

STAT 200 OL4 / US2 Sections Final Exam Spring 2015

The final exam will be posted at 12:01 am on May 8, and it is due at 11:59 pm on May 10, 2015. 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.

Answer all 25 questions. Make sure your answers are as complete as possible. Show all of your work and reasoning. In particular, when there are calculations involved, you must show how you come up with your answers with critical work and/or necessary tables. Answers that come straight from programs or software packages will not be accepted. If you need to use software (for example, Excel) and /or online or hand-held calculators to aid in your calculation, please cite the sources and explain how you get the results.

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

This exam has 250 total points.

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.* (25 pts)

- (a) If the variance from a data set is zero, then all the observations in this data set must be identical.
- (b) $P(A \text{ AND } A^c) = 1$, where A^c is the complement of A .
- (c) The mean is always equal to the median for a normal distribution.
- (d) A 99% confidence interval is wider than a 95% confidence interval of the same parameter.
- (e) It is easier to reject the null hypothesis if we use a smaller significance level α .

Refer to the following frequency distribution for Questions 2, 3, 4, and 5. *Show all work. Just the answer, without supporting work, will receive no credit.*

A random sample of 25 customers was chosen in UMUC MiniMart between 3:00 and 4:00 PM on a Friday afternoon. The frequency distribution below shows the distribution for checkout time (in minutes).

Checkout Time (in minutes)	Frequency	Relative Frequency
1.0 - 1.9	4	
2.0 - 2.9		0.4
3.0 - 3.9		
4.0 - 4.9	5	
Total	25	

- 2. Complete the frequency table with frequency and relative frequency. (5 pts)
- 3. What percentage of the checkout times was at least 3 minutes? (5 pts)
- 4. In what class interval must the median lie? Explain your answer. (5 pts)
- 5. Assume that the largest observation in this dataset is 4.8. Suppose this observation were incorrectly recorded as 8.4 instead of 4.8. Will the mean increase, decrease, or remain the same? Will the median increase, decrease or remain the same? Why? (5 pts)

Refer to the following information for Questions 6, 7, and 8. *Show all work. Just the answer, without supporting work, will receive no credit.*

A 6-faced die is rolled two times. Let A be the event that the outcome of the first roll is an even number, and B be the event that the outcome of second roll is greater than 4.

- 6. How many outcomes are there in the sample space? (5 pts)
- 7. What is the probability that the outcome of the second roll is greater than 4, given that the first roll is an even number? (10 pts)

8. Are A and B independent? Why or why not? (5 pts)
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Refer to the following situation for Questions 9, 10, and 11.

The five-number summary below shows the grade distribution of two STAT 200 quizzes.

	Minimum	Q1	Median	Q3	Maximum
Quiz 1	12	40	60	95	100
Quiz 2	20	35	50	90	100

For each question, give your answer as one of the following: (a) Quiz 1; (b) Quiz 2; (c) Both quizzes have the same value requested; (d) It is impossible to tell using only the given information. Then explain your answer in each case. (5 pts each)

9. Which quiz has less interquartile range in grade distribution?
10. Which quiz has the greater percentage of students with grades 90 and over?
11. Which quiz has a greater percentage of students with grades less than 60?
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Refer to the following information for Questions 12 and 13. Show all work. Just the answer, without supporting work, will receive no credit.

There are 1000 juniors in a college. Among the 1000 juniors, 200 students are in the STAT200 roster, and 100 students are in the PSYC300 roster. There are 80 students taking both courses.

12. What is the probability that a randomly selected junior is taking at least one of these two courses? (10 pts)
13. What is the probability that a randomly selected junior is taking PSYC300, given that he/she is taking STAT200? (10 pts)
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14. UMUC Stat Club is selecting three officers for the school year - a president, a vice president and a treasurer. There are 10 qualified candidates. How many different ways can the officers be selected? Show all work. Just the answer, without supporting work, will receive no credit. (5 pts)
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15. Imagine you are in a game show. There are 6 prizes hidden on a game board with 10 spaces. One prize is worth \$100, another is worth \$20, and four are worth \$5. You have to pay \$20 to the host if your choice is not correct. Let the random variable x be the winning. Show all work. Just the answer, without supporting work, will receive no credit.

