STAT 200
OL1/US1 Sections
Final Exam
Summer 2016

The final exam will be posted at 12:01 am on July 8, and it is due at 11:59 pm on July 10, 2016. Eastern Time is our reference time.

This is an open-book exam. You may refer to your text and other course materials as you work on the exam, and you may use a calculator. You must complete the exam individually. Neither collaboration nor consultation with others is allowed. It is a violation of the UMUC Academic Dishonesty and Plagiarism policy to use unauthorized materials or work from others.

Answer all 20 questions. Make sure your answers are as complete as possible. Show all of your supporting work and reasoning. Answers that come straight from calculators, programs or software packages without any explanation will not be accepted. If you need to use technology (for example, Excel, online or hand-held calculators, statistical packages) to aid in your calculation, you must cite the sources and explain how you get the results.

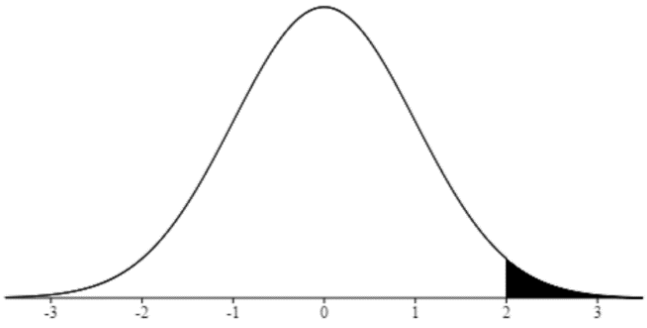
Record your answers and work on the separate answer sheet provided.

This exam has 200 total points; 10 points for each question.

You must include the Honor Pledge on the title page of your submitted final exam. Exams submitted without the Honor Pledge will not be accepted.

1. True or False. *Justify for full credit.*

(a) If P(A) = 0.4, P(B) = 0.5, and A and B are independent, then P(A AND B) = 0.9.
(b) If the variance of a data set is 0, then all the observations in this data set must be zero.
(c) The mean is always equal to the median for a normal distribution.
(d) A 95% confidence interval is wider than a 90% confidence interval of the same parameter.
(e) In a two-tailed test, the value of the test statistic is 2. The test statistic follows a distribution with the distribution curve shown below. If we know the shaded area is 0.03, then we have sufficient evidence to reject the null hypothesis at 0.05 level of significance.



2. Choose the best answer. *Justify for full credit.*

(a) Among the Senators in the current Congress, 54% are Republicans. The value 54% is a
(i) statistic
(ii) parameter
(iii) cannot be determined

(b) The hotel ratings are usually on a scale from 0 star to 5 stars. The level of this measurement is
(i) interval
(ii) nominal
(iii) ordinal
(iv) ratio

(c) In a career readiness research, 100 students were randomly selected from the psychology program, 150 students were randomly selected from the communications program, and 120 students were randomly selected from cyber security program. This type of sampling is called:

(i) cluster
(ii) convenience
(iii) systematic
(iv) stratified

3. Choose the best answer. *Justify for full credit.*

(a) A study of 10 different weight loss programs involved 500 subjects. Each of the 10 programs had 50 subjects in it. The subjects were followed for 12 months. Weight change for each subject was recorded. You want to test the claim that the mean weight loss is the same for the 10 programs. What statistical approach should be used?

(i) t-test
(ii) linear regression
(iii) ANOVA
(iv) confidence interval

(b) A STAT 200 instructor teaches two classes. She wants to test if the variances of the score distribution for the two classes are different. What type of hypothesis test should she use?

(i) t-test for two independent samples
(ii) t-test for matched samples
(iii) z-test for two samples
(iv) F- test

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4. The frequency distribution below shows the distribution for IQ scores for a random sample of 1000 adults. (*Show all work. Just the answer, without supporting work, will receive no credit.)*

IQ Scores	Frequency	Relative Frequency
50 - 69	24	
70 - 89	228	
90 -109	493	
110 - 129		0.23
130 - 149	25	
Total	1000	

(a) Complete the frequency table with frequency and relative frequency. Express the relative frequency to three decimal places.
(b) What percentage of the adults in this sample has an IQ score of at least 110?
(c) Does this distribution have positive skew or negative skew? Why or why not?

5. The five-number summary below shows the grade distribution of two STAT 200 quizzes for a sample of 500 students.

	Minimum	Q1	Median	Q3	Maximum
Quiz 1	15	35	55	85	100
Quiz 2	20	35	50	90	100

For each question, give your answer as one of the following: (i) Quiz 1; (ii) Quiz 2; (iii) Both quizzes have the same value requested; (iv) It is impossible to tell using only the given information. Then *explain* your answer in *each* case.

(a) Which quiz has less range in grade distribution?
(b) Which quiz has the greater percentage of students with grades 85 and over?
(c) Which quiz has a greater percentage of students with grades less than 60?

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6. A sample of 10 LED light bulbs consists of 1 defective and 9 good light bulbs. A quality control technician wants to randomly select two of the light bulbs for inspection. Find the probability that the first selected light bulb is good and the second light bulb is also good. **(***Show all work. Just the answer, without supporting work, will receive no credit.)*

(a) Assuming the two random selections are made with replacement.
(b) Assuming the two random selections are made without replacement.

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7. There are 1000 students in a high school. Among the 1000 students, 250 students take AP Statistics, and 300 students take AP French. 100 students take both AP courses. Let S be the event that a randomly selected student takes AP Statistics, and F be the event that a randomly selected student takes AP French. *Show all work. Just the answer, without supporting work, will receive no credit.*

(a) Provide a written description of the complement event of (S OR F).
(b) What is the probability of complement event of (S OR F)?

