BUS 310, Exam #1A, 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. Based on your analysis of the furniture company, state your objective function (an algebraic equation), and the maximum revenue. Note the meaning of any variables. (8 points)

$800X_1 + 300X_2 + 800X_3 + 300X_4 = \text{Revenue}$

$= 1{,}460{,}000$

X_1 = oak tables
X_2 = oak chairs
X_3 = pine tables
X_4 = pine chairs

2. What production levels of each type of chairs and tables will the company need to produce to obtain the maximum revenue listed above? (8 points)

$X_1 = 0$
$X_2 = 3000$
$X_3 = 700$
$X_4 = 0$

3. State the value of the shadow price for the Oak constraint and interpret the meaning in context. (8 points)

60

if the amount of oak available is increased, the revenue will increase by $60 per unit

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

4. Find a 98% confidence interval for your stratified sample and interpret it in context. (8 points)

(29.63, 33.72)

We are 98% confident that the true mean of age of students is between 29.63 and 33.72.

answers will vary

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

5. Using the cluster sample calculated at home, find a 95% confidence interval for GMAT scores. Interpret the results of your interval. Do you think your sample is representative of the data? Why or what not? (12 points)

(694, 708) answers will vary
we are 95% confident that the true mean GMAT score is between 694 and 708. it may be representative if GMAT score doesn't vary much by age. it is a large sample.

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

6. Report your 95% confidence interval for the difference of means. Is there a meaningful difference between monthly expenses for the married and unmarried students? Explain. (10 points)

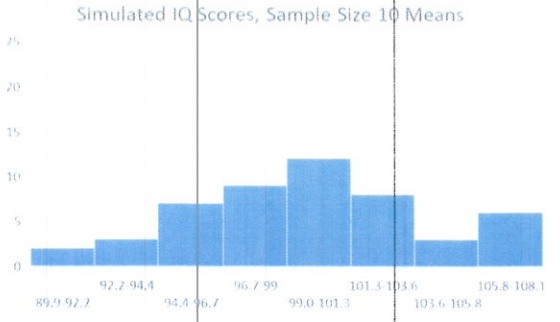
(333.16, 407.96)

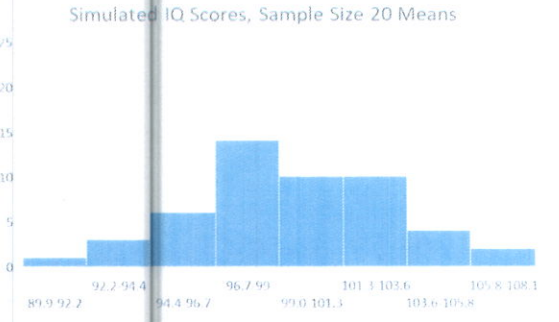
Yes, there is a difference of expenses (we are 95% confident the difference is between $333 and $408) because 0 is not included in the interval.

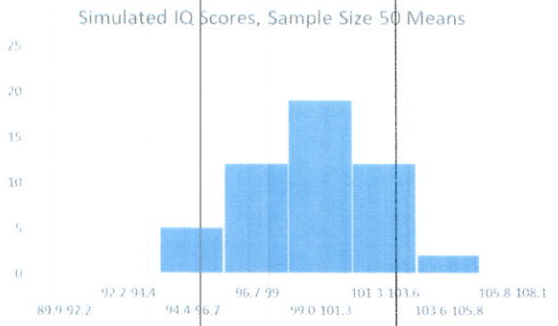
Calculations in Excel: (1) 32 points, (2) 15 points, (3) 20 points, (4) 20 points.

