Last name________________________________ First name______________________________

Take Home Exam 5 Math 40 Spring 2019 Due May 21, Tuesday, before the start of your Final Exam

Instructions: Write your final ***answers on the lines provided and*** $\boxed{\textbf{box}}$ ***them***. You may seek help from anywhere/one but must write your own work. Exams failing to show all pertinent work, on these pages, that addresses the level and context of each problem will have their scores severely downgraded. Work on other sheets of paper will not be accepted. Electronics are okay for computing statistic. For hypothesis testing, distribution graphs showing the critical region(s), critical values, test-statistic must be illustrated. Hypothesis test should use CI only if requested.

1. In a study of the relationship between heights and trunk diameters of trees, botany students collected sample data. Listed below are the tree circumferences (in feet).

   1.8 1.9 1.8 2.4 5.1 3.1 5.5 5.1 8.3 13.7 5.3 4.9 3.7 3.8 4.0 3.4 5.2 4.1 3.7 3.9

   Using the circumferences listed above, find the following (a) mean; ______________

   (b) median _________; (c) mode _____________; (d) midrange_________; (e) range ____________;

   (f) standard deviation_____________; (g) variance____________; (i) Q_2 ____________

   (i) Q_1_____________ (j) Q_3________________; (k) P_{10}_________________

   L) List the 5-number summary. __________ __________ ___________ ___________ ____________

   L) Create a box-whisker plot.

2. a) Using the same tree circumferences listed in Problem 1 above, construct a frequency distribution table. Use seven class intervals with 1.0 as the lower limit of the first class and a class width of 2.0.

   b) Create a frequency histogram for the data and an Ogive.

3. State Chebyshev's Theorem for the proportion of a data set lying within K standard deviations of the mean.

   a) What percentage of the population lies within 2 standard deviations of the mean? __________

   b) What percentage of the population lies within 3 standard deviations of the mean? __________

   c) Using the percentages for the boundaries of the data within 2 standard deviations of the mean, compare Chebyshev's Theorem's predictions to the actual data range in problem #1 above.

4. For a men's soccer team, the mean height of men is 69.0 in. and the standard deviation is 2.5 in. Use the range rule of thumb to identify the minimum "usual" height and the maximum "usual" height. In this context, is a height of 72 inches (or 6 ft) unusual? Why or why not?

5. a) In mathematical terms, state the definition of the probability of an event E occurring, where E is a subset of the total sample space S. You can assume E is a simple event

a) ____________________

b) What is the probability that the event E does not occur? Use the complement.

b)____________________

c) What is the probability that the event E occurs or does not occur?

c) ________________

6. Consider the experiment of tossing a fair coin 4 times, and representing each possible outcome as a list of four letters, each an H or a T, depending on whether a 'head' or a 'tail' turns up. One element in the sample space for this experiment is THTT.

a) Calculate n(S), the size of the sample space for this experiment. List the outcomes.

b) What is the probability of landing at least 1 head? __________________________

c) Create a probability distribution table for the random variable of the number of heads for the 4 tossed coins.

d) What is the expected value of the random variable as the number of heads from the toss of the 4 coins? _____________

e) If 10 coins were similarly tossed, what is the probability of at least one head appears? ________________

7. A manufacturing company producing multi-board parallel microprocessors produces defective processors 03.5% of the time due to compatibility issues with multiple circuit boards. A customer purchasing 100 boards will not tolerate more than 2 defective boards. What is the probability that the customer receives at most 3 defective boards in the shipment of 100?

____

8. Specifications for vending machines made by the Newton Machine Company require that they dispense amounts of coffee having a mean of 12 oz.
Listed below are amounts of coffee (in ounces) randomly selected from different machines. Use these sample results to construct a 95% confidence interval for the mean amount of coffee in all dispensed cups. Does this confidence interval suggest that the machines are working properly? Why or why not? Is there anything else about the data suggesting that there is a problem?
11.5 10.8 9.7 13.0 11.5 11.1 13.2 11.1 11.1 12.6 6.8 11.4 9.0 10.6 10.1 10.8
Note: You need to compute the sample mean and standard deviation.

