King Fahd University of Petroleum & Minerals
Mathematics & Statistics Department

STAT 319: Probability & Statistics for Engineers & Scientists

Term 161
Final Exam
Wednesday 18/01/2017
8:00 – 11:00 AM

Please circle your instructor name:

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Std. Name: Std. ID: Serial No.:

MULTIPLE CHOICE QUESTIONS

Q1]... From a batch of 100 items of which 20 are defective, exactly two items are chosen, one at a time, without replacement. The probability that the second item chosen is defective is

A. 0.20.

B. 0.10.

C. 0.50.

D. 0.80.

E. 0.00.

Q2]... A machine has four components, A, B, C, and D, set up in such a manner that all four parts must work for the machine to work properly. Assume the probability of one part working does not depend on the functionality of any of the other parts. Also assume that the probabilities of the individual parts working are $P(A) = P(B) = 0.94$, $P(C) = 0.98$, and $P(D) = 0.99$. Find the probability that at least one of the four parts will work.

A. 0.999999.

B. 0.857269.

C. 0.000001.

D. 0.142731.

E. 0.573102.

Q3]... Let A and B be two independent events such that $P(A) = 0.4$ and $P(B) = 0.5$, what is the probability that only one of the two events occur?

A. 0.50.

B. 0.70.

C. 0.90.

D. 0.20.

E. 0.00.

Q4]... Among five applicants for chemical engineering positions in a firm, two are rated as excellent and the others are rated as good. A manager randomly selected two applicants to interview. The probability that the manager chooses at least one of those rated excellent equal to

A. 0.70.

B. 0.30.

C. 0.90.

D. 0.10.

E. 0.92.

Q5]... In a NiCd battery, a fully charged cell is composed to Nickelic Hydroxide. Nickel is an element that has a multiple oxidation states. Let X be the nickel charge which has the following probability mass function:

X	0	1	2	3
$p(x)$	0.18	k	0.33	0.15

Determine the value of k and the mean of the nickel charge.

A. $k = 0.34$, $\mu = 1.45$.

B. $k = 0.34$, $\mu = 3.01$.

C. $k = 0.34$, $\mu = 9.01$.

D. $k = 0.45$, $\mu = 9.01$.

E. $k = 0.45$, $\mu = 3.01$.

Q6]... A random variable X takes the values $1, 2, 3$ with $E(X) = 1.7$ and $P(X = 1) = 0.5$. Find $P(X > 2|X > 1)$.

A. 0.4.

B. 1.

C. 0.

D. 0.25.

E. 0.2.

Q7]... Suppose that a continuous random variable taking values between 0 and 2 and having the probability density function below, then probability that X between 0 and 1 equal to

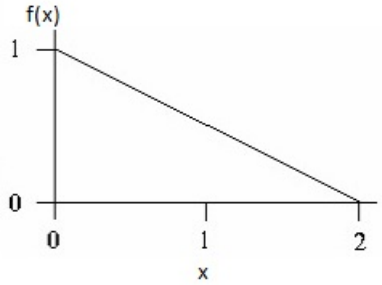
A. 0.75.

B. 0.33.

C. 0.66.

D. 0.25.

E. 0.50.



Q8]... The amount of corn chips dispensed into a 24-ounce bag by the dispensing machine has been identified as possessing a normal distribution with a mean of 24.5 ounces and a standard deviation of 0.2 ounce. What chip amount represents the 67^{th} percentile for the bag weight distribution?

A. 24.59 oz.

B. 24.09 oz.

C. 25.63 oz.

D. 25.13 oz.

E. 23.13 oz.

Q9]... The service time at teller windows in a bank were found to be an exponential distribution with a mean 3.2 minutes. A customer arrives at a window at 10:30 A.M. The probability that he will still be there at 10:34 A.M equal to

A. 0.2865.

B. 0.0407.

C. 0.7135.

D. 0.9592.

E. 0.

Q10]... The graph below shows cumulative proportion plotted against land values (in dollars per acre) for farms on sale in a rural community. What is the median land value?

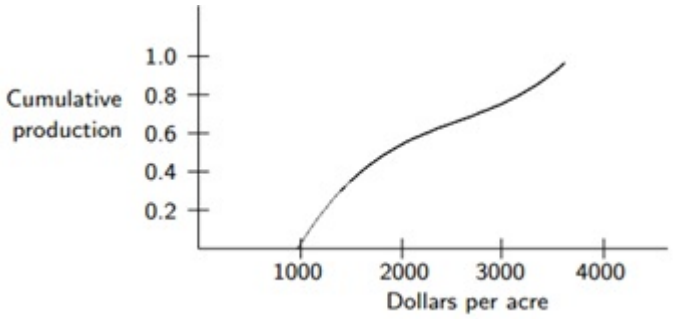
A. \$1900.

B. \$2500.

C. \$2600.

D. \$1000.

E. \$1500.



Q11]... The boxplot below summarize the distribution of RAM verbal and math scores among students at KFUPM high school, which of the following statements is/are true?

