

National University of Computer and Emerging Sciences, Lahore Campus



Course: Probability & Statistics
 Program: BS Computer Science
 Duration: 3 hour
 Paper Date: December 22, 2017
 Section: All
 Exam: Final

Course Code: MT206
 Semester: Fall-17
 Total Marks: 50
 Weight: 50%
 Page(s): 02
 Roll No: [scribbled]
 Section: [scribbled]

Instruction/Notes: Attempt all questions.
 Formula Sheet is allowed.
 Exchange of calculators and stationary is strictly prohibited. Attempt parts of same question together. If you think some information is missing or wrong make assumptions and clearly state them.

✓ **Question 1: (6 marks)** In FAST University in the class of 100 CS students, 54 studied Sociology, 69 studied Image processing, and 35 studied both Sociology and Image Processing. If one of these students is selected at random, find the probability that

- (a) The student took sociology or image processing. *SU IP*
 (b) The student did not take either of these subjects. *S' ∩ IP', (S ∩ IP)'*
 (c) The student took image processing but not sociology. *IP ∩ S'*

✓ **Question 2: (5 marks)** Arrivals to a bank automated teller machine (ATM) are distributed according to a Poisson distribution with a mean equal to three per 15 minutes.

- a) Determine the probability that in a given 15-minute segment no customers will arrive at the ATM.
 b) What is the probability that fewer than four customers will arrive in a 30-minute segment?

✓ **Question 3: (6 marks)** A rocket motor is manufactured by bonding an igniter propellant and a sustainer propellant together inside a metal housing. The shear strength of the bond between the two types of propellant is an important quality characteristic. It is suspected that the shear strength is related to the age in weeks of the batch of sustainer propellant. Eight observations on shear strength and age are shown in the table below

$$\hat{y} = b_0 + b_1 x$$

Shear Strength (psi) y	2158.7	1678.2	2316.0	2061.3	2207.5	1708.3	1784.7	2575.0
Age of Propellant (weeks) x	15.5	23.8	8.0	17.0	5.5	19.0	24.0	2.5

- a) Estimate the linear regression line.
 b) Predict the shear strength when age of propellant = 6.00 and calculate the error.

$$e = y - \hat{y}$$

Question 4: (5 marks) It is known that screws produced by a certain company will be defective with probability 0.01, independently of each other. The company sells the screws in packages of 10 and offers a money-back guarantee that at most 1 of the 10 screw is defective. What proportion of packages sold must the company replace?

$$X < 1$$

$$p = 0.01$$

$$n = 10$$

$$\hat{p} = \frac{p}{n}$$

$$np$$

$$p = P(\text{Success})$$

$$\hat{p} =$$

$$1/7$$

Question 5: (6 marks) Entry to Fast University is determined by a national test. The scores on this test are normally distributed with a mean of 500 and a standard deviation of 100.

- If Maida wants to be admitted to this university and she knows that she must score better than at least 70% of the students who took the test. Maida takes the test and scores 585. Will she be admitted to this university?
- Maida is told that 10% of the students taking the test have higher scores than she does? What was Maida's score?
- What percentage of students taking this test will have scores below 300?

Question 6: (8 marks) Samples of two types of cord have breaking strengths in pounds as shown.

Type-1:	28	26	20	24	22
Type-2:	22	18	16	14	20

- On the basis of the 01% level, test if is type-1 is significantly better than type-2? Assuming the population variances are equal.
- Construct the 99% confidence interval for the mean difference, assuming the population variances are equal.

Question 7: (6 marks) A university has found over the years that out of all the students who are offered admission, the proportion who accept is .70. After a new director of admissions is hired, the university wants to check if the proportion of students accepting has increased significantly. Suppose they offer admission to 1200 students and 888 accept. Is this evidence at the 5% level of significance that there has been a significant increase in proportion of students accepting admission? Use P.value in your conclusion.

Question 8: (8 marks) Suppose that a radioactive particle is randomly located in a square with sides of unit length. That is, if two regions within the unit square and of equal area are considered, the particle is equally likely to be in either region. Let Y_1 and Y_2 denote the coordinates of the particle's location. A reasonable model for the relative frequency histogram for Y_1 and Y_2 is the bivariate analogue of the univariate uniform density function

$$f(y_1, y_2) = 1, \quad 0 \leq y_1 \leq 1, 0 \leq y_2 \leq 1$$

- Find (Cumulative Density Function) $F(0.2, 0.4)$
- Find $P(0.1 \leq Y_1 \leq 0.3, 0 \leq Y_2 \leq 0.5)$
- Find $Var(Y_1 + 2Y_2)$