

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

STAT 319: PROBABILITY & STATISTICS FOR ENGINEERS & SCIENTISTS

FINAL EXAM, Semester 052  
 Time: 7.30- 10.00 a.m., Jun 04, 2006

1. *Please CIRCLE the name of your instructor; Write CLEARLY your name and Section Number. Not doing so will cost you ONE mark each.*
2. *Do not keep mobile with you during the exam, turn off and leave it aside.*
3. *Keep your answers to at least 4 decimal places.*
4. *Check that the exam paper has 7 questions and 7 pages.*

Instructors:

Musawar Malik,  
 Ibrahim Rahimov,  
 Anwar Joarder.

Student Surname:

ID#

Section #

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Question No	Full Marks	Marks Obtained
1	5	
2	5	
3	8	
4	7	
5	10	
6	10	
7	5	
Total	50	

**Q1. (marks 5).** Suppose that in a lunar rocket flight, each midcourse-correction thruster has a probability of 0.70 of working and the rocket has 4 thrusters that work independently. What is the probability that at least 2 of the thrusters are working?

**Q2. (marks 2+3).** The reading given by a thermometer calibrated in ice water (actual temperature  $0^{\circ}C$ ) is a random variable with probability density function

$$f(x) = \begin{cases} k(1-x^2), & -1 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$

**a)** Find the constant  $k$ .

**b)** What is the probability that the thermometer reads above  $0^{\circ}C$ ?

**Q3. (marks 5+3).**

- a) An electric scale gives a reading equal to the true weight plus a random error that is normally distributed with mean 0 and standard deviation 0.10. Suppose that the results of five successive weightings of the same object are: 3.112, 3.136, 3.151, 3.105, 3.114. Determine a 95% confidence interval estimate of the true weight.

- b) **(This part has no any relationship with part a)).** A sample is used to obtain a 95% confidence interval for the mean of a population. The confidence interval goes from 15 to 19. If the same sample had been used to test the null hypothesis that the mean of the population is equal to 20 versus the alternative hypothesis that the mean of the population differs from 20, would you accept or reject the null hypothesis at a level of significance of 0.05? Why?

**Q4. (marks 5+2).** The manufacturer of a new fiberglass tire claims that its average life will be at least 40000 miles. To verify this claim, a sample of 12 tires is tested, with their lifetimes (in 1000s of miles) being as follows:

36.1, 40.2, 33.8, 38.5, 42, 35.8, 37, 41, 36.8, 37.2, 33, 36

**a)** Test the manufacturer's claim at the 5% level of significance.

**b)** Do you have strong evidence to reject null hypothesis? For which significance levels you would accept null hypothesis?

**Q5.** The Sergio Lumber Company manufactures plywood. One step in the process is the one where the veneer is dried by passing through a huge dryer (similar to an oven) where much of the moisture in the veneer is extracted. At the end of this step, samples of veneer are tested for moisture content. The company claims that pine veneer will be less moist on average than will fir veneer. The following data were reported recently where the values represent the percent moisture in the wood:

Pine	13.1	10.2	14.7	17.8	17.6	19.2	7.4	13.3	17.3	10.7
Fir	19.8	13.5	20.3	20.5	21.4	23.4	14.6	18.8		

Use the following summary statistics:  $\sum x = 141.3$ ,  $\sum x^2 = 2132.41$ ;

$\sum y = 152.3$ ,  $\sum y^2 = 2978.75$

a. (marks 2). Write hypothesis to the problem.

b. (marks 4). Determine decision rule (RR) for the significance level 0.05.

c. (marks 4). Assuming that the populations are normally distributed and the populations have equal variances, find the value of the test statistic and make decision.

**Q6.** An individual claims that the fuel consumption of his automobile does not depend on how fast the car is driven. To test the plausibility of this hypothesis, the car was tested at various speeds between 45 and 70 miles per hour. The miles per gallon attained at each of these speeds was determined, with the following data resulting

Speed	45	50	55	60	65	70	75
Miles per gall	24.2	25.0	23.3	22.0	21.5	20.6	19.8

Some summary statistics:  $s_{xx} = 700$ ,  $s_{yy} = 21.757$ ,  $s_{xy} = -119$ .

a. (marks 2). Do these data refute the claim that the mileage per gallon of gas is unaffected by the speed at which the car is being driven?

b. (marks 5). Fit a regression line to the data.

c. (marks 3). Estimate the mean mileage per gallon by a 95% confidence interval if the speed of the car is 60.

**Q7. (marks 3+2).** Following are measurements of tensile strength in ksi ( $x$ ) and Brinell hardness ( $y$ ) for 5 specimens of cold drawn copper.

$x$	106	106	107	105	104
$y$	38	40	41	38	40

- a. Calculate coefficient of correlation and coefficient of determination.
- b. Explain the above quantities.