Seat No. : _____

AI-104

April-2025

Int. M.Sc., (CA & IT) Sem.-VIII

QUANTITATIVE TECHNIQUES

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : 1. Attempt each question on new page.
2. Non-programable scientific calculator and Statistical tables are allowed.

1. (A) A newspaper boy has the following probabilities of selling a magazine : **14**

No. of copies sold	Probability
10	0.10
11	0.15
12	0.20
13	0.25
14	0.30

Cost of a copy is ₹ 3 and sale price is ₹ 5. He can not return unsold copies. How many copies should be ordered for the following criteria ?

(i) EMV Criterion

(ii) EVPI Criterion

(iii) EOL Criterion

OR

(B) A gambler at a horse race is considering placing a bet on a specific horse. There are four possible alternatives and four states of nature with the following pay-offs : **14**

Strategies	States of Nature			
	A wins	B wins	C wins	All lose
Bet A	7	-2	-2	-2
Bet B	3	3	-2	-2
Bet C	2	2	2	-2
Do not bet	0	0	0	0

What decision will be made by gambler for the following criterion ?

(i) Maximax Criterion

(ii) Minimax Criterion

(iii) Maximin Criteria

(iv) Hurwicz Criterion with $\alpha = 0.5$

(v) Savage regret minimax Criterion

(vi) Laplace Criterion

2. Attempt any **TWO** of the following : **14**

(A) Calculate EOQ from the following information. A Ltd. sells 2,25,000 units of a wrist watch per annum. The unit cost per watch is ₹ 1,000. The cost of placing an order is ₹ 500 and carrying cost is 10% of unit price cost. Also, find out the number of orders to be placed per year, the time between two successive orders and the annual inventory cost level.

(B) A product is sold at the rate of 50 pieces per day and is manufactured at the rate of 250 pieces per day. The setup cost of the machines is ₹ 1,000 and the shortage cost is found to be ₹ 0.15 per piece per day. Find the minimum cost batch size. Also, compute the optimal number of orders in a year and cycle time.

(C) The demand for an item in a company is 18,000 units per year, and the company can produce the item at a rate of ₹ 3,000 per month. The cost of one set up is ₹ 500 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is ₹ 20 per month. Determine the optimum manufacturing quantity and the number of shortages. Also, determine the time between set-ups.

3. Attempt any **TWO** of the following : **14**

(A) What are the main components that make up a Queuing System ? How would you explain the concept of "Queue Structure" of a queuing system ? What are the operating characteristics of a queuing system and how do they impact its performance ?

(B) The arrival of aircraft at an international airport tends to follow a Poisson distribution, in spite of schedule flight time, due to high operating variability in the schedule time. It can be assumed that the aircraft arrives at an average rate of 6/hr. The landing service is provided through a single runway by a control tower according to exponential distribution with an average service time of 6 mins/flight.

(i) Find the probability that will be more than 10 mins altogether to wait for landing and to land an aircraft.

(ii) What is the probability that the runway will be free for an incoming flight ?

(iii) What is the waiting time for an incoming flight ?

(iv) What is the average of an incoming flights on airport ?

(C) A television repairman finds that the time spent on his jobs has an exponential distribution with mean of 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets follows a Poisson distribution approximately with an average rate of 10 per 8-hour day

(i) What is the repairman's expected idle time each day ?

(ii) How many jobs are ahead of the average set just brought in ?

4. Attempt any **TWO** of the following : **14**

(A) What is simulation ? Describe the simulation process. State the two major reasons for using simulation to solve a problem. What are the advantages and limitations of simulation ?

(B) A small retailer has studied the weekly receipts and payments over the past 200 weeks and has developed the following set of information :

Weekly Receipts (₹)	**Probability**	**Weekly payment (₹)**	**Probability**
3000	0.20	4000	0.30
5000	0.30	6000	0.40
7000	0.40	8000	0.20
12000	0.10	10,000	0.10

Using the following sequence of random numbers, simulate the weekly pattern of receipts and payments for the 12 weeks of the next quarter, assuming further that the beginning bank balance is ₹ 8,000. What is the estimated balance at the end of the 12-week period ? What is the highest weekly balance during the quarter ? What is the average weekly balance for the quarter ?

Random numbers

For Receipts	03	91	38	55	17	46	32	43	69	72	24	22
For Payments	61	96	30	32	03	88	48	28	88	18	71	99

(C) The Tit-Fit Scientific Laboratories is engaged in producing different types of high-class equipment for use in science laboratories. The company has two different assembly lines to produce its most popular product 'Pressurex'. The processing time for each of the assembly lines is regarded as a random variable and is described by the following distributions :

Process Time	**Assembly A_1**	**Assembly A_2**
10	0.10	0.20
11	0.15	0.40
12	0.40	0.20
13	0.25	0.15
14	0.10	0.05

Using the following random numbers, generate data on the process times for 15 units of the item and compute the expected process time for the product. For the purpose, read the numbers vertically taking the first two digits for the processing time on Assembly A_1 and the last two digits for processing time on Assembly A_2.

41 34	83 43	36 02	75 05	74 28
74 76	11 83	94 45	00 89	34 24
49 43	19 15	54 15	08 80	93 09

5. Attempt any **TWO** of the following : **14**

(A) In the following table are recorded data showing the experience of machine operators and their performance rating as given by the number of good parts turned out per 100 pieces :

Operators	1	2	3	4	5	6	7	8
Experience (years)	16	12	18	4	3	10	5	12
Performance rating	87	88	89	68	78	80	75	82

Obtain the regression equation of performance rating on experience. Use this equation to estimate the probable performance if an operator has 7 years of experience.

(B) What is Seasonal variation ?

The decision-making body of a fertilizer firm producing fertilizers wants to predict future sales trend for the years 2016 and 2018 based on the analysis of its past sales pattern. The sales of the firm for the last 7 years, for this purpose, are given below :

Years	**Sales (in '000 tonnes)**
2008	70
2009	75
2010	90
2011	98
2012	85
2013	91
2014	100

(C) Obtain the least squares regression equation of Y on X from the following Data :

X	89	86	74	65	64	63	66	67	72	79
Y	92	91	84	75	73	72	71	75	78	84

Use the regression equation to forecast values of Y when (i) X = 70 and (ii) X = 85.