

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS, DHAHRAN, SAUDI ARABIA
DEPARTMENT OF MATHEMATICS

STAT 201: Introduction to Statistics

Term 211, Final Exam, Saturday December 25, 2021, 08:00 AM

Name: _____ ID #: _____

Please mark the correct answer to each of the questions by completely darkening the circle of your choice with a dark pen or pencil.

MULTIPLE CHOICE:

	A	B	C	D	E
Q.No.1: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.2: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.3: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Q.No.5: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.6: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.7: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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Q.No.9: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.10: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.11: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.12: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.13: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.14: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.15: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

MULTIPLE CHOICE:

	A	B	C	D	E
Q.No.16: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.17: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.18: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.19: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.20: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.21: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.22: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.23: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.24: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.25: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.26: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.27: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Q.No.28: -	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Code: 00

Score: 

Instructions:

1. Formula sheet is attached at the end of this exam. You are not allowed to bring with you, formula sheet or any other printed/written paper.
2. Mobiles are not allowed in exam. If you have your mobile with you, turn it off and keep it under your seat so that it is visible to proctor. Your mobile(s) should not be in your pocket during the exam.
3. The answers are rounded. If the exact answer is not there in any of the 5 choices, then pick the one that you think is closest to correct answer.
4. Make sure you have 10 unique pages of exam paper (including this title page.)

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Q1: The measurement scale in which the values are categorized to represent qualitative differences and ranked in meaningful manner is classified as:

- A. **Ordinal scale**
- B. Nominal scale
- C. Interval scale
- D. Ratio scale
- E. Discrete scale

Q2: The probability that a customer at a fast-food restaurant orders a beverage is 0.60. The probability that a customer orders French fries is 0.50. The probability that a customer orders both a beverage and French fries is 0.42. What is the probability that the next customer orders exactly one of these two items?

- A. **0.26**
- B. 0.4
- C. 0.58
- D. 0.68
- E. 0.5

Q3: Two independent events A and B have the same probability of occurrence say a . What is the probability of occurrence of at least one of these two events?

- A. **$a(2 - a)$**
- B. $2a$
- C. a^2
- D. a
- E. $2 - a$

Q4: A large electronic store received a shipment of 240 mobile phones of which 190 are Android and the remaining 50 are iPhone. A salesman picked 10 phones randomly for displaying. What is the probability that at least one iPhone will be selected for display purpose?

- A. **0.908**
- B. 0.092
- C. 0.254
- D. 0.654
- E. 0.308

Q5: In an orientation event at KFUPM stadium, there are desks of every department where a representative of department is available for students to provide any information about the programs offered by department. The probability that a student visits the desk of Mathematics department is 0.37, independent of the other students. For the next ten students, what is the probability that four of them visit the Mathematics desk?

- A. **0.246**
- B. 0.019
- C. 0.754
- D. 0.063
- E. 0.417

Q6: The average amount of meat that a person consumes per year is 218 pounds. Assume that the variance is 625 pounds² and the distribution is approximately normal. Find the probability that a person selected at random consumes more than 237 pounds per year.

- A. **0.22363**
- B. 0.77637
- C. 0.51197
- D. 0.48803
- E. 0.41482

Q7: The average expiry time of a specific brown bread is 12 days, with a standard deviation of 2 days. Assuming that the expiry time of these breads follow approximately a normal distribution. 99.9% of the breads expire within how many days?

- A. **18.18 days**
- B. 5.82 days
- C. 17 days
- D. 16.66 days
- E. 7.34 days

Q8: U.S. Census Bureau reports that the average annual consumption of fresh fruit per person is 99.9 pounds and the standard deviation of fresh fruit consumption is about 30 pounds. Suppose a researcher took a random sample of 38 people and had them keep a record of fresh fruit they ate for one year. What is the probability that the sample average for fruit consumption will be between 93 and 96 pounds?

- A. **0.13406**
- B. 0.07780
- C. 0.21186
- D. 0.28966
- E. 0.86594

Q9: Suppose that a random sample of nine recently sold houses in a certain neighborhood resulted in a sample standard deviation of \$12,000. The width of a 95 percent confidence interval for the mean price of all recently sold houses in this neighborhood is equal to:

- A. **18448**
- B. 9224
- C. 7440
- D. 14880
- E. 4000

Q10: A school principal was instructed by his board to estimate the average number of school days missed by students in the past year. From a random sample of 40 students, he constructed a 95% confidence interval that came out to be [7, 11] days. Which one of the following is the most correct interpretation of this interval estimate?