I. The range of the math scores equal the range of the verbal score.

II. The highest math score equal to the median verbal score.

III. The verbal scores appear to be roughly symmetric, while the math scores appear to be skewed to the right.

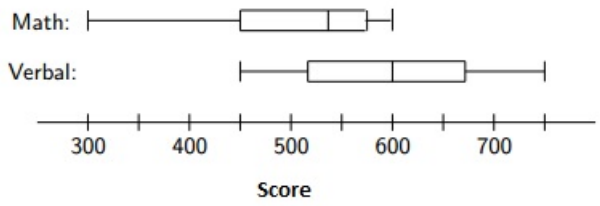
A. I and II.

B. II only.

C. III only.

D. II and III.

E. All are true.



Q12]... The following statistics were collected on two groups of cattle:

	Group A	Group B
size	45	30
mean	1000 lbs	800 lbs
standard deviation	80 lbs	70 lbs

Which of the following statements is correct?

A. Group A is relatively less variable than Group B because Group A's coefficient of variation is smaller.

B. Group A is less variable than Group B because Group A's standard deviation is larger.

C. Group A is more variable than Group B because the sample size is larger.

D. Group A is more variable than Group B because the sample mean is larger.

E. Group A is less variable than Group B because the standard deviation per animal is smaller.

Q13]... The elasticity of a polymer is affected by the concentration of a reactant. When low concentration is used, the true mean elasticity is 55, and when high concentration is used the true mean elasticity is 60. The variance of elasticity is 16 regardless of concentration. Assuming the concentration of reactants are independent, a random sample of size 16 from each level of concentration is selected, find $P(\bar{X}_{\text{high}} - \bar{X}_{\text{low}} > 2)$.

A. 0.9830.

B. 0.0170.

C. 0.8984.

D. 0.2139.

E. None of the choices.

Q14]... As the sample size ..... the variance of the sample mean .....

A. increases, decreases.

B. decreases, decreases.

C. decreases, remains the same.

D. increases, remains the same.

E. None of the choices.

Q15]... A local bank needs information concerning the savings account balances of its customers. A random sample of 15 accounts was checked. The mean balance was \$686.75 with a standard deviation of \$256.20. Find a 98% confidence interval for the true mean. Assume that the account balances are normally distributed.

A. (\$513.14, \$860.36).

B. (\$544.87, \$828.63).

C. (\$532.62, \$840.88).

D. (\$557.09, \$816.41).

E. (\$487.31, \$860.33).

Q16]... A university dean is interested in determining the proportion of students who receive some sort of financial aid. Rather than examine the records for all students, the dean randomly selects 200 students and finds that 118 of them are receiving financial aid. Use a 98% confidence interval to estimate the true proportion of students on financial aid. Express the answer in the form $\hat{P} \pm E$ and round E to three decimal places.

A. 0.59 ± 0.081.

B. 0.59 ± 0.035.

C. 0.59 ± 0.068.

D. 0.59 ± 0.057.

E. 0.59 ± 0.075.

Q17]... Which of the following statements is true?

A. If an infinite number of random samples are collected and a 99% confidence interval for μ is computed from each sample, about 1% of the time the intervals won't cover their respective population mean.

B. The statement, "the 95% confidence interval for the population mean is (350, 400)" means that 95% of the population values are between 350 and 400.

C. It is necessary that the distribution of the variable of interest follows a normal distribution.

D. For a given standard error, lower confidence levels produce wider confidence intervals.

E. If you increase sample size, the width of confidence intervals will increase.

Q18]... You have created a 95% confidence interval for the true population mean with result (10, 15). What decision will you make if you test $H_0 : \mu = 16$ vs $H_1 : \mu \neq 16$ at $\alpha = 0.1$?

A. Reject H_0 in favor of H_1.

B. Don't reject H_0 in favor of H_1.

C. Reject H_1 in favor of H_0.

D. Fail to reject H_1 in favor of H_0.

E. We can't tell what our decision will be from the information given.

Q19]... If, as a result of a hypothesis test, you reject the null hypothesis when it is false, then you have committed

A. No error.

B. An acceptance error.

C. A Type I error.

D. A Type II error.

E. We can't tell depend on the information given.

Q20]... An analyst is conducting a test involving the following hypotheses

$$H_0 : \mu = 100 \text{ vs. } H_1 : \mu > 100.$$

The population is known to be normally distributed with a standard deviation of 24. Assume that the sample size is 36 and the acceptance region is $\bar{X} \leq 106.58$, the probability of making a Type II error if the population mean actually equals 105 is

A. 0.6554.

B. 0.3446.

C. We can't tell depend on the information given.

D. 0.0500.

E. 0.0250.

Q21]... The engineer measures weight of 25 pieces of steel and obtains an average of 6. The weight follows normal distribution with variance 16. He wants to test that the population mean is more than 5. Find the p-value of the test.

A. 0.1056.

B. 0.8944.

C. 0.1500.

D. 0.0500.

E. 1.0000.

Q22]... A local eat-in pizza restaurant wants to investigate the possibility of starting to deliver pizzas. The owner of the store has determined that home delivery will be successful if the average time spent on the deliveries does not exceed 34 minutes. The owner has randomly selected 23 customers and has delivered pizzas to their homes in order to test if the mean delivery time actually exceeds 34 minutes. Suppose the p-value for the test was found to be 0.029. State the correct conclusion.

