# *STAT 200*
# *OL4 / US2 Sections*
# *Final Exam*
# *Spring 2017*

**The final exam will be posted at 12:01 am on May 5, and it is due at 11:59 pm on May 7, 2017. 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.**

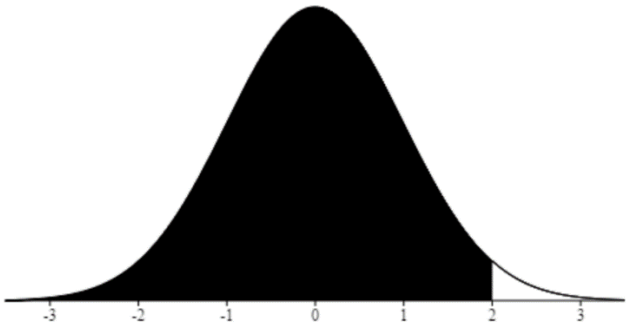
**Record your answers and work on the separate answer sheet provided.**

**This exam has 20 questions; 5% 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 A and B are any two events, then P(A AND B) ≤ P(A OR B).
(b) If the variance of a data set is 0, then all the observations in this data set must be zero.
(c) The volume of milk in a jug of milk is 128 oz. The value 128 is from a discrete data set.
(d) When plotted on the same graph, a distribution with a mean of 60 and a standard deviation of 5 will look less spread out than a distribution with a mean of 40 and standard deviation of 8.
(e) In a left-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 0.97, then we do not 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 2016. 100 students graduated from UMUC in 2016 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) 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

---

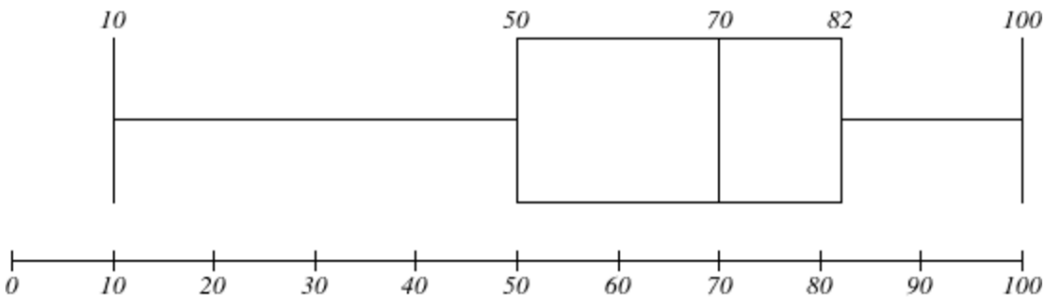
**3.** The frequency distribution below shows the distribution for IQ scores for a random sample of 1000 adults. (*Show all work. Just the answer, without supporting work, will receive no credit.)*

| IQ Scores | Frequency | Cumulative Relative Frequency |
|---|---|---|
| 50 - 69 | 23 | |
| 70 - 89 | 249 | |
| 90 -109 | | 0.743 |
| 110 - 129 | | |
| 130 - 149 | 25 | |
| Total | 1000 | |

(a) Complete the frequency table with frequency and cumulative relative frequency. Express the cumulative relative frequency to three decimal places.
(b) What percentage of the adults in this sample has an IQ score between 90 and 129, inclusive?
(c) Which of the following IQ score groups does the median of this distribution belong to? 70 – 89, 90 – 109, or 110 – 129? Why?

---

**4.** The five-number summary below shows the grade distribution of a STAT 200 quiz for a sample of 160 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 fewest students?
(i) 30 - 50
(ii) 50 - 70
(iii) 70 - 90
(Iv) Cannot be determined
(c) How many students in the sample are in the score band between 50 and 70?

---

**5.** Consider selecting one card at a time from a 52-card deck. What is the probability that the first card is an ace and the second card is also an ace? (Note: There are 4 aces in a deck of cards) (*Show all work. Just the answer, without supporting work, will receive no credit.)*

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

---

**6.** There are 1000 juniors in a college. Among the 1000 juniors, 300 students are taking STAT200, and 150 students are taking PSYC300. There are 50 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 OR P).
(b) What is the probability of complement event of (S OR P)?

---

**7.** Consider rolling a fair 6-faced die twice. Let A be the event that the sum of the two rolls is at most 6, 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 most 6 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.

---

**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 8 qualified candidates. How many different ways can the officers be appointed?

**9**. Let random variable *x* represent the number of heads when a fair coin is tossed two times.

(a) Construct a table describing the probability distribution.
(b) Determine the mean and standard deviation of *x*. (Round the answer to two decimal places)

**10.** Mimi plans on growing tomatoes in her garden. She has 20 cherry tomato seeds. Based on her experience, the probability of a seed turning into a seedling is 0.60.

(a) Let X be the number of seedlings 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?
(b) Find the probability that she gets at least 15 cherry tomato seedlings. (round the answer to 3 decimal places) *Show all work. Just the answer, without supporting work, will receive no credit.*

**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 9 and 12 feet tall? (round the answer to 4 decimal places)
(b) Find the 80th percentile of the pecan tree height distribution. (round the answer to 2 decimal places)

**12.** Based on the performance of all individuals who tested between July 1, 2012 and June 30, 2015, the GRE Quantitative Reasoning scores are normally distributed with a mean of 152.47 and a standard deviation of 8.93. (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 36 test scores. What is the standard deviation of the sample means? (Round your answer to three decimal places)
(b) What is the probability that 36 randomly selected test scores will have a mean test score that is between 148 and 152?

**13.** A survey showed that 1200 of the 1600 adult respondents believe in global warming. Construct a 95% 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.*

**14.** A city built a new parking garage in a business district. For a random sample of 100 days, daily fees collected averaged $2,000, with a standard deviation of $500. Construct a 90% 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.*

**15.** A researcher claims the proportion of auto accidents that involve teenage drivers is less than 20%. ABC Insurance Company checks police records on 200 randomly selected auto accidents and notes that teenagers were at the wheel in 32 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 researcher's claim that the proportion of auto accidents that involve teenage drivers is less than 20%? Explain.

---

**16.** 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 the regular exercise helps weight loss? Assume Mimi wants to use a 0.05 significance level to test the claim.

| | Weight (pounds) | |
|---|---|---|
| Subject | Before | After |
| 1 | 190 | 180 |
| 2 | 170 | 160 |
| 3 | 185 | 175 |
| 4 | 160 | 160 |
| 5 | 200 | 190 |

(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 regular exercise helps weight loss? Justify your conclusion.

---

**17.** In a pulse rate research, a simple random sample of 400 men results in a mean of 80 beats per minute, and a standard deviation of 10.8 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.

---

**18.** 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 | 18 | 15 | 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.

---

**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*** | 80 | 93 | 50 | 60 | 100 | 40 | 85 | 70 | 75 | 85 |
|---|---|---|---|---|---|---|---|---|---|---|
| ***y*** | 70 | 96 | 50 | 63 | 96 | 38 | 83 | 60 | 77 | 87 |

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

---

**20**. A study of 8 different weight loss programs involved 160 subjects. Each of the 8 programs had 20 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) | 27.82 | | |
| Error (Within) | | | |
| Total | 543.05 | 159 | 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.