- A. **We are 95% confident that the average number of school days missed by students is between 7 and 11 days.**
- B. The probability that a randomly selected student misses between 7 to 11 days is 0.95.
- C. The actual average number of school days (μ) missed by students is between 7 and 11 days.
- D. The sample average number of school days (\bar{X}) missed by students is between 7 and 11 days with a probability 0.95.
- E. 5% of the students miss less than 7 days or more than 11 school days.

Q11: A sample of 100 cups of coffee from a coffee machine is collected, and the amount of coffee in each cup is measured. Suppose that 9 cups contain less than the amount of coffee specified on the machine. Construct a 96.6 percent confidence interval estimate of the proportion of all cups dispensed that give less than the specified amount of coffee.

- A. **[0.0293 , 0.1507]**
- B. [0.0378 , 0.1422]
- C. [0.0142 , 0.1658]
- D. [0.0041 , 0.1759]
- E. [0.0328 , 0.1472]

Q12: For testing $H_0: \mu = 10$ against $H_1: \mu \neq 10$, a random sample of size $n = 25$ gave $\bar{X} = 11.5$ and $s = 2.5$. What is the smallest level of significance (α) at which we reject H_0 ?

- A. **0.00270**
- B. 0.00135
- C. 0.02500
- D. 0.05000
- E. 0.00990

Q13: A manufacturer claims that the mean lifetime of the batteries it produces is at least 250 hours of use. A sample of 20 batteries yielded the average to be 246.15 hours with a standard deviation of 8.65 hours. For testing the said hypothesis, the calculated test statistic is equal to -1.99049. Based on the rejection region approach at $\alpha = 0.05$, which one of the following statements is true?

- A. **We reject manufacturer's claim because the calculated test statistic is less than -1.729.**
- B. We fail to reject manufacturer's claim because the calculated test statistic is less than +1.729.
- C. We fail to reject manufacturer's claim because the calculated test statistic is less than -2.093.
- D. We reject manufacturer's claim because the calculated test statistic is less than +2.093.
- E. We fail to reject manufacturer's claim as the sample average is less than 250.

A standard drug is known to be effective in 72 percent of cases in which it is used to treat a certain infection. A new drug has been developed, and testing has found it to be effective in 42 cases out of 50.

Answer the following Q14 and Q15 using above information:

Q14: For testing that the new drug is more effective than the old one, what is the value of Z-statistic?

- A. **1.89**
- B. 2.31
- C. -1.89
- D. -2.31
- E. 29.76

Q15: For testing that the new drug is more effective than the old one, what is the p-value of test?

- A. **0.02938**
- B. 0.97062
- C. 0.05876
- D. 0.94124
- E. 0.04407

In a study of water contamination in wells, 223 wells were tested and the results are tabulated below:

Pollutant Level	Type of Well	
	Private	Public
Low	81	72
High	22	48

Answer the following Q16 and Q17 using above information:

Q16: Construct a 97% confidence interval for the difference between the proportion of high pollutant level in two types of well. The lower limit is equal to:

- A. **-0.317**
- B. -0.299
- C. -0.186
- D. 0.0016
- E. 0.002

Q17: For testing the hypothesis that the proportion of high pollutant level in both type of wells is equal, the p-value is equal to:

- A. **0.00278**
- B. 0.00139
- C. 0.99861
- D. 0.99722
- E. 0.00307

A new water purification unit is installed in a large housing compound. Before its installation, a random sample yielded the following data about the percentage of impurity: $n_1 = 16$, $\bar{X}_1 = 9.85$, $s_1^2 = 6.79$. After installation, another independent random sample resulted in $n_2 = 13$, $\bar{X}_2 = 8.18$, $s_2^2 = 6.18$.

