STAT 200
OL2 Sections
Final Exam
Fall 2016

The final exam will be posted at 12:01 am on November 4, and it is due at 11:59 pm on November 6, 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 100 total points; 5 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) A is an event, and A^c is the complement of A, then $P(A \text{ AND } A^c) = 0$.
   (b) If the variance of a data set is 0, then all the observations in this data set must be zero.
   (c)   If a 95% confidence interval for a population mean contains 1, then the 99% confidence
        interval for the same parameter must contain 1
   (d) When plotted on the same graph, a distribution with a mean of 60 and a standard deviation
        of 5 will look more spread out than a distribution with a mean of 40 and standard deviation
        of 8.
   (e) In a two-tailed test, the value of a 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.
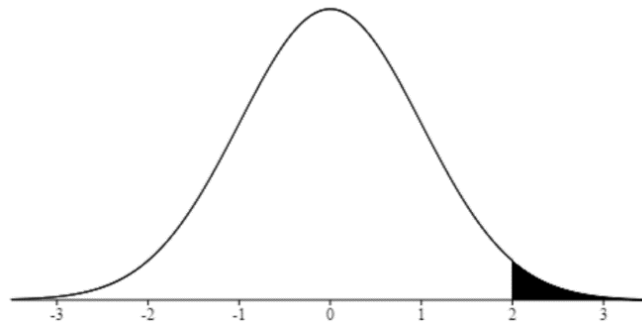
2.   Choose the best answer. *Justify for full credit.*

(a)   A study was conducted at a local college to analyze the average GPA of students graduated
        from UMUC in 2015. 100 students graduated from UMUC in 2015 were randomly selected,
        and the average GPA for the group is 3.5. The value 3.5 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)   A STAT 200 student is interested in the number of credit cards owned by college students. She
        surveyed all of her classmates to collect sample data. This type of sampling is called:

        (i)   simple random
        (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	23	
70 - 89		0.250
90 -109	448	
110 - 129		
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 90?

(c)   Does this distribution have positive skew or negative skew? Why or why not?

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5.   The five-number summary below shows the grade distribution of a STAT 200 quiz for a sample of 800 students.
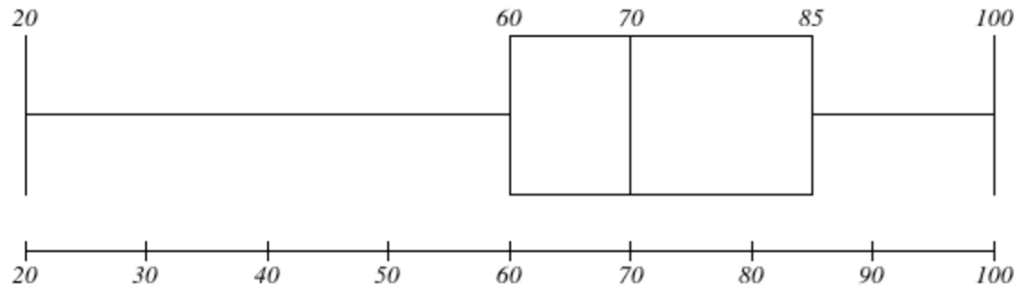
Answer each question based on the given information, and *explain* your answer in *each* case.

(a)   What is the range in the grade distribution?
(b)   Which score band has the fewest students?
        (i) 30 - 60
        (ii) 60 - 85
        (iii) 80 - 100
        (Iv) Cannot be determined
(c)   How many students are in the score band between 70 and 85?

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6.   Consider selecting one card at a time from a 52-card deck. What is the probability that the first card is from the suit of hearts and the second card is also from the suit of hearts? (Note: There are 13 cards from the suit of hearts in a deck of cards) (*Show all work. Just the answer, without supporting work, will receive no credit.*)

(a)   Assuming the card selection is without replacement.
(b)   Assuming the card selection is with replacement.

