

ID.No./Seat No. 07E102



MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY,  
JAMSHORO.

SECOND TERM SECOND YEAR (4<sup>TH</sup> TERM) B.E.(ELECTRICAL) REGULAR  
EXAMINATION 2008 OF 07-BATCH

STATISTICAL METHODS AND ESTIMATION

Dated: 07-12-2008. Time Allowed: 03 Hours. Max.Marks 80

NOTE: ATTEMPT ANY FIVE QUESTIONS.

Q.No. Marks

Q1 (a) Define descriptive and inferential statistics. Give its importance and uses in the field of Electrical Engineering. (6)

(b) The following data represent the length of life, in seconds, of 40 fruit flies subject to a new spray in controlled laboratory experiment: (10)

66<sup>v</sup> 79<sup>v</sup> 60<sup>v</sup> 81<sup>v</sup> 82<sup>v</sup> 60<sup>v</sup> 76<sup>v</sup> 90<sup>v</sup>  
70<sup>v</sup> 81<sup>v</sup> 74<sup>v</sup> 72<sup>v</sup> 86<sup>v</sup> 82<sup>v</sup> 87<sup>v</sup> 83<sup>v</sup>  
71<sup>v</sup> 68<sup>v</sup> 65<sup>v</sup> 72<sup>v</sup> 93<sup>v</sup> 79<sup>v</sup> 54<sup>v</sup> 75<sup>v</sup>  
82<sup>v</sup> 50<sup>v</sup> 94<sup>v</sup> 57<sup>v</sup> 64<sup>v</sup> 85<sup>v</sup> 71<sup>v</sup> 80<sup>v</sup>  
66<sup>v</sup> 85<sup>v</sup> 79<sup>v</sup> 81<sup>v</sup> 62<sup>v</sup> 76<sup>v</sup> 82<sup>v</sup> 80<sup>v</sup>

Set up a relative frequency distribution table for the above data. Also draw Histogram and frequency polygon.

Q2: What are the different measures of location and measures of variability? Find the Mean, Median and Co-efficient of variation of Q # 01 (b). (16)

Q3 (a): What is meant by Conditional Probability for dependent events? There are 272 employees in an organization. 180 employees are graduates and 95 are females and 145 graduates are males. What is the probability that a randomly selected employee is a (8)  
(i) Graduate and female? (ii) Male and not graduate?

(b): State and prove Baye's theorem. 20% of male workers and 40% of female workers of an organization are readers of a magazine. Male workers of the organization are 70%. A randomly selected worker is found to be a reader of the magazine. What is the probability that he is a male? (8)

Q4 (a): What do you know about continuous random variable and its probability density function? The life time in hours of a battery cell is known to have the density function: (7)

$$f(x) = \begin{cases} \frac{1}{100} e^{-x/100}, & x \geq 0 \\ 0, & \text{otherwise} \end{cases}$$

Find the probability that a battery cell will last more than 150 hours?

(b): Two refills for a ballpoint pen are selected at random from a box that contains 3 blue refills, 2 red refills and 3 green refills. If X is the number of blue refills and Y is the number of red refills selected, find (i) the joint probability function f(x, y) and (ii) P[(X, Y) ∈ A], where A is the region {(x, y) / x + y ≤ 1}. (9)

Cont'd on P/2....

$\mu = 3$   
 $\sigma^2 = 0.25$

05 (a): Define Binomial and Poisson distribution and also prove that both are the probability distributions. (08)

(b): A certain type of storage battery lasts on the average of 3 years with a standard deviation of 0.5 year. Assuming that the battery lives are normally distributed, what will be the minimum life of batteries having highest 15% lives? Draw the normal curve. (08)

06 (a): Define Sampling and discuss its advantages. What do you mean by sampling with and without replacement?  
If the size of a sample is 64 and standard error of mean is 1.5, then what should be the sample size if standard reduced to 0.6? (09)

