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

STAT 319: Probability & Statistics for Engineers & Scientists

Final Exam Semester 151
Thursday Dec 24, 2015
12:30 pm to 2:30 pm.

Please encircle your instructor name:

Abbas Al-Sawi Anabosi

Malik Riaz Samouh

Name: ID #: Section #:

Question No	Full Marks	Marks Obtained
1	**10**	
2	**20**	
3	**10**	
4	**10**	
5	**10**	
6	**10**	
Total	**70**	

Q.1: (4+4+2 =10 points)

a. A company employs 800 men under the age of 55. Suppose that 30% carry a marker on the male chromosome that indicates an increased risk for high blood pressure. If 10 men in the company are tested for the marker in this chromosome, what is the probability that exactly 1 man has the marker?

b. An electronics repair shop has determined that the time between failures for a particular electronic component part is exponentially distributed with a mean time between failures of 200 hours. Based on this information, what is the probability that a part will fail in the first 20 hours?

c. There are four hotels in a town. Three men check into hotels in the town. What is the probability that all three check into the same hotel?

Q.2: (4+2+2+2+5+5 = 20points)

The following table shows the experimental data in a study of the strength of pipes. The response y is the load (in pounds per foot) until the first crack, and the independent variable x is the age of the pipe (in days). We collected sample data on nine randomly chosen pipes and obtained the following information:

$\sum_{i=1}^{9} x_i = 228$, $\sum_{i=1}^{9} x_i^2 = 5958$, $\sum_{i=1}^{9} y_i = 93762$, $\sum_{i=1}^{9} y_i^2 = 982337764$, $\sum_{i=1}^{9} x_i y_i = 2348190$

Using this sample information, do the following:

a. Fit a linear regression model to the data above.

b. Estimate the error variance.

c. What assumptions do you need to fit a linear regression model?

d. Compute the coefficient of determination and interpret it.

e. Is there evidence that older pipes need less load until they crack?

f. Using a 99% confidence interval, estimate the mean load (in pounds per foot) until the first crack, if the age of the pipe (in days) is 30.

Q.3:- (5+1+2+2 = 10 points)

A manufacturer of video display units is testing two microcircuit designs to determine whether they produce equivalent current flow. Development engineering has obtained the following data:

Design 1	$n_1 = 25$	$\bar{x}_1 = 23.5$	$s_1^2 = 12$
Design 2	$n_2 = 20$	$\bar{x}_2 = 24.4$	$s_2^2 = 18$

(Assume that the $\sigma_1^2 = \sigma_2^2 = \sigma^2$ and the data are drawn from normal populations.)

a. Calculate a 96% confidence interval for the difference between means of these two designs. Also interpret your results.

b. Write the value of the standard error used in part (a).

c. What is the value for the margin of error in part (a).

d. Determine whether there is any difference in the mean current flow between the two designs. Use the interval obtained in part (a) to answer this part.

Q.4:- (6+3+1= 10 points)

Two suppliers manufacture a plastic gear used in a laser printer. The impact strength of these gears measured in foot-pounds is an important characteristic. A random sample of $n_1 = 32$ gears from the first supplier results in $\overline{x}_1 = 290$ and $S_1 = 12$, while another random sample of $n_2 = 36$ gears from the second supplier results in $\overline{x}_2 = 321$ and $S_2 = 22$.

a. Test the claim that the mean impact strength of gears from supplier 2 is more than 23 foot-pounds higher than that of supplier 1. Clearly state your hypotheses, test statistics, critical values and your final conclusions. Use 4% level of significance to test the hypothesis (using critical-value approach).

b. Compute the p-value for part (a) and verify your conclusions using p-value approach.

c. What assumptions do you need to perform testing in part (a)**?**

Q.5:- (3+3+4= 10 points)

a. Interpret the following numbers.

i. r = - 0.87

ii. $\beta_1 = 0.94$

iii. $\sigma = 2.4$

b. Write T if the statement is true and F if it is false.

i. A parameter, like μ, is constant that describes certain characteristic of a sample.

ii. The median is highly affected by extreme values.

iii. The mode is a measure of variability.

iv. If the original units in a data set are (linear) inches, then the standard deviation of the set is expressed in square inches.

v. According to the "Empirical rule", which applies to bell-shaped distributions, at least 90 percent of the observations in a data set fall within two standard deviations of the mean.

vi. The third quartile of a population or distribution corresponds to the 30th percentile of the distribution.

c. Write "Free" if the measure is free from the units of measurement, otherwise write "Not-Free"

Measures	**Free/Not-Free**
Mean	
Standard Deviation	
Percentiles	
Slope Coefficient (β_1)	
Z-Score	
Co-efficient of Determination	
Coefficient of correlation	
Co-efficient of Variation	

Q.6:- (4+6= 10 points)

A company manufactures tube light rods for household use. The length of the tube rods (in meters) is assumed to follow $N(\mu = 1, \sigma^2 = 0.01^2)$. Any manufactured tube rod is declared defective if its length is less than 0.98 m or greater than 1.02 m.

a. If a random sample of size 10 rods is selected, what is the probability that the mean length is less than 1.01 meter?

b. Suppose KFUPM bought a shipment of 1000 tube rods, what is the probability that at least 940 rods are non-defective?