A. At $\alpha = 0.025$, we fail to reject H_0.

B. At $\alpha = 0.05$, we fail to reject H_0.

C. At $\alpha = 0.02$, we reject H_0.

D. At $\alpha = 0.03$, we fail to reject H_0.

E. At $\alpha = 0.01$, we reject H_0.

Q23]... Nine students took the SAT and their scores are listed below. Later on, they read a book on test preparation and retook the SAT. Their new scores are listed below. Construct a 95% confidence interval on the difference in mean scores. Assume that the difference in scores is normally distributed.

Student	1	2	3	4	5	6	7	8	9
Scores before reading book	720	860	850	880	860	710	850	1200	950
Scores after reading book	740	860	840	920	890	720	840	1240	970

A. $(-30.496, -0.615)$.

B. $(-20.341, 4.852)$.

C. $(-26.213, -4.898)$.

D. $(-29.290, -1.821)$.

E. $(-28.254, -2.857)$.

Q24]... Assume a sample of size 25 is selected from each of two independent normal populations with common unknown variance. When testing $H_0 : \mu_1 - \mu_2 = 0$ vs. $H_1 : \mu_1 - \mu_2 > 0$, the test statistic value was -2.13. What is the critical value for the test?

A. 1.677.

B. 1.853.

C. 1.645.

D. 2.011.

E. 1.960.

Q25]... For testing $H_0 : P_1 - P_2 = 0$ versus $H_1 : P_1 - P_2 < 0$ at $\alpha = 0.05$, we reject H_0 if

A. $Z_0 < -1.645$.

B. $Z_0 < 1.645$.

C. $|Z_0| > 1.645$.

D. $Z_0 < -1.96$.

E. $|Z_0| > 1.96$.

Q26]... If the dependent variable increases as the independent variable increases in a simple linear regression model, then the coefficient of correlation will be in the range:

A. 0 to 1.

B. -1 to 0.

C. -0.5 to 0.

D. -0.5 to 0.5.

E. We can't tell depend on the information given.

Q27]... The sample correlation coefficient between X and Y is 0.375. It has been found out that the p-value is 0.256 when testing $H_0 : \rho = 0$ versus $H_1 : \rho \neq 0$. To test $H_0 : \rho \leq 0$ versus $H_1 : \rho > 0$ at significance level of 10%, what is the p-value?

A. 0.128.

B. 0.256.

C. 0.512.

D. 0.375.

E. We can't find the p-value depend on the information given.

Q28]... In a simple linear regression model, your estimated slope is equal to 3.2 and the standard error of the slope is 0.5 for a sample of size more than 100. What can be said about the relationship between X and Y?

A. There is a positive linear relationship.

B. There is a negative linear relationship.

C. There is no relationship.

D. There is a negative relationship.

E. We can't say anything depend on the information given.

Q29]... In a simple linear regression model, the coefficient of determination R^2 measures the proportion of variation in Y that is

A. explained by the variation in X.

B. caused by the variation in X.

C. explained by the variation in ϵ.

D. unexplained by the variation in X.

E. None of the choices.

Based on the following information, answer Questions 30 - 35. The data below are the scores of 10 randomly selected students from a statistics class and the number of hours they slept the night before the exam.

Hours, X	3	5	2	8	2	4	4	5	6	3
Scores, Y	65	80	60	88	66	78	85	90	90	71

The estimated regression line is $\hat{Y} = 5.044X + 56.11$ and you are given that $SSE = 318.038$, $S_{xx} = 31.6$, $S_{yy} = 1122.1$, $S_{xy} = 159.4$.

Q30]... Construct a 95% confidence interval about the mean value of the score on the final exam, given $x = 7$ hours.

A. $(82.840, 99.996)$.

B. $(2.458, 7.630)$.

C. $(17.203, 53.413)$.

D. $(74.536, 108.300)$.

E. $(53.524, 58.696)$.

Q31]... What is the estimated residual for the first observation?

A. -6.242.

B. 4.633.

C. -4.633.

D. 0.050.

E. 1.96.

Q32]... For one hour increase in the number of hours slept at night, what is the approximate increase in the mean score?

A. 5.044.

B. 56.11.

C. 6.252.

D. 74.54.

E. 82.84.

Q33]... For testing $H_0 : \beta_1 = 0$ versus $H_1 : \beta_1 \neq 0$, what is the value of the test statistic?

A. 4.497.

B. 0.986.

C. 4.009.

D. 5.115.

E. 1.122.

Q34]... Find the percentage of the variation in the scores Y that is unexplained by the variation in the number of hours X.

A. 0.28.

B. 0.08.

C. 0.93.

D. 0.48.

E. 0.86.

Q35]... Calculate the correlation coefficient between X and Y.

A. 0.85.

B. 0.96.

C. 0.27.

D. 0.72.

E. 0.38.