Mean _______

St. dev._______

CI ________________________________

Problem??____

9. A NAPA Auto Parts supplier wants information about how long car owners plan to keep their cars. A simple random sample of 35 car owners results in a mean of 7 years and a standard deviation of 2.75 years, respectively (based on data from a Roper poll). Assume that the sample is drawn from a normally distributed population.
a. Find a 95% confidence interval estimate of the population mean.

____

b. Find a 95% confidence interval estimate of the population standard deviation.

____

c. If several years pass and you want to conduct a new survey to estimate the mean length of time that car owners plan to keep their cars, how many randomly selected car owners must you survey? Assume that you want 99% confidence that the sample mean is within 0.35 year (or 3 months) of the population mean, and also assume that $\sigma = 3.7$ years (based on the latest result).

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10. Each year, billions of dollars are spent at theme parks owned by Disney, Universal Studios, Sea World, Busch Gardens, and others. A survey includes 222 people who took trips that included visits to theme parks, and there were 1111 other respondents who took trips without visits to a theme park (based on data from the Travel Industry Association of America).

a. Find the point estimate of the percentage of people who visit a theme park when they take a trip.

____

b. Find a 95% confidence interval estimate of the percentage of all people who visit a theme park when they take a trip.

____

11. In one of Mendel's famous hybridizations experiments, 8023 offspring peas were obtained and 24.94% of them had green flowers. The others had white flowers. Create a hypothesis test that uses a 0.05 significance level to test the claim that green-flowered peas occur at a rate of 25%.

a) What is the test statistic? ___________

b) What are the critical values? _______

c) What is the P-value? ___________

d) Sketch a curve to illustrate the test.

e) What are your hypotheses? H_0: ____________

H_A: ____________

f) State your conclusion and why!

12. Data Set 13 from your text includes a sample of 27 blue M&Ms with a mean weight of 0.8560 g. Assume that σ is known to be 0.0565 g. Create a hypothesis test that uses a 0.05 significance level to test the claim that the mean weight of all M&Ms is equal to 0.8535 grams as is the claim printed on each bag.

a) What are your hypotheses? H_0:________________

H_A:________________

b) What is the test statistic? __________

c) What are the critical values? _______

d) Sketch a curve to illustrate the test.

e) State your conclusion and why!

13. Use 106 body temperatures with a mean of 98.20^0F and standard deviation of 0.62^0 F to test the claim that the mean body temperature is less than 98.6^0. Test with a significance level of 0.05. Use the traditional method.

a) What are the null and alternative hypotheses? H_0: ____________ H_A: _______________

b) What is the test statistic? __________

c) What are the critical value(s)? _______

d) Sketch a curve to illustrate the test.

e) State your conclusion and why! Does it appear that what you have been led to believe about body temperatures as you have grown up is true?

14. Quarters are currently minted with weights having a mean of 5.670 g and a standard deviation of 0.062 g. New equipment is being tested in an attempt to improve quality by reducing variation. A simple random sample of 24 quarters is obtained from those manufactured with the new equipment, and this sample has a standard deviation of 0.049 g. Use a 0.05 significance level to test the claim that quarters manufactured on the new equipment have a standard deviation less than 0.062 g. Does the new equipment appear to be effective in reducing the variations of weights?

H_0:_____________

H_A:_____________

α=_____________

c.v.=____________

t.s._____________

n=_____________

d.f.____________

Conclusion:

a) Now consider that you change to a α = 0.10 significance level and perform your test using the

new critical value ________

Conclusion:

b) How have you manipulated the results??

c) Now, returning to the original 0.05 level of significance, suppose the sample size was 51 and not 24, with the statistics remaining the same, what does your analysis reveal now?

