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

STAT 319: PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS

Final Examination, Term 121

TIME: 0800 am to 1030 am, Saturday, 5th January, 2013 Exhb-A

Please Check/circle the name of your instructor; Write clearly your name, ID, and section number.

Check Section # / Serial # in the top left corner ID#

Name in Capital Letters:

Instructors: □ Anabosi □Joarder
□ Malik □ Sharabati

You are allowed to use electronic calculators and other reasonable writing accessories that help write the exam. Try to define events, formulate problem and solve.

Do not keep your **mobile** with you during the exam, turn off your mobile and leave it aside.

No	Marks	Marks Obtained	Strengths and Weakness Observed
1	11		
2	4		
3	3		
4	3		
5	23		
6	27		
7	14		
8	18		
Total	103		

Kindly report grade out of 30 so that students know his precise standing.

1. [11 Marks] A fiber spinning process currently produces a fiber whose strength is normally distributed with a mean of μ N/m^2. The minimum acceptable strength is 65 N/m^2.

a. [3 Marks] If the fiber strength has a normal distribution with 75 N/m^2 and standard deviation 5 N/m^2, determine the 1st percentile.

b. [4 Marks] 10% of the fiber produced by the current method fails to meet the minimum specification. What is the standard deviation of fiber strengths in the current process if $\mu = 75$.?

c. [4 Marks] If the standard deviation is 5 N/m^2, to what value must the mean be set so that only 1% of the fiber will fail to meet the specification?

2. [4 Marks] A company claims that its chocolate chip cookies have, on the average, 16 chocolate chips in each cookie. Assume that a Poisson random variable with mean 16 is the appropriate model for the number of chips in a cookie. What is the probability that in a sample of 3 cookies, there will be exactly 10 chips?

3. [2+1 = 3 Marks] Consider a t-distribution with 20 degrees of freedom.
a. Determine its 99^{th} percentile.
b. Determine its median.

4. [3 Marks] What is the minimum sample size needed to estimate the proportion of the under filled bottles of mineral water within an error of 0.1 and a confidence level of 97%?

5. [8+ 12+3=23 Marks] Two types of engine fuel were compared in terms of the number of miles driven per one gallon of fuel (mileage). Twelve vehicles were randomly selected and the mileages were recorded by the two types of fuel.

Type A	20	21	27	31	29	22	32	24	28	26	25	23
Type B	16	18	22	29	26	20	30	23	24	27	19	17

a. [8 Marks] Determine, by a 95% confidence interval, the confidence interval of the difference between the mileages of the two types of fuels.

b. [12 Marks] Test, at 5% level of significance, that type B has less mileage, on the average, than type A.

c. [3 Marks] If each of sample sizes were increased to 30, how would you modify your method of test in part (b). Describe only.

6. [27 Marks] A machine produces metal rods used in an automobile suspension system. A random sample of 10 rods is selected, and the diameter is measured. The resulting data (in millimeters) are as follows:

8.24	8.25	8.20	8.23	8.24
8.23	8.19	8.23	8.28	8.24

a. [8 Marks] Find a 95% confidence interval on mean rod diameter.
b. [12 Marks] Is there evidence that the mean yield is not 8.22 mm? Use 0.05 level of significance.
c. [3 Marks] What is the *P*-value for the test in part (b) if true standard deviation of diameters were 0.025?
d. [4 Marks] What is the probability that mean diameter of the rods of sample size 10 exceeds 8.233 millimeters?) Assume that true standard deviation of diameters is 0.025? Compare this probability with that obtained in part (c).

7. [14 Marks] The following sample observations have been obtained by a chemical engineer investigating the relationship between the weight of final product, y, in pounds, and the volume of raw materials, x, in gallons:

x	14	23	9	17	10	22	5	12	6	16
y	68	105	40	79	81	95	31	72	45	93

where $\sum x = 134,\ \sum y = 709,\ \sum x^2 = 2140,\ \sum y^2 = 55895,\ \sum xy = 10747,$

$s_{xx} = 1412.5,\quad s_{yy} = 1812.4\ ,\quad s_{xy} = -1272.5,\quad SSE \approx 666.023895.$

a. [4 Marks] Calculate the least squares estimates for the regression equation.

b. [1+1 =2 Marks] Draw the regression line. Find the error in estimating the product weight if the materials volume is 16 gallons, and show it in your graph.

c. [8 Marks] Using a 95% confidence level, estimate an observation of the product weight if the materials volume is 16 gallons.

8. [18 Marks] A candy bar manufacturer is interested in trying to estimate how sales are influenced by the price of their product. To do this, the company randomly chooses 6 small cities and offers the candy bar at different prices. Using candy bar sales as the dependent variable, the company will conduct a simple linear regression on the data below:

City	Price ($)	Sales
River Falls	1.30	100
Hudson	1.60	90
Ellsworth	1.80	90
Prescott	2.00	40
Rock Elm	2.40	38
Stillwater	2.90	32

a. [2+1=3 Marks] Construct a scatter plot of the above sample. Do you recommend fitting a simple linear regression model?
b. [1+2=3 Marks] Calculate the amount of linear correlation and explain it.
c. [12 Marks] Test that the higher the price, the less is the amount of sales. Is your decision compatible with part (a) and (b)?