

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

STAT 319: PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS

Final Exam, Term 112
Time: 7.00- 9.45 p.m., Monday May 21, 2012

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

Instructors:

- Anabosi Al-Sabah. Joarder
 Muttlak Riaz

Student Surname: _____ **ID#** _____ **Section #** _____

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. See example below.

Example Q:

(3pts) Find the **Area** of a rectangle with perimeter of 30 units and length of 8 units.

Example Answer with grading point scheme.

Perimeter = $2(l + w) = 30 \rightarrow l + w = 15$ (1 pt)

Length = $l = 8 \rightarrow w = 15 - l = 7$ (1pt)

\Rightarrow Area = $l \cdot w = 8 \cdot 7 = 56 \text{ unit}^2$. (1 pt)

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

Question No	Full Marks	Marks Obtained
1	10	
2	16	
3	10	
4	10	
5	10	
6	10	
7	19	
Total	85	

Note: You may assume $\alpha = 0.05$ for testing if not otherwise stated.

Q2. (4x4=16). Answer the following problems:

I. Extensive experience with fans of a certain type used in diesel engines has suggested that the exponential distribution provides a good model for time until failure. Suppose the mean time until failure is 3 years. What is the probability that the lifetime of a fan exceeds 3 years?

II. An assembly line is out of control with 20% of the items produced being independently defective, what is the probability that two successive items are defective?

III. A purchaser of electrical components buys them in lots of size 10. It his policy to inspect 3 components randomly from a lot to accept the lot only if all 3 are non-defective. If there are two defective items in each lot, what proportion of lots does the purchaser reject?

IV. The thickness of certain electronic components is normally distributed with the mean of 10 mm and standard deviation 1mm. Find the median for the thickness of these electronic components.

Q3. (7+1+2=10) The following sample data were obtained for the curing time, in hours, of an experimental adhesive,

31.5 28.7 42.5 39.3 29.8 31.0 36.3 33.4 35.5 37.2

a. Construct a 98% confidence interval for the mean curing time of the adhesive.

b. Interpret the interval obtained in (a).

c. Use this confidence interval to test the claim that the mean curing time is not equal to 35, at 2% significance level.

Q4. (7+3=10) Records indicate that of all vehicles undergoing emissions testing during the previous year, 70% passed on the first try. A random sample of 200 cars tested in a particular county during the current year yields 160 that passed on the first try.

a. Does this suggest that the true proportion for this county during the current year is larger than the previous proportion? Report your p-value.

b. Determine the sample size to estimate proportion of all vehicles to within $\pm 3\%$ with 95% confidence level.

Q5. (8+2=10) Fifteen specimens of a new computer chip were tested for speed in a certain application, along with 15 specimens of chips with the old design. The average speed, in MHz, for the new chips was 495.6, and the standard deviation was 19.4. The average speed for the old chips was 481.2, and the standard deviation was 14.3.

a. Can you conclude that the mean speed for the new chips is greater than that of the old chips? State the appropriate null and alternate hypotheses, test statistics, decision and final recommendation.

b. What assumptions you have made for part(a)?

Q6. (7+3=10) A random sample of 100 automobile owners shows that, an automobile is driven on the average 23,500 kilometers per year with a standard deviation of 3900 kilometers. Assume the distribution of measurements to be normal.

a. Construct a 99% confidence interval for the average number of kilometers an automobile is driven. Also interpret this confidence interval in the context of the given problem

b. What can we assert with 99% confidence about the possible size of our error if we estimate the average number of kilometers driven to be 23,500 kilometers per year?

Q.7 (3+2+3+5+6 =19) The tensile strength (Y) of a paper product is related to the amount of hardwood in the pulp (X). Ten samples are produced in the pilot plant, and the data obtained are shown in the following table.

x	10	15	15	20	20	20	25	25	28	30
y	160	171	175	182	184	181	186	193	195	200

where $\sum x_i = 208$, $\sum y_i = 1827$, $\sum x_i^2 = 4684$, $\sum y_i^2 = 335077$, $\sum x_i y_i = 38665$

a. Calculate the least squares estimates for the regression equation tensile relating strength to percent hardwood.

b. Find the error in estimating the tensile strength if the percent hardwood is 20.

c. Calculate the coefficient of determination for regressing tensile strength to percent hardwood, and explain it.

d. Using a 99% confidence level, estimate a future tensile strength if the percent hardwood is 16.

e. If the engineer thinks: the higher the percent hardwood, the more the tensile strength. Do the data support his thought at 5% level of significance?