New c.v._________

New t.s.____________

How have the results changed? What is happening with the interchange of sample size and significance level?

15. A daughter’s height at age 30 and her mother’s height at age 30 are related below.
   a) draw a scatter diagram with the mother’s height on the horizontal axis.
   b) compute the correlation coefficient r
   c) test for correlation using a significance of $\alpha = 0.05$ (draw your diagram and show your numbers)
   d) derive the line of best fit or trend line and write it in slope-intercept form.
   e) What would be the best prediction for the height of a daughter at age 30 whose mother was 66 inches tall at 30 years?

Mother's	63	67	64	60	65	67	59	60
Child	58.6	64.7	65.3	61	65.4	67.4	60.9	63.1

b)____________________

a)

c)_______________________________________

d)__________________________________

16. The IQ scores from Data Set 5 in Appendix B from our Triola text lists full IQ scores for a random sample of subject with low lead levels in their blood and another random sample of subjects with high lead levels in their blood. The statistics are summarized below. Use a 0.05 significance level to test the claim that the mean IQ score of people with low lead levels is higher than the mean IQ score of people with high lead levels. Use the method of testing for two independent means from two populations.

Low Lead Levels: $n = 78$, $\overline{X} = 92.89$, $s = 15.34$

High Lead Levels: $n = 21$, $\overline{X} = 86.9$, $s = 8.99$

H_0:_____________

H_A:_____________

α=_____________

c.v.=____________

t.s._____________

n=_____________

d.f.____________

Conclusion

17. This year, a survey of 500 drivers showed that 28% of the people send text messages while driving. Last year a survey of 800 drivers showed that 22% of those send text messages while driving. At $\alpha = 0.05$, can it be concluded that there has been an increase in the number of drivers who text message while driving? Use the method for testing for two populations.

H_0:_____________

H_A:_____________

α=_____________

c.v.=____________

t.s._____________

n=_____________

d.f.____________

Conclusion:

18. A pair of 4-sided dice are rolled, numbered 1-4 accordingly with the face down number counted and their sum is recorded. a) Create a probability distribution table for the random variable as the sum of the dice. Hint: Create a diagram of the possible outcomes.

X	P(X)

b) What is the mean of the distribution? What is the standard deviation of the distribution? μ= _________ σ = ___________

c) If a game is created where the roller wins double the value of the odd sums and loses the value of the even sums, what is the expected –payoff (value) for the game?

d) If the dice are rolled 720 times, how many times would you expect a sum of 5 to appear? _________

19. A simple random sample of 36 filtered 100-mm cigarettes is obtained yielding a tar content with a standard deviation of 2.5 mg. Use a 0.05 significance level to test the claim that the tar content of filtered 110-mm cigarettes has a standard deviation different from 3.0 mg, which is the standard deviation for unfiltered king-size cigarettes.

H_0:_____________

H_A:_____________

α=_____________

c.v.=____________

t.s._____________

n=_____________

d.f.____________

Conclusion:

20. Live characters at Disney World have height requirements with a minimum of 56 inches and a maximum of 75 inches. Women's heights are normally distributed with a mean of 63.8 inches and a standard deviation of 2.6 inches. What would be the new minimum height requirement if Disney wanted to exclude the shortest 10% of women from being a live character?

21. Below is a random sample of the number of assists and the total number of points for a sample of NHL scoring leaders.

Assists	22	26	31	37	38	42	50
Total pts	48	58	66	79	78	85	90

a) draw a scatter diagram with the assists on the horizontal axis.

b) compute the correlatation coefficient r = _______________

c) Test the correlation using a 5% significance level drawing the appropriate diagram below.

Correlation? _________________

d) derive the line of best fit or trend line and write it in slope-intercept form. ______________________

e) What would be the best prediction for the number of points given 40 assists? ___________________

22. If you want to estimate the proportion of weekend, binge-drinkers at the college with 98% confidence and a margin of error of 2%, how many students would you need in your survey?