BUS 310, Final Exam C, Part II, Spring 2019 Name KEY

Section _____

Instructions: This exam is in three 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. Part III is to be done entirely in class without 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 C.
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.

6. Put away your computer and pick up Part III. For this part of the exam, you will only be allowed to use a four-function or scientific calculator that is not connectable to the Internet. You may not use the calculator on your phone. You may not share a calculator with someone else taking this portion of the exam at the same time.

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. State the variables used in your final regression model. (5 points)

Intercept
Year X_1
CPIT X_2
Cars X_3
MPG X_4

2. Write the regression equation obtained and the R^2 value. (6 points)

$$Y = 2048.2X_1 - 392.8X_2 + 0.326X_3 - 2849.16X_4 - 394,554.5$$

$$R^2 = 0.96559$$

3. An extreme outlier is any residual that is more than three standard errors in size. Does your model have any extreme outliers? (5 points)

NO

4. Using a model that contains all available variables to predict Gas Used, which variable has the highest p-value? State the variable, and the hypothesis (null and alternative) that the p-value is testing. (8 points)

CPI p-value 0.919966

$H_0: \beta_i = 0$
$H_a: \beta_i \neq 0$

Since $0.919966 > 0.05$, we fail to reject the null thus we assume the coeff is zero and remove the variable from the model.

5. Do the variables included in the final model appear to be linear or non-linear? In explaining your reasoning, be sure to appeal to both the residual graphs and the scatterplots. (6 points)

the variables appear to be very nonlinear from the scatterplots. The residualplots look less bad but there appears to be something periodic going on.

6. Do any of the variables discarded in your model appear to be colinear with variables that remain? This is to say, among the variables discarded, do any of them show an especially high correlation with any variables left in the model? If so, which ones, and gives the corresponding correlations. [Hint: a table of correlations will help here.] (6 points)

yes. retail price & station price 0.9705
CPI & CPIT 0.996516
Year & Income 0.995753

answers may vary a bit but all should be >0.97 and a subject of these variables

The following questions refer to problem #2 from Part I:

7. State the null and alternative hypotheses, the test statistic and p-value from your χ^2-test. Is there sufficient evidence to support the claim that movie rating depends on genre? (10 points)

Ho: The variables rating and genre are independent
Ha: The variables are dependent

$X^2 = 97.128$
p-value: 7.41×10^{-13}
reject null

There is strong evidence to think movie ratings do depend on genre

8. State the degrees of freedom for your χ^2-test. (5 points)

The following questions refer to problem #3 from Part I:

9. State the confidence interval for the proportion of men in the program. Interpret the result in context. (8 points)

(57.75%, 62.05%)

We are 95% confident that the true proportion of men in graduate business schools is between 57.75% and 62.05%

10. State the null and alternative hypotheses for your one-sample t-test. Also state the test-statistic and p-value. Is there sufficient evidence that the amount of debt is less than the national average? (10 points)

$H_0: \mu = 30{,}000$
$H_a: \mu < 30{,}000$

$t = -5.91$
p-value: 2.055×10^{-9}

reject null

There is sufficient evidence to think that the mean student debt of those in graduate business schools is less than the national average

Calculations in Excel: (1) 40 points, (2) 20 points, (3) 45 points.

Part II:

11. Using the data on sheet #11 conduct an ANOVA test to determine if this data provides sufficient evidence to support that the National Company and its competitors have the same market share? State your null and alternative hypotheses, your test statistic and p-value. Summarize the conclusion so that a lay person can understand it. (10 points)

H_0: all means the same $\mu_1 = \mu_2 = \mu_3$
H_a: at least one mean is different

$F = 11.088$
p-value: $0.0003 < 0.05$

reject null

There is sufficient evidence that the mean market share of the companies are different.

12. Create a boxplot of the data. Does it agree with your conclusion above? If not, why not. If your test showed that the brands are different, which two brands are the most different? (6 points)

Yes, it agrees.

it appears that Competitor 2 is most different from National but also quite different from Competitor 1

13. Does the assumption of equal variance appear to be met? Why or why not? (6 points)

Yes, approximately

2 are approximately S.S. one is a bit higher but not dramatically so and could be due to the small data set

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

ANOVA: $MSE = \frac{\left(\sum_{j=1}^{J} n_j(\bar{Y}_j-\bar{\bar{Y}})^2\right)}{J-1}$ $MSS = \sum_{j=1}^{J}\frac{(n_j-1)s_j^2}{n-J}$ $F = \frac{MSE}{MSS}$

Upload your completed Excel **files (plural!)** 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. Put away your computer and pick up the final portion of the exam.