(b): State Central Limit Theorem. An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a random sample of 16 bulbs will have an average life of length 775 hours. (07)

07 (a): A manufacturer of car batteries claims that the batteries will last, on the average of 3 years with a variance of 1 year. If 5 of these batteries have life times of 1.9, 2.4, 3.0, 3.5 and 4.2 years, construct a 95% confidence interval for  $\sigma^2$  and decide if the manufacturer's claim that  $\sigma^2 = 1$  is valid. Assume that the population of battery lives to be approximately normally distributed. (07)

(b) A farmer claims that the average yield of wheat of variety - A exceeds the average yield of variety - B by at least 12 bushels per acre. To test this claim, 50 acres of each variety are planted and grown under similar conditions. Variety - A yielded on the average 86.7 bushels per acre with a standard deviation of 6.28 bushels per acre while variety - B yielded on the average 77.8 bushels per acre with a standard deviation of 5.61 bushels per acre. Test the farmer's claim at  $\alpha = 0.01$ . (09)

08 (a): What do you know about goodness of fit test? An admission committee has submitted a report to the principal of a college, claiming that among the freshmen, 20% of the students have shown preference for Pre - Medical, 40% for Pre - Engineering, 25% for Commerce and rest of the freshmen for Arts. Of the 620 freshmen for this year, 98 students declared for Pre - Medical, 300 students went for Pre - Engineering, 182 students preferred Commerce and the rest of the students declared for Arts. Test at  $\alpha = 0.05$ , if this data confirm the claim of the admission committee. (09)

(b): Define Regression and Correlation.  
The following table gives the age of cars of certain make and the annual maintenance costs. Obtain the regression equation for costs related to age. Also predict the maintenance cost, if the age of car is 12 years. (07)

Age of cars in years	2	4	6	8
Maintenance cost in Rs. hundreds	10	20	25	30



MEHRAN UNIVERSITY OF ENGINEERING AND TECHNOLOGY,  
JAMSHORO.

SECOND TERM SECOND YEAR (4<sup>TH</sup> TERM) B.E.(ELECTRICAL) REGULAR  
EXAMINATION 2009 OF 03-BATCH.

STATISTICAL METHODS & ESTIMATION

Dated: 12-12-2009. Time Allowed: 03 Hours. Max.Marks 80

NOTE: ATTEMPT ANY FIVE QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS.

Q.No.

01 (a): Define statistics. Give its important uses in science and engineering. The following data shows the consumptions of electricity in a certain area:

41	33	24	56	49	40	67	55	83	62
169	21	57	43	169	54	76	60	45	77
53	32	36	17	55	35	78	53	28	45
40	41	39	175	23	28	56	28	59	29

Construct the frequency distribution table. Also draw the Histogram and Ogive.

(b): A manufacturing company owns two plants I and II which manufacture the same product. The weekly output of two plants for the past 5 years is as follows:

	Number of weeks	
	Plant - I	Plant - II
11 - 15	10	15
16 - 20	15	20
21 - 25	135	60
26 - 30	65	150
31 - 35	35	15

Which of the two plants gave more stable production during the period?

02 (a): State and prove additive law of probability.

Three manufacturers produce HD in three types. The weekly production level is shown as under.

	Type of HD			Total
	100 GB	200 GB	300 GB	
M1	1000	1500	2000	4500
M2	1500	1000	2500	5000
M3	2500	2500	1000	6000
Total	5000	5000	5500	15,500

A hard disk is chosen at random. What is the probability that either

- it is manufactured by M2 or M3
- it is manufactured by M1 or it was 200 GB hard disk
- it is 200 GB or 300 GB hard disk.

(b): Define conditional probability, dependent events, independent events and mutually exclusive events.

A bag contains 4 white balls and 3 black balls. A second bag contains 2 white balls and 5 black balls. A ball is drawn at random from the 1<sup>st</sup> bag and placed in the 2<sup>nd</sup> bag. Now a ball is drawn from the 2<sup>nd</sup> bag what is the probability that it is a black ball?

