KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
Term 111

STAT 319: PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS

FINAL EXAM Wednesday January 11, 2012

Please check/circle your instructor's name

□ Anabosi □ Joarder □ Muttlak

□ Riaz □ Alsawi □ Al-Sabah.

Name: _____ ID #: _____

☺ Important Note:

Show all your work including formulas, intermediate steps and final answer.

Question No	Full Marks	Marks Obtained
1	6	
2	5	
3	4	
4	12	
5	14	
6	6	
7	6	
8	17	
Total	70	

1) A box of 500 rivets contains good rivets as well as rivets with defects summarized below.
   i) 30 rivets with type A defect
   ii) 15 rivets with type B defect
   iii) 4 rivets with type A and type B defects

A rivet is chosen at random, answer the following:

a) If a rivet with a type A defect is obtained, what is the probability that this rivet also has a type B defect? *(2 pts.)*
b) What is the probability that it has type A defect only? *(2 pts.)*
c) What is the probability that it is not defective? *(2 pts.)*

2) Suppose that a box contains 10% defective microchips. A purchaser decides to select 5 microchips one after another without replacement. Assume that the box has 30 microchips.
   a) What is the probability that two microchips in the sample will be defective? *(3 pts.)*
   b) What is the probability that the first two microchips in the sample will be defective and the last three will be good? *(2 pts.)*

3) The average life of a compressor is 10 years with a standard deviation of 1 year. The manufacturer replaces free all compressors that fail while under guarantee. If they are willing to replace only 3% of all the compressors sold, how long a guarantee should they offer? Assume lives of the compressors follow a normal distribution. *(4 pts.)*

4) The following sample data represent the gasoline mileages (in miles per gallon) determined for cars in a particular weight class:

25	25	26	26	27	27	27	27	28	28	28
28	29	29	29	29	29	30	30	30	30	31
31	31	32								

Use $\sum x_i = 712, \quad \sum x_i^2 = 20366$

a) Does this data set satisfy the empirical rule? Explain. *(5 pts.)*
b) Test the hypothesis that the mean mileage is 28 miles per gallon. *(5 pts.)*
c) What can you say about the test in b) given the conclusion of part a)? *(2 pts.)*

5) To evaluate the effect of computers in engineering education, two groups of 35 students each were randomly selected and the following information were obtained on their GPA

	Group A (With computers)	Group B (Without computers)
Group size	35	35
Group mean	3.38	3.26
Group variance	0.2209	0.2116

a) Estimate the difference in the mean GPA with a 94% confidence interval. *(3 pts.)*

b) In part a) above, do you need any assumptions? If yes, what? *(1 pt.)*

c) Based on the interval in a) above, do you think there is a difference between the two methods? Explain. *(2 pts.)*

d) At the 6% significance level test the claim that computer usage in education improves the GPA. *(4 pts.)*

e) What is the smallest significance level at which you will reject the hypothesis in d)? *(2 pts.)*

f) Can you test the hypothesis in d) using the interval found in a)? Explain *(2 pts.)*

6) A company that manufactures computer chips finds that 8% of all chips manufactured are defective. Management is concerned that untrained employees are partially responsible for the high defect rate. In an effort to decrease the percentage of defective chips, management decides to provide additional training to those employees hired within the last year. After training was implemented, a sample of 450 chips revealed only 27 defects. Was the additional training effective in lowering the defect rate? Test at the 1% significance level? *(6 pts.)*

7) In a study of material costs, a random sample of 50 cases of a particular model had a mean of SR 973.25 and a standard deviation of SR 72.5.
   a) What is the probability that an error of no more than SR 10 is made when estimating the true mean material cost of this model by SR973.25? *(3 pts.)*
   b) How many cases should you sample to be able to assert with a probability of 0.95 that the sample mean will be within SR 10 of the true mean? *(3 pts.)*

8) 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

$\sum x_i = 134, \quad \sum y_i = 709, \quad \sum x_i^2 = 2140, \quad \sum y_i^2 = 55895, \quad \sum x_i y_i = 10747$

a) Find the regression line. *(4 pts.)*

b) Estimate the error variance. *(2 pts.)*

c) Estimate the final product weight and the error if the materials volume is 16 gallons. *(2 pts.)*

d) Using a 99% confidence level, estimate the mean product weight if the materials volume is 16 gallons. *(3 pts.)*

e) Calculate the coefficient of determination for regressing the final product weight on the raw materials volume and interpret it. *(2 pts.)*

f) If the chemical engineer thinks that there is no significant linear relation between the final product weight and the raw materials volume. At the 5% significance level, do the data support his thought? *(4 pts.)*