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In-Class Final Exam Review Questions

Disclaimer and Directions: These practice questions are intended to familiarize you with the *style* of the final exam. The content of actual final exam questions will differ. The exam format is multiple choice. Choose the single best answer for each question.

Questions 1–2.

Classify the following random variables as either discrete or continuous.

1. The time required for an email to travel through the Internet from its point of origin to its destination, in seconds.
(a) discrete (b) continuous
2. The number of companies listed on the New York Stock Exchange whose stock increased in value between Jan. 1, 2012 and March 1, 2012.
(a) discrete (b) continuous

Question 3.

A buyer for a lumber company must decide whether to buy a piece of land containing 5000 pine trees. If 1000 of the trees are at least 40 feet tall, the buyer will purchase the land, otherwise not. The owner of the land reports that the trees average 30 feet in height, with a standard deviation of 3 feet. It is also known that tree heights form a bell-shaped distribution.

3. Based on this information, what is the buyer's decision?
 - (a) Purchase the land since approximately 20% of the trees are at least 40 feet tall.
 - (b) Do not purchase the land since approximately 500 of the trees are at least 40 feet tall.
 - (c) Do not purchase the land since approximately 0% of the trees are at least 40 feet tall.
 - (d) Do not purchase the land since approximately 68% of the trees are between 27 and 33 feet tall.
 - (e) Purchase the land since approximately 95% of the trees are between 40 and 46 feet tall.

Questions 4–8.

Henry Jordan is an accountant who works for the *Toys R Us* toy retailer corporation. Mr. Jordan works at a regional corporate office located in Atlanta, Georgia. On Dec. 30, 2018, Mr. Jordan was called into the office of his supervisor, Ms. Pamela White. Ms. White gave the following instructions to Mr. Jordan:

“Listen, Henry. A tax specialist hired by *Toys R Us* management has found a new tax break in the tax code which may enable *Toys R Us* to reduce the amount it pays in 2018 corporate taxes by \$2,500,000.

“But in order to use this tax break, *Toys R Us* needs to know the Total Retail Value of Inventory (the total dollar value of all toy products in stock at retail prices) at each of our retail locations scattered around the country on the precise date of Dec. 31, 2018.

“Unfortunately, the inventory computer program at one particular retail location in Denver, Colorado has crashed, so we have no idea what the TRVI is at that location.

“Your job is to fly to the Denver location and calculate the TRVI on Dec. 31, 2018. This is important, because without that information, *Toys R Us* will not be able to use the tax break. Take a calculator with you, because you will need to manually add up the retail prices of all toy products in stock at the location to obtain the TRVI.”

So, Jordan rushed off to the Atlanta airport to try to catch a flight to Denver. Unfortunately, icy weather resulted in the cancellation of all flights from Atlanta on Dec. 30 and on Dec. 31, 2018. On Jan. 1, 2019, Jordan called White from the Atlanta airport. “I’m sorry, Pam,” he said, “I was not able to get to Denver by Dec. 31. In fact, I’ve been stuck here at the Atlanta airport for two days.”

White answered, “That’s okay, Henry. Nice try. I will inform *Toys R Us* management that we have no information about the TRVI at the Denver location on Dec. 31, 2018, and therefore, that *Toys R Us* cannot use the tax break for 2018 taxes.”

Consider the **Six Steps of Inference** as they apply to the question of determining the TRVI at the Denver retail location on Dec. 31, 2018.

4. Identify the population.

- (a) All toy products at all *Toys R Us* retail locations on Dec. 31, 2018.
- (b) All toy products in stock at the Denver location on Dec. 31, 2018.
- (c) The retail prices of all toy products at all *Toys R Us* retail locations on Dec. 31, 2018.
- (d) All *Toys R Us* retail locations on Dec. 31, 2018.
- (e) All toy products in stock at the Denver location during 2018.