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7.   There are 1000 students in a high school. Among the 1000 students, 250 students take AP Statistics, and 100 students take AP French. 80 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)?

8.   Consider rolling a fair 6-faced die twice. Let A be the event that the sum of the two rolls is at least 10, 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 rolls is at least 10 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.

9.   There are 5 books in the "Statistics is Fun" series. (*Show all work. Just the answer, without supporting work, will receive no credit).*

(a)   How many different ways can Mimi arrange the 5 books in her book shelf?

(b)   Mimi plans on bringing two of the five books with her in a road trip. How many different ways can the two books be selected?

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

11.   Mimi joined UMUC basketball team since summer 2016. On average, she is able to score 30% of the field goals. Assume she tries 15 field goals in a game.

(a)   Let X be the number of field goals that Mimi scores in the game. 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 scores at least 2 of the 15 field goals. (round the answer to 3 decimal places) *Show all work. Just the answer, without supporting work, will receive no credit.*

12.   A research concludes that the number of hours of exercise per week for adults is normally distributed with a mean of 3.5 hours and a standard deviation of 3 hours. *Show all work. Just the answer, without supporting work, will receive no credit.*

(a)   Find the 80th percentile for the distribution of exercise time per week. (round the answer to 2 decimal places)

(b)   What is the probability that a randomly selected adult has more than 7 hours of exercise per week? (round the answer to 4 decimal places)

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)   Consider all random samples of 64 test scores. What is the standard deviation of the sample means?

(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.   An insurance company checks police records on 1200 randomly selected auto accidents and notes that teenagers were at the wheel in 180 of them. Construct a 90% confidence interval estimate of the proportion of auto accidents that involve teenage drivers. *Show all work. Just the answer, without supporting work, will receive no credit.*

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15.   A city built a new parking garage in a business district. For a random sample of 64 days, daily fees collected averaged $2,000, with a standard deviation of $400. Construct a 95% confidence interval estimate of the mean daily income this parking garage generates. *Show all work. Just the answer, without supporting work, will receive no credit.*

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16.   ABC Company claims that the proportion of its employees investing in individual investment accounts is higher than national proportion of 45%. A survey of 100 employees in ABC Company indicated that 50 of them have invested in an individual investment account.

        Assume Mimi wants 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 ABC Company's claim that the proportion of its employees investing in individual investment accounts is higher than 45%? Explain.

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17.   Mimi was curious if regular excise really helps weight loss, hence she decided to perform a hypothesis test. A random sample of 5 UMUC students was chosen. The students took a 30-minute exercise every day for 6 months. The weight was recorded for each individual before and after the exercise regimen. Does the data below suggest that regular exercise helps weight loss?

Subject	Weight (pounds)	
	Before	After
1	160	130
2	170	160
3	185	175
4	165	165
5	200	190

        Assume we want 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. *Show all work; writing the correct critical value, without supporting work, will receive no credit.*

(d) Is there sufficient evident to support the claim that regular exercise helps weight loss? Justify your conclusion.

18. In a pulse rate research, a simple random sample of 50 men results in a mean of 80 beats per minute, and a standard deviation of 11.5 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 0.10 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.

19.   The UMUC MiniMart sells five different types of Halloween candy bags. The manager reports that the five types are equally popular. Suppose that a sample of 500 purchases yields observed counts 120, 85, 110, 90, and 95 for types 1, 2, 3, 4, and 5, respectively. Use a 0.05 significance level to test the claim that the five types are equally popular. *Show all work and justify your answer.*

Type	1	2	3	4	5
Number of Bags	120	85	110	90	95

(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 manager's claim that the five types of candy bags are equally popular? Justify your answer.

20.   A STAT 200 instructor believes that the average quiz score is a good predictor of final exam score. A random sample of 10 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	85	40	65	75	90
y	72	75	65	90	60	85	50	60	75	95

(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 82? *Show all work and justify your answer.*