

***STAT 200  
US2/OL3 Sections  
Final Exam  
Summer 2017***

**This is an open-book exam. You may refer to your text and other course materials for the current course 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.**

**Submit your answers and work on the separate answer sheet provided.**

***Include the Honor Pledge on the title page of your submitted final exam.  
Exams submitted without the Honor Pledge will not be accepted.***

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

- (a) If A and B are independent,  $P(A) = 0.4$  and  $P(B) = 0.5$ , then  $P(A \text{ AND } B) = 0.2$ .
  - (b) If all the observations in a data set are identical, then the variance for this data set is zero.
  - (c) There may be more than one mode in a data set.
  - (d) A 95% confidence interval is wider than a 98% confidence interval of the same parameter.
  - (e) It's easier to reject the null hypothesis in a hypothesis test at 0.05 significance level than at 0.01 significance level.
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2. Choose the best answer. *Justify for full credit.*

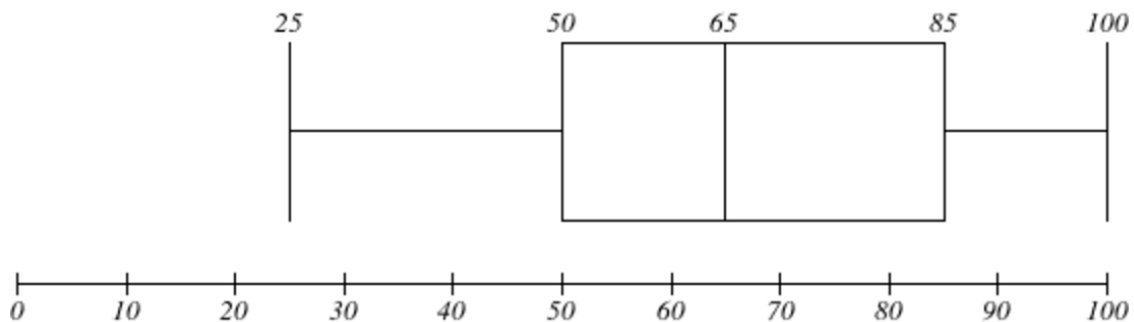
- (a) The quality control department of a semiconductor manufacturing company tests every 100th product from the assembly line. This type of sampling is called:
  - (i) cluster
  - (ii) convenience
  - (iii) systematic
  - (iv) stratified
  
- (b) A study was conducted at a local college to analyze the trend of average GPA of students graduated from the college. According to the Registrar, the average GPA for all students graduated from the college in 2016 is 3.5. The value 3.5 is a
  - (i) statistic
  - (ii) parameter
  - (iii) cannot be determined
  
- (c) 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

3. A random sample of 200 students was chosen from UMUC STAT 200 classes. The frequency distribution below shows the distribution for study time each week (in hours). (*Show all work. Just the answer, without supporting work, will receive no credit.*)

Study Time (in hours)	Frequency	Relative Frequency
0.0 – 4.9	6	
5.0 - 9.9	24	
10.0 - 14.9	50	
15.0 -19.9		0.35
20.0 – 24.9		
Total	200	

- (a) Complete the frequency table with frequency and relative frequency. Express the relative frequency to two decimal places.
- (b) What percentage of the study times was at least 15 hours?
- (c) In what class interval must the median lie? 5.0 – 9.9, 10.0 -14.9, 15.0 – 19.9, or 20.0 – 24.9? Why?
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4. The five-number summary below shows the grade distribution of a STAT 200 quiz for a sample of 150 students.



Answer each question based on the given information, and *explain* your answer in *each* case.

- (a) What is the interquartile range in the grade distribution?
- (b) Which of the following score bands has the most students?
- 30 - 50
  - 50 - 70
  - 65 - 85
  - Cannot be determined
- (c) How many students in the sample are in the score band between 65 and 100?
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5. A basket contains 3 white balls, 3 yellow balls, and 4 red balls. Consider selecting one ball at a time from the basket. (*Show all work. Just the answer, without supporting work, will receive no credit.*)
- (a) Assuming the ball selection is with replacement. What is the probability that the first ball is red and the second ball is also red?
- (b) Assuming the ball selection is without replacement. What is the probability that the first ball is red and the second ball is also red?
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6. There are 1000 juniors in a college. Among the 1000 juniors, 300 students are taking STAT200, and 200 students are taking PSYC300. There are 100 students taking both courses. Let  $S$  be the event that a randomly selected student takes STAT200, and  $P$  be the event that a randomly selected student takes PSYC300. (*Show all work. Just the answer, without supporting work, will receive no credit.*)
- (a) Provide a written description of the complement event of  $(S \text{ OR } P)$ .
- (b) What is the probability of complement event of  $(S \text{ OR } P)$ ?
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7. Consider rolling a fair 6-faced die twice. Let  $A$  be the event that the product of the two rolls is at most 5, and  $B$  be the event that the first one is an even number.
- (a) What is the probability that the product of the two rolls is at most 5 given that the first one is an even number? *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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8. Answer the following two questions. (*Show all work. Just the answer, without supporting work, will receive no credit.*)
- (a) Mimi has seven books from the Statistics is Fun series. She plans on bringing three of the seven books with her in a road trip. How many different ways can the three books be selected?
- (b) UMUC Stat Club must appoint a president, a vice president, and a treasurer. There are 12 qualified candidates. How many different ways can the officers be appointed?
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9. Assume random variable  $x$  follows a probability distribution shown in the table below. Determine the mean and standard deviation of  $x$ . (Round the answer to two decimal places) *Show all work. Just the answer, without supporting work, will receive no credit.*