5. Identify the sample.

- (a) There is no sample.
- (b) All toy products in stock at the Denver location on Dec. 31, 2018 that Henry Jordan would have examined had he been able to fly to Denver.
- (c) The Denver location on Dec. 31, 2018.
- (d) The retail prices of all toy products at the Denver location on Dec. 31, 2018.
- (e) All toy products in stock at the Denver location on Dec. 31, 2018.

6. What variable did Pamela White wish to measure on each unit in the population?

- (a) The TRVI at the Denver location on Dec. 31, 2018.
- (b) The retail price of a toy product.
- (c) A “Yes” or “No” answer as to whether *Toys R Us* can use the tax break for 2018 taxes.
- (d) The amount of tax reduction in 2018 for *Toys R Us*.
- (e) A “Yes” or “No” answer as to whether Henry Jordan is able to fly to Denver.

7. What is the summary of the sample data?

- (a) There is no summary since there are no sample measurements.
- (b) The summary is exactly equal to the average TRVI on Dec. 31, 2018 at all *Toys R Us* locations other than the Denver location.
- (c) The TRVI at the Denver location on Dec. 31, 2018 can be estimated by the TRVI at the Denver location on Dec. 31, 2017.
- (d) The amount of tax reduction in 2018 for *Toys R Us* is exactly \$0.
- (e) The answer is “No” as to whether *Toys R Us* receives a tax reduction in 2018.

8. What is the inference?

- (a) The TRVI at the Denver location on Dec. 31, 2018 must be estimated from previous records.
- (b) There is no inference since there is no summary of sample data.
- (c) It's time to go drink beer on the beach.
- (d) It's time to fire Henry Jordan.
- (e) The TRVI at the Denver location on Dec. 31, 2018 is approximately equal to the average TRVI on Dec. 31, 2018 at all *Toys R Us* locations other than the Denver location.

Questions 9–11.

Three marbles are drawn at random and without replacement from a box which contains three red marbles and two blue marbles.

9. What is the probability of drawing three red marbles?
(a) 0 (b) $9/10$ (c) $4/5$ (d) 1 (e) None of the answers is correct.
10. What is the probability of drawing two red marbles and one blue marble?
(a) $1/10$ (b) $3/10$ (c) $7/10$ (d) $3/5$ (e) None of the answers is correct.
11. What is the probability of drawing one red marble and two blue marbles?
(a) 0 (b) $9/10$ (c) $7/10$ (d) $3/10$ (e) None of the answers is correct.

Questions 12–13.

NASA's space shuttles each have three on-board navigation computers, used by astronauts to safely return to earth from orbit. Any of the computers can, by itself, return the shuttle safely, assuming it is not malfunctioning. The three computers are designed to operate independently of each other, and the chance that any individual computer malfunctions during a single flight is 1%.

12. What is the probability that a single shuttle flight returns safely to earth?
(a) 0.01 % (b) 97.0 % (c) 99.99 % (d) 99 % (e) 99.9999 %
13. If there are 12 shuttle flights scheduled for 2002, what is the probability that at least one of these flights will be unable to return to earth? (Assume that shuttle flights operate independently.)
(a) 3.0 % (b) 0.0004 % (c) 11.9934 % (d) 0.0012 % (e) 99.9996 %

Questions 14–16.

The table below shows information from a review of the medical records of 587 Norwegians who experienced at least one heart attack. For each of these individuals, it was recorded whether or not the individual died within five years after the first heart attack and also whether the individual's blood system contained low or high levels of an enzyme known as homocysteine. The objective of the medical review is to determine whether the level of homocysteine is related to risk of death within five years after a first heart attack among Norwegians.

