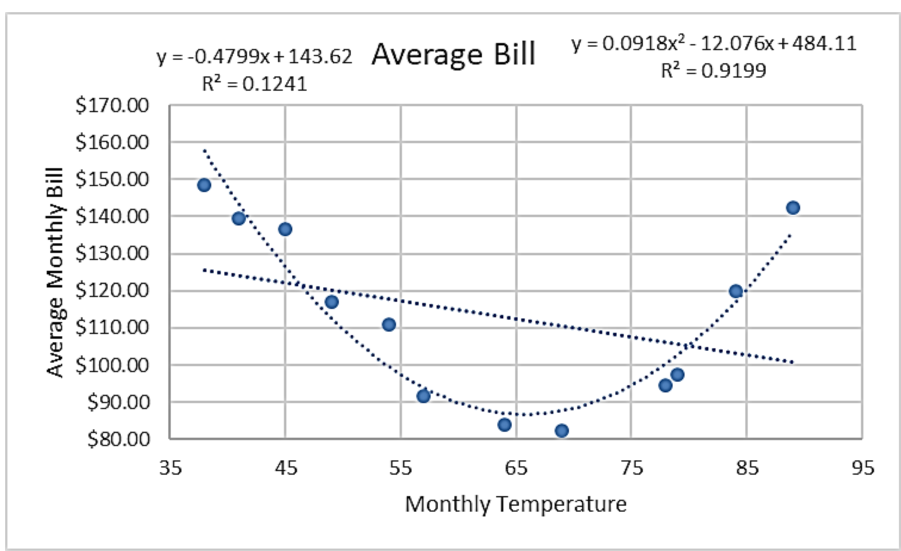
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	39.26667	2	19.63333	4.814714	0.016282	3.354131
Within Groups	110.1	27	4.077778			
Total	149.3667	29				

14. State the null and alternative hypothesis for single-factor ANOVA using proper notation and/or terminology. (4 points)

15. Using a 1% significance level, do you reject or fail to reject the null hypothesis? (4 points)

16. Interpret a Type I error in this context (of the ANOVA test above). (6 points)

Use the scatterplot shown of temperature and average electric bill to answer the questions that follow.



17. Based on the scatterplot, is the linear model an appropriate model for the data? (4 points)

18. Using the better model, predict the average monthly bill for a month with an average monthly temperature of 74 degrees. (6 points)

19. Which variable in the scatterplot is the explanatory variable? (4 points)

Use the multiple regression output and the residual plots to answer the following questions. The data predicts an overall employee rating based on the results of four tests.

Regression Statistics	
Multiple R	0.9157898
R Square	0.8386710
Adjusted R Square	0.8128584
Standard Error	6.3022990
Observations	30

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	5161.9923	1290.498	32.49072	1.43375E-09
Residual	25	992.97432	39.71897		
Total	29	6154.9666			

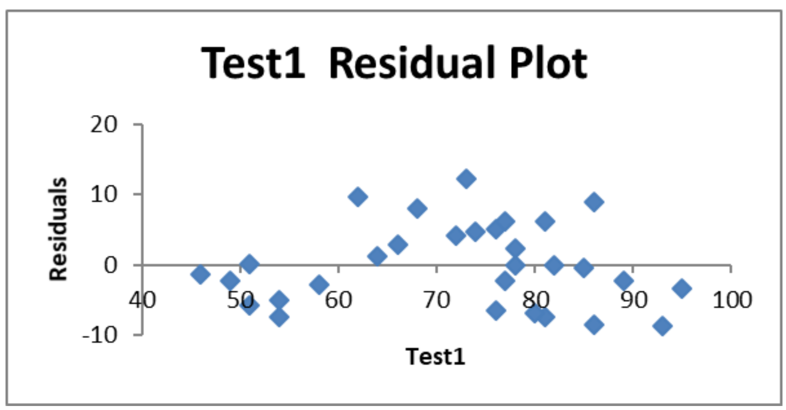
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 90.0%*	*Upper 90.0%*
Intercept	-57.198345	10.438851	-5.479	1.08E-05	-78.6975	-35.6991	-75.0293	-39.3673
Test1	0.6079173	0.1140467	5.330	1.59E-05	0.37303	0.84280	0.41310	0.80272
Test2	0.4869782	0.1466522	3.3206	0.00276	0.18494	0.78901	0.23647	0.73748
Test3	-0.6185604	0.1778282	-3.478	0.001864	-0.98480	-0.25231	-0.92231	-0.31480
Test4	1.2308779	0.1956889	6.2899	1.4E-06	0.82784	1.63390	0.89661	1.56514

20. Interpret the coefficient reported for Test #2 in context. (4 points)

21. State a 90% confidence interval for the coefficient for Test #4. (6 points)

22. Can any coefficients be eliminated from the model? Why or why not? (6 points)

23. The Residual plot vs. Test #1 is shown. Does the plot appear to exhibit any problems? Why or why not? (6 points)



24. What assumption of regression models is being tested in the residual plot? (6 points)

25. Predict the rating of a single employee with test scores $x_1 = 74, x_2 = 65, x_3 = 88, x_4 = 73$. (5 points)

Upload your completed Excel files to the Exam #2 submission box in Blackboard and submit your completed paper exam to your instructor. You may not modify anything once the exam is submitted.

Standard errors: $\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$ $s_{pooled} = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$

$s_{x_1-x_2} = s_{pooled}\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}$

Sample sizes: $n > \hat{p}(1-\hat{p})\left(\frac{z_{\alpha/2}}{E}\right)^2$ $n > \left(\frac{z_{\alpha/2}\sigma}{E}\right)^2$ $m = n = \frac{4z_{\alpha/2}^2(\sigma_1^2+\sigma_2^2)}{w^2}$

Confidence intervals:

One sample: $\bar{x} \pm t_{\alpha/2,n-1}\frac{s}{\sqrt{n}}$ $\hat{p} \pm z_{\alpha/2}\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

Two samples (independent): $(\bar{x}_1 - \bar{x}_2) \pm t_{\alpha/2,n-1}\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}$ $(\hat{p}_1 - \hat{p}_2) - z_{\alpha/2}\sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1}+\frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$

Test statistics:

One sample: $z \text{ or } t = \frac{\bar{x}-\mu_0}{s/\sqrt{n}}$ $z = \frac{\hat{p}-p_0}{\sqrt{p_0(1-p_0)/n}}$

Two samples: dependent: $z \text{ or } t = \frac{\bar{d}_0-\delta}{\frac{s_d}{\sqrt{n}}}$

Independent: $z \text{ or } t = \frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$ $z = \frac{(\hat{p}_1-\hat{p}_2)-(p_1-p_2)}{\sqrt{\frac{p_1(1-p_1)}{n_1}+\frac{p_2(1-p_2)}{n_2}}}$

Degrees of freedom (two samples, unpooled) $\nu = \frac{\left(\frac{s_1^2}{m}+\frac{s_2^2}{n}\right)^2}{\frac{\left(\frac{s_1^2}{m}\right)^2}{m-1}+\frac{\left(\frac{s_2^2}{n}\right)^2}{n-1}}$

χ^2Tests: $\chi^2 = \sum_{all\ cells}\frac{(obs-\exp)^2}{exp}$