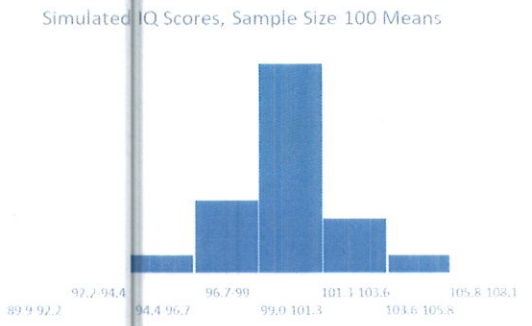
Part II:

7. Fifty (50) simulated samples of IQ scores are taken with each of 4 different sample sizes. Histograms of the means of the simulated data for each sample size are shown below, along with a table of summary statistics. Use this information to answer the questions that follow.









	Mean	Standard Deviation
Sample Size 10	98.7	4.708
Sample Size 20	100.2	3.198
Sample Size 50	100.4	2.481
Sample Size 100	100.2	1.529
Population	**100**	**15**

a. Describe what is happening to the histograms shown above as the sample sizes increase. (6 points)

they become narrower and more normal

b. The table shows the mean of the means from each sample size simulation, and the standard deviations of the means from 50 samples of each size. Calculate the standard error for a sample size of N=100 and N=50 using the population values shown in the table (the formula is on the back page). State and label both values. How does the simulated standard deviation compare to the value obtained from the simulation? Explain. (10 points)

Calculated values are $N = 50$ 2.12
$N = 100$ 1.5

they are about the same as the simulation and decreasing as sample size increases

8. A 90% confidence interval for a population proportion is determined to be 0.64 to 0.75. If the confidence level is increased to 95%, and everything else remains the same, in what way will the confidence interval change? (6 points)

it will get wider

9. If the sample size increases and everything else remains the same, in what way will the confidence interval change? (6 points)

the confidence interval gets narrower

10. Describe what a sampling frame is. (6 points)

the list of people or objects from which a sample will be selected

11. As the sample size increases, the t-distribution approaches what distribution? (6 points)

the normal distribution

12. If the standard deviation of the lifetime of a vacuum cleaner is estimated to be 250 hours, how large of a sample, at minimum, must be taken to be 96% confident that the margin of error will not exceed 45 hours? (12 points)

131

13. Give an example of a measurement error. Describe a situation in which it might occur and why it poses a problem for statistics. (8 points)

mis-recording or miscalculating a value, not knowing how to use equipment or malfunctioning equipment.

it can bias the data

14. Use the data in the data file for Exam #1 that matches your test. It contains data from a marketing company about the brand they market, and their competitor's brand. Find the proportion of the sample that uses "our brand". Find a 99% confidence interval and interpret the result in context. (15 points)

(45.5%, 61.7%)

We are 99% Confident that the true proportion of purchases of our brand is between 45.5% and 61.7% we can't tell for sure which is more popular

15. Use the data in the data file for Exam #1 that matches your test. It contains data from a sample of men and women matched for similar experience, age, education and other factors.
    a. Is this data paired or independent? (6 points)

Paired

    b. Construct a confidence interval for the difference of means. (12 points)

(211.96, 381.28)

16. A 95% confidence interval is calculated from a sample size of 77, and it is found to be (45.6, 80.2), for the mean speed in miles per hour on a certain road in the US. What is the point estimate at the center of this interval? What is the standard deviation of the sample from which it was drawn? [Hint: use the confidence interval formula at the end of the exam to solve for σ.] (12 points)

mean $\bar{x} = 62.9$

$s = 76.2$ or 77.5 (depending on z or t)

T Z

17. Calculate the probabilities associated with the following z and t values. Round each value to 4 decimal places. (6 points each)

a. $P(z < -0.83)$ 0.2033

b. $P(z \geq 1.72)$ 0.0427

c. $P(t > 1.36, df = 52)$ 0.0898

d. $P(t \leq -1.9 \text{ or } t \geq 1.9, df = 104)$ 0.0602

18. What are the conditions that need to be met to use the proportion confidence interval formula? [Hint: it assumes the normal approximation to the binomial distribution.] (5 points)

$npq \geq 10$ (or $np(1-p) \geq 10$)

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