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8. Consider rolling two fair dice. Let A be the event that the sum of the two dice is 8, and B be the event that the first one is a multiple of 3.

(a) What is the probability that the sum of the two dice is 8 given that the first one is a multiple of 3? *Show all work. Just the answer, without supporting work, will receive no credit.*
(b) Are event A and event B independent? Explain.

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9. Answer the following two questions. (*Show all work. Just the answer, without supporting work, will receive no credit).*

(a) UMUC Stat Club is sending a delegate of 2 members to attend the 2016 Joint Statistical Meeting in Chicago. There are 10 qualified candidates. How many different ways can the delegate be selected?

(b) A bike courier needs to make deliveries at 6 different locations. How many different routes can he take?

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10. Assume random variable *x* follows a probability distribution shown in the table below. Determine the mean and standard deviation of *x*. *Show all work. Just the answer, without supporting work, will receive no credit.*

x	-2	0	1	2	3
P(*x*)	0.1	0.1	0.3	0.2	0.3

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11. Rabbits like to eat the cucumbers in Mimi's garden. There are 10 cucumbers in her garden which will be ready to harvest in about 10 days. Based on her experience, the probability of a cucumber being eaten by the rabbits before harvest is 0.30.

(a) Let X be the number of cucumbers that Mimi harvests (that is, the number of cucumbers not eaten by rabbits). As we know, the distribution of X is a binomial probability distribution. What is the number of trials (n), probability of successes (p) and probability of failures (q), respectively?

(b) Find the probability that Mimi harvests at least 8 of the 10 cucumbers. (round the answer to 3 decimal places) *Show all work. Just the answer, without supporting work, will receive no credit.*

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12. Assume the weights of men are normally distributed with a mean of 170 lbs and a standard deviation of 30 lbs. *Show all work. Just the answer, without supporting work, will receive no credit.*

(a) Find the 75^{th} percentile for the distribution of men's weights.

(b) What is the probability that a randomly selected man weighs more than 200 lbs?

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13. Assume the SAT Mathematics Level 2 test scores are normally distributed with a mean of 500 and a standard deviation of 100. *Show all work. Just the answer, without supporting work, will receive no credit.*

(a) If a random sample of 64 test scores is selected, what is the standard deviation of the sample mean?

(b) What is the probability that 64 randomly selected test scores will have a mean test score that is between 475 and 525?

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14. A survey showed that 80% of the 1600 adult respondents believe in global warming. Construct a 90% confidence interval estimate of the proportion of adults believing in global warming. *Show all work. Just the answer, without supporting work, will receive no credit.*

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15. In a study designed to test the effectiveness of garlic for lowering cholesterol, 49 adults were treated with garlic tablets. Cholesterol levels were measured before and after the treatment. The changes in their LDL cholesterol (in mg/dL) have a mean of 3 and standard deviation of 14. Construct a 95% confidence interval estimate of the mean change in LDL cholesterol after the garlic tablet treatment. *Show all work. Just the answer, without supporting work, will receive no credit.*

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16. Mimi is interested in testing the claim that banana is the favorite fruit for more than 80% of the adults. She conducted a survey on a random sample of 100 adults. 85 adults in the sample chose banana as his / her favorite fruit.

Assume Mimi wants to use a 0.05 significance level to test the claim.

(a) Identify the null hypothesis and the alternative hypothesis.

(b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*

(c) Determine the *P*-value for this test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*

(d) Is there sufficient evidence to support the claim that banana is the favorite fruit for more than 80% of the adults? Explain.

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17. In a study of freshman weight gain, the measured weights of 5 randomly selected college students in September and April of their freshman year are shown in the following table.

	Weight (kg)	
Student	September	April
1	67	66
2	53	52
3	64	68
4	71	69
5	70	71

Is there evidence to suggest that the mean weight of the freshmen in April is greater than the mean weight in September?

Assume we want to use a 0.10 significance level to test the claim.

(a) Identify the null hypothesis and the alternative hypothesis.

(b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*

(c) Determine the P-value for this test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*

(d) Is there sufficient evidence to support the claim that the mean weight of the freshmen in April is greater than the mean weight in September? Justify your conclusion.

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18. In a pulse rate research, a simple random sample of 40 men results in a mean of 80 beats per minute, and a standard deviation of 11.3 beats per minute. Based on the sample results, the researcher concludes that the pulse rates of men have a standard deviation greater than 10 beats per minutes. Use a 0.05 significance level to test the researcher's claim.

(a) Identify the null hypothesis and alternative hypothesis.

(b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*

(c) Determine the *P*-value for this test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*

(d) Is there sufficient evidence to support the researcher's claim? Explain.

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19. The UMUC Daily News reported that the color distribution for plain M&M's was: 40% brown, 20% yellow, 20% orange, 10% green, and 10% tan**.** Each piece of candy in a random sample of 100 plain M&M's was classified according to color**,** and the results are listed below. Use a 0.05 significance level to test the claim that the published color distribution is correct. *Show all work and justify your answer.*

Color	Brown	Yellow	Orange	Green	Tan
Number	42	21	12	7	18

(a) Identify the null hypothesis and the alternative hypothesis.

(b) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*

(c) Determine the P-value. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*

(d) Is there sufficient evidence to support the claim that the published color distribution is correct? Justify your answer.

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20. A STAT 200 instructor believes that the average quiz score is a good predictor of final exam score. A random sample of 5 students produced the following data where x is the average quiz score and y is the final exam score.

x	80	50	60	100	70
y	145	150	130	180	120

(a) Find an equation of the least squares regression line. *Show all work; writing the correct equation, without supporting work, will receive no credit.*

(b) Based on the equation from part (a), what is the predicted final exam score if the average quiz score is 90? *Show all work and justify your answer.*