

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 Pine constraint and interpret the meaning in context. (8 points)

$$26.67$$

if the amount of pine increases, the revenue increases  
 by \$26.67 per unit

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

4. Find a 92% confidence interval for your stratified sample and interpret it in context. (8 points)

$$(30.18, 33.18)$$

We are 92% confident that the true mean  
 of age of students is between 30.18 and 33.18

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.*

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

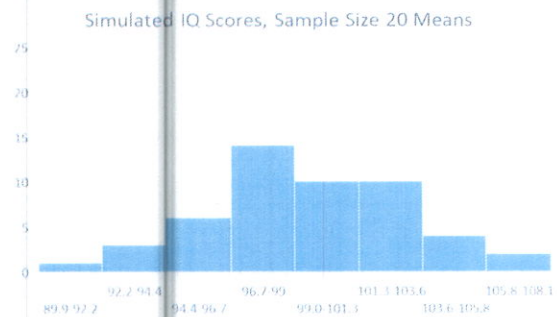
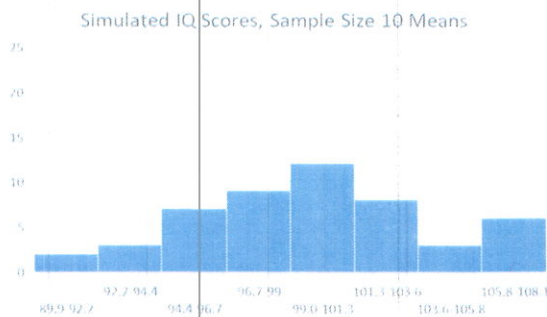
6. Report your 95% confidence interval for the difference of means. Is there a meaningful difference between monthly expenses for the married and unmarried students? Explain. (10 points)

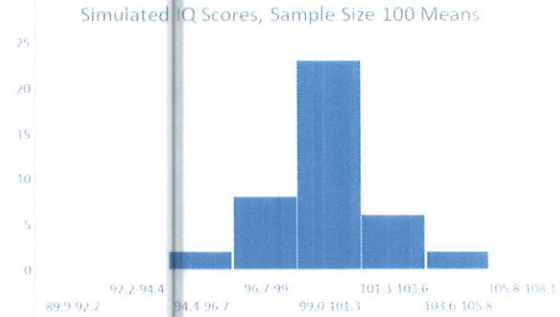
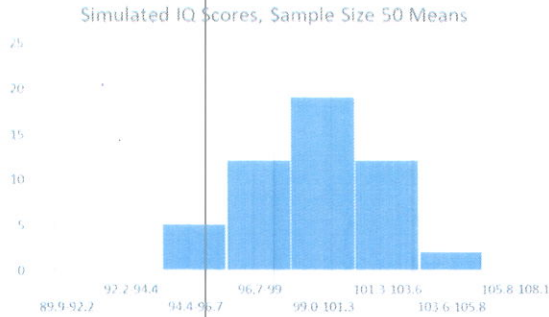
*(333.16, 407.96)  
Yes, there is a difference of expenses (we are 95% certain it is between \$333 and \$408) because 0 is not included in the interval*

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
<b>Population</b>	<b>100</b>	<b>15</b>

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

*they become narrower and more normal (more symmetrical)*

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  $N=10$  and  $N=20$  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*

$N=10$	4.74
$N=20$	3.35

*They are about the same as the simulations and decreases as sample size increases*

8. A 99% confidence interval for a population proportion is determined to be 0.68 to 0.89. If the confidence level is decreased to 95%, and everything else remains the same, in what way will the confidence interval change? (6 points)

*it will get narrower*

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

the interval gets wider

10. Describe how a systematic sample is found. (6 points)

divide population  $N$  by sample size  $n$  to get  $N/n = k$ . round to the nearest whole # if necessary (down). Randomly select first value between 1 and  $k$ , then systematically select every  $k^{\text{th}}$  person after that

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

Normal distribution

12. If the standard deviation of the lifetime of a vacuum cleaner is estimated to be 180 hours, how large of a sample, at minimum, must be taken to be 97% confident that the margin of error will not exceed 54 hours? (12 points)

53

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

not mailing back a survey or not answering a phone call from a surveyor

it makes the sample less representative

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 90% confidence interval and interpret the result in context. (15 points)

(48.4%, 58.8%)

We are 90% confident that the true proportion of purchasers of our brand is between 48.4% and 58.8%. 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 106, and it is found to be (32.6, 70.2), 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  $\sigma$ .] (12 points)

mean  $\bar{x} = 51.4$

$s = 97.6$  or  $98.8$   
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.  $P(z < 0.83)$       0.7967

b.  $P(z \geq -1.72)$       0.9573

c.  $P(t > -1.36, df = 52)$       0.9102

d.  $P(t \leq -1.9 \text{ or } t \geq 1.9, df = 8)$       0.0940

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)

$$npq \geq 10$$

Upload your completed Excel files to the Exam #1 submission box in Blackboard and submit your completed paper exam to your instructor. You may not modify anything once the exam is submitted.