Answer the following Q18, Q19 and Q20 using above information:

Q18: To construct a confidence interval for difference between mean purity level before and after installing purification unit assuming equal variances, the pooled variance is equal to:

- A. **6.52**
- B. 6.29
- C. 6.99
- D. 6.18
- E. 6.45

Q19: Assuming equal variances, construct a 99.9% confidence interval for difference between mean purity level before and after installing purification unit. The upper limit is equal to:

- A. **5.188**
- B. 5.158
- C. 4.931
- D. 4.908
- E. 5.372

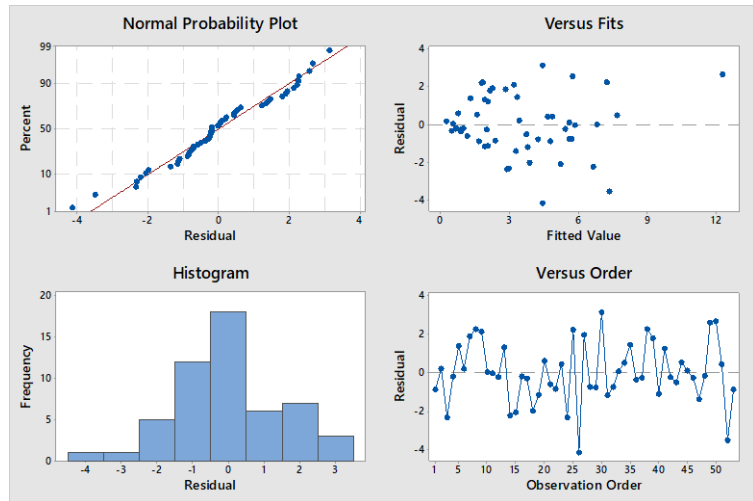
Q20: Assuming equal variances, we want to test that there is a significant difference between the mean purity level before and after installing purification unit. At 0.005 level of significance, we reject H_0 if the absolute value of test statistic is greater than:

- A. **3.057**
- B. 3.038
- C. 2.771
- D. 2.805
- E. 2.575

Q21: Residual analysis is provided in the following graphs for a simple linear regression model:

Which of the assumptions of linear regression model is/are seriously violated?

- A. **Constant variance**
- B. Normality and constant variance
- C. Independence and linearity
- D. Linearity
- E. None



The length of breads (measured in inches) manufactured on two different baking machines is being investigated. Two random samples of sizes n_1 and n_2 are selected. The sample information for the two machines in the form of sample sizes, means and variances are given as:

Machine 1: $n_1 = 30$, $\bar{x}_1 = 11.73$, $s_1^2 = 0.3$

Machine 2: $n_2 = 10$, $\bar{x}_2 = 10.68$, $s_2^2 = 0.4$.

Assuming unequal population variances, we want to test that the average bread lengths for machine 1 is higher than that of machine 2.

Answer the following Q22 and Q23 using above information:

Q22: What is the calculated value of T-statistic?

- A. **4.696**
- B. 5.054
- C. 3.678
- D. 3.816
- E. 4.486

Q23: What is the degree of freedom?

- A. **13**
- B. 12
- C. 14
- D. 27
- E. 38

Q24: For a simple linear regression model, if $SST = 3189$ and $SSE = 1042$ then the percentage of variation in response variable that is explained by the regression is

- A. **67.3%**
- B. 32.7%
- C. 31.89%
- D. 10.42%
- E. 0%

Q25: Suppose we have the following sample of size $n = 2$ on response variable (y) and predictor (X):

X	y
x_1	4
x_2	10

We fit a simple linear regression model to this data to predict y using X as a predictor. The sum of squares of regression (SSR) for this model is equal to:

- A. **18**
- B. 64
- C. 6
- D. 116
- E. 14

The following relates the breaking strength of eight pieces of rope and the percentage of that rope that is nylon (rather than cotton).

Percentage nylon	0	10	20	20	30	40	50	50
Breaking strength (pounds)	160	240	325	345	350	490	510	540

Answer the following Q26, Q27 and Q28 using above information:

Q26: Which one of the following is true?

- A. **There is direct strong linear relationship between percentage of nylon and breaking strength.**
- B. There is inverse strong linear relationship between percentage of nylon and breaking strength.
- C. The linear relationship between percentage of nylon and breaking strength is not significant.
- D. 98.42% of the variation in breaking strength is explained by percentage nylon.
- E. 1% increase in nylon results in a 98.42% increase in the breaking strength of rope.

Q27: Due to 1% increase in nylon, the average breaking strength

- A. **increases by 7.234 pounds**
- B. decreases by 7.234 pounds
- C. increases by 171.065 pounds
- D. decreases by 171.065 pounds
- E. does not change significantly

Q28: Find an interval that, with 95 percent confidence, will contain the breaking strength of a piece of rope that is 35 percent nylon.

- A. **[356.769 , 491.741]**
- B. [359.031 , 489.479]
- C. [400.772 , 447.738]
- D. [399.957 , 448.553]
- E. [459.872 , 605.658]