03 (a): State Bay's theorem. Police plan to enforce speed limits by using radar traps at 3 different locations within the city limits. The radar traps at each of the locations  $L_1, L_2, L_3$  are operated 35%, 25%, and 30% of the time, and if a person who is speeding on his way to work has probabilities of 0.2, 0.1, and 0.2, respectively, of passing through these locations, what is the probability that he will receive a speeding ticket? Also find the probability that a person passes through the location  $L_2$  given that he has received the speeding ticket.

- 03 (b): Define discrete and continuous random variables. Let X be the random variable denoting the hours of life of an electric bulb. Suppose X is distributed with density function.

$$f(x) = \frac{1}{900} e^{-x/900} \text{ for } x > 0$$

Find the expected life time of such a bulb. Also calculate the variance.

- 04 (a): Let X and Y be independent random variables with joint p.d.f.

$$f(x,y) = \frac{x(1+3y^2)}{4}, 0 < x < 2, 0 < y < 2$$

$$= 0, \text{ else where}$$

Find E(X) and E(Y).

- (b): State Binomial and Poisson distributions. Show that both distributions are probability distributions.

- 05 (a): Let X have a binomial distribution with

$$n=4 \text{ and } p = \frac{2}{5}. \text{ Find } P(X=1), P(X=\frac{5}{2}), P(X=5) \text{ and } P(X \leq 2).$$

$$P(2 < X < 5)$$

- (b): Discuss briefly the main features of "Normal Distribution". An Electric wires produced by some company for use in a certain systems has a normal distribution with a mean resistance of 0.13 ohms and standard deviation of 0.06 ohms. What is the probability that a randomly selected wires will have a resistance (i) between 0.10 and 0.16 ohms and (ii) greater than 0.2 ohms?

$$X > 0.2$$

- 06 (a): An electric company manufactures capacitors that have a mean capacitance of 1.5 farads and standard deviation of 0.12 farads. The distribution of capacitance is approximately normal. Find the probability that a random sample of 36 capacitors will have an average resistance (i) less than 1.65 farads (ii) greater than 1.3 farads?

- (b): Define type I & type II errors. Ten independent readings of the voltage of the cell were taken and the results were as follows 1.16, 1.13, 1.14, 1.17, 1.12, 1.15, 1.11, 1.09, 1.13 and 1.11. Calculate 95% confidence interval for the voltage of a cell assuming that the population is normal.

- 07 (a): A manufacturer of TV tubes has for many years used a process giving mean tube life of 4800 hours and standard deviation of 460 hours. A new process is tried to see if it will increase the life significantly. A sample of 250 new tubes gave a mean life of 5000 hours. Is the new process better than old at 1% level of significance?

- (b): The number of messages sent to a computer bulletin board is hypothesized to follow a Poisson distribution. A random sample of 60 bulletin boards has been collected and the following number of messages is observed:

No. of messages	0	1	2	3
Observed Freq:	25	18	11	6

Fit a Poisson distribution and determine the goodness of fit.

- 08: Define Regression, Correlation and Coefficient of determination.

A central heating fuel distributor records the following sales of fuel oil (000s. of liters) over 10 winter weeks along with the average temperature( $^{\circ}$ C) for each week.

Week	1	2	3	4	5	6	7	8	9	10
Fuel oil sales(000s of liters)	26	17	7	12	30	40	20	15	10	5
Average temperature	15	10	14	12	6	4	8	11	13	15

- (a) Compute the best fit regression between fuel oil sales and temperature, assuming that fuel oil sales are dependent on temperature.  
 (b) Test the significance of the regression coefficient b, at 5% level of significance  
 (c) What is the degree of correlation between sales and temperatures?  
 (d) What fuel oil sales would be expected if the temperature rose to 16  $^{\circ}$ C?