	Death within 5 years after first heart attack	Survival more than 5 years after first heart attack	Total
High homocysteine	138	85	223
Low homocysteine	174	190	364
Total	312	275	587

14. What statistical population is associated with this medical review?
- (a) All Norwegians
 - (b) All Norwegians who have experienced at least one heart attack
 - (c) All Norwegians with potential heart problems
 - (d) All human beings who have experienced at least one heart attack
 - (e) All human beings with potential heart problems
15. How many variables are measured in this study?
- (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
16. Based on the table, which of the following statements is true?
- (a) Death within five years after a first heart attack is independent of survival for more than five years after a first heart attack among Norwegians.
 - (b) The level of homocysteine is independent of whether or not a Norwegian dies within five years after a first heart attack.
 - (c) The probability of death within five years of a first heart attack is greater for Norwegians with low homocysteine than for Norwegians with high homocysteine.
 - (d) The probability of death within five years of a first heart attack is greater for Norwegians with high homocysteine than for Norwegians with low homocysteine.
 - (e) Among all Norwegians with high homocysteine and who also experience at least one heart attack, the probability of death within five years of a first heart attack is 47.8%.

Questions 17–21.

An elevator serving a hospital is designed to hold up to 15 passengers and has a maximum safe capacity of 2440 pounds. The weight of passengers who use the elevator is normally-distributed with an average of 149 pounds and a standard deviation of 20 pounds.

17. What is the probability that a single passenger on the elevator weighs between 140 and 150 pounds?
- (a) 0.1736 (b) 0.1537 (c) 0.2236 (d) 0.1935 (e) 0.1915
18. What is the probability that a single passenger on the elevator weighs more than 200 pounds?
- (a) 0.9946 (b) 0.4946 (c) 0.0054 (d) 0.5054 (e) 0.9954
19. If five passengers enter the elevator together, what is the probability that exactly four of them weigh 200 pounds or less?
- (a) 0.1512 (b) 0.000000004 (c) 0.9786 (d) 0.0264 (e) 0.1613

20. If we consider only elevator trips which carry 8 passengers, how many of these passengers, on average, weigh 200 pounds or less?
- (a) 3.957 (b) 4.043 (c) 0.043 (d) 5.038 (e) 7.957
21. What is the probability that the elevator's safe capacity is exceeded by a full load of 15 passengers?
- (a) 1.0 (b) 2.65 (c) 0.0040 (d) 0 (e) 0.0137

Questions 22–26.

In January of the year 2000, a Gallup poll asked a random sample of 1633 American adults, “In general, are you satisfied or dissatisfied with the way things are going in the United States?” In the poll, 1127 said that they were satisfied.

22. Describe the population parameter.
- (a) $x = 1127$ adult Americans who are satisfied in January 2000
 (b) $p =$ proportion of all adult Americans who are satisfied in January 2000
 (c) $\hat{p} =$ proportion of all adult Americans who are satisfied in January 2000
 (d) $p = .6901$
 (e) $\hat{p} = .6901$
23. Provide the best estimate.
- (a) $x = 1127$ adult Americans who are satisfied in January 2000
 (b) $p =$ proportion of all adult Americans who are satisfied in January 2000
 (c) $\hat{p} =$ proportion of all adult Americans who are satisfied in January 2000
 (d) $p = 0.6901$
 (e) $\hat{p} = 0.6901$
24. Provide the 90% margin of error.
- (a) 0.0188 (b) 0.0114 (c) 0.0002 (d) 0.0138 (e) 0.0227
25. Provide the 90% confidence interval.
- (a) (0.6713, 0.7089) (b) (0.6787, 0.7015) (c) (0.6763, 0.7039) (d) (0.6674, 0.7128)
 (e) (0.6899, 0.6903)
26. Would it be unrealistic to claim that at least $2/3$ of all adults in the U.S. were satisfied in January 2000?
- (a) Yes, it would be unrealistic.
 (b) No, it would not be unrealistic.
 (c) Not possible to determine because a confidence interval is based on a sample, not the population.

Questions 27–30.

Climatologists say that one location is “warmer on average” than another location during any year in which the average daily high temperature for the first location exceeds the average for the second location. Equivalently, the second location is “colder on average” than the first.