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

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- 10.** Rabbits like to eat the cucumbers in Mimi's garden. There are 12 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 12 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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- 11.** The heights of pecan trees are normally distributed with a mean of 10 feet and a standard deviation of 2 feet. *Show all work. Just the answer, without supporting work, will receive no credit.*
- (a) What is the probability that a randomly selected pecan tree is between 7 and 12 feet tall? (round the answer to 4 decimal places)
  - (b) Find the 60th percentile of the pecan tree height distribution. (round the answer to 2 decimal places)
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- 12.** Based on the performance of all individuals who tested between July 1, 2013 and June 30, 2016, the GRE Quantitative Reasoning scores are normally distributed with a mean of 152.57 and a standard deviation of 9.02. ([https://www.ets.org/s/gre/pdf/gre\\_guide\\_table1a.pdf](https://www.ets.org/s/gre/pdf/gre_guide_table1a.pdf)). *Show all work. Just the answer, without supporting work, will receive no credit.*
- (a) Consider all random samples of 49 test scores. What is the standard deviation of the sample means? (Round your answer to three decimal places)
  - (b) What is the probability that 49 randomly selected test scores will have a mean test score that is greater than 153? (Round your answer to four decimal places)
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- 13.** In a study designed to test the effectiveness of acupuncture for treating migraine, 225 patients were randomly selected and treated with acupuncture. After one-month treatment, the number of migraine attacks for the group had a mean of 2 and standard deviation of 1.5. Construct a 95% confidence interval estimate of the mean number of migraine attacks for people treated with acupuncture. *Show all work. Just the answer, without supporting work, will receive no credit.*
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- 14.** Mimi conducted a survey on a random sample of 100 adults. 60 adults in the sample chose banana as his / her favorite fruit. Construct a 90% confidence interval estimate of the proportion of adults whose favorite fruit is banana. *Show all work. Just the answer, without supporting work, will receive no credit.*
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- 15.** A researcher claims the proportion of auto accidents that involve teenage drivers is less than 20%. ABC Insurance Company checks police records on 300 randomly selected auto accidents and notes that teenagers were at the wheel in 50 of them. Assume the company wants to use a 0.05 significance level to test the researcher's 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 proportion of auto accidents that involve teenage drivers is less than 20%? Explain.
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- 16.** In a study of memory recall, 5 people were given 10 minutes to memorize a list of 20 words. Each was asked to list as many of the words as he or she could remember both 1 hour and 24 hours later. The result is shown in the following table.

	Number of Words Recalled	
Subject	1 hour later	24 hours later
1	14	12
2	18	17
3	11	9
4	15	13
5	12	12

Is there evidence to suggest that the mean number of words recalled after 1 hour exceeds the mean recall after 24 hours? 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  $P$ -value, without supporting work, will receive no credit.*
  - (d) Is there sufficient evidence to support the claim that the mean number of words recalled after 1 hour exceeds the mean recall after 24 hours? Justify your conclusion.
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- 17.** In a pulse rate research, a simple random sample of 500 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 less than 12 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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18. The UMUC MiniMart sells five different types of teddy bears. The manager reports that the five types are equally popular. Suppose that a sample of 500 purchases yields observed counts for types 1, 2, 3, 4, and 5 shown as the table below.

Type	1	2	3	4	5
Number	120	95	90	95	100

Assume we want to use a 0.05 significance level to test the claim that the four types are equally popular.

- Identify the null hypothesis and the alternative hypothesis.
  - Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
  - Determine the P-value. *Show all work; writing the correct P- value, without supporting work, will receive no credit.*
  - Is there sufficient evidence to support the manager's claim that the five types are equally popular? Justify your answer.
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19. 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.

$x$	72	93	55	65	100	40	85	70	75	85
$y$	70	96	50	70	94	50	83	65	77	87

- Find an equation of the least squares regression line. *Show all work; writing the correct equation, without supporting work, will receive no credit.*
  - 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.*
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- 20.** A study of 8 different weight loss programs involved 240 subjects. Each of the 8 programs had 30 subjects in it. The subjects were followed for 12 months. Weight change for each subject was recorded. We want to test the claim that the mean weight loss is the same for the 8 programs.

- (a) Complete the following ANOVA table with sum of squares, degrees of freedom, and mean square (*Show all work*):

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)
Factor (Between)	42.5		
Error (Within)			
Total	553.05	239	N/A

- (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 mean weight loss is the same for the 8 programs at the significance level of 0.05? Explain.