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- (a) What is your expected winning in this game? (5 pts)
(b) Determine the standard deviation of x . (Round the answer to two decimal places) (10 pts)
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16. Mimi just started her tennis class three weeks ago. On average, she is able to return 30% of her opponent's serves. Assume her opponent serves 10 times. *Show all work. Just the answer, without supporting work, will receive no credit.*

- (a) Let X be the number of returns that Mimi gets. 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? (5 pts)
(b) Find the probability that that she returns at least 1 of the 10 serves from her opponent. (10 pts)
(c) How many serves can she expect to return? (5 pts)
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Refer to the following information for Questions 17, 18, and 19. *Show all work. Just the answer, without supporting work, will receive no credit.*

The heights of pecan trees are normally distributed with a mean of 10 feet and a standard deviation of 2 feet.

- 17.** What is the probability that a randomly selected pecan tree is between 10 and 12 feet tall? (10 pts)
18. Find the 3rd quartile of the pecan tree height distribution. (5 pts)
19. If a random sample of 100 pecan trees is selected, what is the standard deviation of the sample mean? (5 pts)
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20. A random sample of 225 SAT scores has a sample mean of 1500. Assume that SAT scores have a population standard deviation of 300. Construct a 95% confidence interval estimate of the mean SAT scores. *Show all work. Just the answer, without supporting work, will receive no credit.* (10 pts)

- 21.** Consider the hypothesis test given by

$$H_0 : p = 0.5$$

$$H_1 : p > 0.5$$

In a random sample of 225 subjects, the sample proportion is found to be $\hat{p} = 0.53$.

- (a) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
(b) Determine the p -value for this test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*
(c) Is there sufficient evidence to justify the rejection of H_0 at the $\alpha=0.01$ level?
Explain. (15 pts)

- 22.** Consumption of a large amount of alcohol is known to increase reaction time. To investigate the effects of small amounts of alcohol, reaction time was recorded for five individuals before and after 2 ounces of alcohol was consumed by each. Does the data below suggest that the consumption of 2 ounces of alcohol increases mean reaction time?

Subject	Reaction Time (seconds)	
	Before	After
1	6	7
2	8	8
3	4	6
4	7	10
5	9	10

Assume we want to use a 0.1 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 evidence to support the claim that the consumption of 2 ounces of alcohol increases mean reaction time? Justify your conclusion.

(20 pts)

- 23.** A STAT 200 instructor is interested in whether there is any variation in the final exam grades between her two classes. Data collected from the two classes are as follows:

$$\begin{aligned} \text{Section 1: } n_1 &= 31, & x_1 &= 75, & s_1 &= 12 \\ \text{Section 2: } n_2 &= 30, & x_2 &= 72, & s_2 &= 14 \end{aligned}$$

Her null hypothesis and alternative hypothesis are:

$$H_0: \sigma_1^2 = \sigma_2^2, \quad \text{and} \quad H_a: \sigma_1^2 < \sigma_2^2$$

- (a) Determine the test statistic. *Show all work; writing the correct test statistic, without supporting work, will receive no credit.*
- (b) Determine the p-value for this test. *Show all work; writing the correct P-value, without supporting work, will receive no credit.*
- (c) Is there sufficient evidence to justify the rejection of H_0 at the $\alpha=0.01$ level?

Explain. (10 pts)

- 24.** A random sample of 4 professional athletes produced the following data where x is the number of endorsements the player has and y is the amount of money made (in millions of dollars).

x	0	1	3	5
y	1	2	3	8

- (a) Find an equation of the least squares regression line. *Show all work; writing the correct equation, without supporting work, will receive no credit.* (15 pts)
- (b) Based on the equation from part (a), what is the predicted value of y if $x = 4$? *Show all work and justify your answer.* (5 pts)
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- 25.** 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 critical 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.
- (15 pts)