Weather records for the past 96 years show that Iowa City was warmer than both Ames and Cedar Rapids during 24 years, Iowa City was colder than both Ames and Cedar Rapids during 19 years, and Iowa City was colder than Ames during 38 years.

27. Find the probability that Iowa City is warmer than Ames but colder than Cedar Rapids.
(a) 0.3542 (b) 0.2500 (c) 0.1979 (d) 0.3335 (e) None of the answers is correct to the fourth decimal place.
28. Find the probability that Iowa City is colder than Ames but warmer than Cedar Rapids.
(a) 0.3542 (b) 0.2500 (c) 0.1979 (d) 0.3335 (e) None of the answers is correct to the fourth decimal place.
29. Find the probability that Iowa City is warmer than Ames.
(a) 0.4479 (b) 0.3959 (c) 0.5521 (d) 0.2500 (e) None of the answers is correct to the fourth decimal place.
30. If Iowa City is colder than Ames during the year 2019, does this affect the chances that Iowa City is colder than Cedar Rapids during 2019?
(a) Yes, the chances increase.
(b) Yes, the chances decrease.
(c) No, the chances remain the same.
(d) Impossible to determine based on the available information.

Questions 31–36.

The distance of the route used for the Annual Old Capitol 10,000 Meter Race is measured independently 56 times. The average observed distance is 10,004 meters, with a standard deviation of 15.2 meters. Does the actual mean distance of the route differ from the advertised distance of 10,000 meters? Test at 5% significance.

31. True or False: The number 5% represents the risk of error if the null hypothesis is rejected on the basis of the sample (or stronger) evidence, assuming that the null hypothesis is true.
- (a) True
 - (b) False
 - (c) Additional information is needed before this question can be answered.
32. Which of the following is a correct expression?
- (a) $\bar{x} = 10,000$ (b) $\sigma = 15.2$ (c) $\bar{x} = 10,004$ (d) $\bar{x} = 15.2$
 - (e) None of the expressions is correct.
33. Calculate the value of the test statistic.
- (a) -1.97 (b) 0.00 (c) 1.97
 - (d) None of the answers is correct to the second decimal place.
34. Decide.
- (a) Reject H_0 (b) Fail to Reject H_0 (c) Reject H_A (d) Fail to Reject H_A
35. Interpret.
- (a) There is enough evidence to show that the actual mean distance of the route is 10,000 meters.
 - (b) There is not enough evidence to show that the actual mean distance of the route is 10,000 meters.
 - (c) There is enough evidence to show that the actual mean distance of the route is not 10,000 meters.
 - (d) There is not enough evidence to show that the actual mean distance of the route is not 10,000 meters.
 - (e) None of the answers is correct.
36. Find a 95% confidence interval for the actual mean distance of the route, in meters.
- (a) (9991.92, 10000.08)
 - (b) (9992.02, 9999.98)
 - (c) (9999.92, 10008.08)
 - (d) (10000.02, 10007.98)
 - (e) (10003.45, 10004.55)

Solution

1. b
2. a
3. c
4. b
5. a
6. b
7. a
8. b
9. e $1/10$
10. d
11. d
12. e
13. d
14. b
15. c
16. d
17. d
18. c
19. d
20. e
21. c
22. b
23. e
24. a
25. a
26. b
27. a
28. c
29. e 0.6042
30. b
31. b This is the definition for P -value.

32. c

33. c

- Use μ = actual mean distance of route and test

$$H_A: \mu \neq 10,000$$

$$H_0: \mu = 10,000$$

34. b

- Make a decision either of two ways:
 - Rejection Region:
Reject H_0 if $t < -2.009$ or $t > 2.009$
 \implies Fail to Reject H_0 since $-2.009 < t = 1.97 < 2.009$
 - P -value Method:
From t table, $0.05 < P\text{-value} < 0.10$
 \implies Fail to Reject H_0 since $P\text{-value} > 0.05 = \alpha$ (too risky)

35. d

36. c