

Seat No. : _____

AA-118

April-2018

Fourth Year M.Sc., (CA & IT) Integrated Sem.-VIII

Quantitative Techniques

Time : 3 Hours]

[Max. Marks : 100

1. Answer any **one** : **20**

- (a) A milkman buys milk packets in crates everyday morning. The leftover packets in crates are stored in a refrigerator. The storage process reduces the profit by ₹ 10 per crate. There would be regret of ₹ 5 in case of his purchases falling short of the day's demand. Every crate sold, the milkman earns profit of ₹ 30. Following data are obtained on the actual crates of milk sold for the last 60 days.

Demand (Crate) : 4 5 6 7 8 9 10

Number of days : 6 13 11 10 8 7 5

- (i) Find the optimal number of milk crates to buy.
- (ii) Find EPPI and EVPI.
- (b) A retail store desires to determine the optimal daily order size for a perishable item. The store buys it ₹ 50 per kg and sells at a rate of ₹ 80 per kg. If the order size is more than the demand, excess quantity can be sold at ₹ 65 per kg; opportunity cost for the store is ₹ 10 per kg for the unsatisfied portion of the demand. From the past experience, it is found that demand varies from 50 kg to 200 kg in steps of 50 kg. The possible values of the order size are from 100 kg to 400 kg in steps of 100 kg. Determine the optimal order size by :
- (i) Laplace criteria
- (ii) Maximin criteria
- (iii) Maximax criteria
- (iv) Savage Regret criteria
- (v) Hurwicz criteria ($\alpha = 0.7$)

2. Answer any **two** :

2 × 10 = 20

- (a) Customers arrive at a one-window-drive in bank according to the Poisson distribution with a mean of 10 arrivals per hour. The service time per customer is exponential with a mean of five minutes. The space in front of the window, including the customer being attended, can accommodate a maximum of three cars. Other cars can wait outside this space :
- (i) What is the probability that an arriving customer can move directly to the space in front of the window ?
 - (ii) What is the probability that the arriving customer has to wait outside the designated place ?
 - (iii) How long is an arriving customer expected to wait before availing service ?
- (b) On an average, 20 trucks require repairs each day and arrivals are Poisson distributed. The loss of revenue in terms of opportunity loss estimated to be ₹ 5000 per day for the truck in repair. There are 280 working days. The three facilities are considered with the following characteristics :

	Installation Cost	Labour Cost	Repair rate (trucks per day)	Arrival rate (truck/day)	Economic Life
Facility A :	20,00,000	10,000	30	20	4
Facility B :	40,00,000	15,000	50	20	4
Facility C :	60,00,000	20,000	60	20	4

Determine which facility the company should prefer.

- (c) The company X decides to build a docking facility where one boat at a time can stop for gas and servicing. Arrival of boats follow Poisson distribution with inter arrival time of boats are 12 minutes. Service time follow exponential distribution with 6 minutes per boat. Answer the following :
- (i) What is the probability that there are three boats in the system ?
 - (ii) What is the average number of boats that will be waiting for service ?
 - (iii) What is the average time a boat will spend waiting for service ?
 - (iv) What is the average time a boat will spend at the dock ?

3. Answer any **two** :

2 × 10 = 20

- (a) A wholesaler supplies a particular product to various retailers using EOQ method for ordering. It is observed that this year increase in holding cost 30%, purchase cost is 15% and ordering cost is 20%. Annual demand declined by 10%. What will be the percentage change in order quantity ?
- (b) A company has a demand of 15,000 units per year for an item and it can produce 2000 units per month. Setup cost is ₹ 400 per setup, holding cost per unit per month is ₹ 0.15. Find the optimum lot size and the total cost per year, where cost of each unit is ₹ 4. Also find the maximum inventory, manufacturing time and total cycle time.
- (c) A consumable item has a demand of 12000 units per year. The cost of one procurement is ₹ 200 and the holding cost is ₹ 4 per unit per year. Lead time is 15 days :
- (i) What is the economic lot size ?
 - (ii) The number of orders per year.
 - (iii) The time between orders.
 - (iv) The total cost per year (purchase cost ₹ 2/unit)
 - (v) What is the reorder level ?

4. Answer any **one** :

20

- (a) A company manufactures 30 units of a product everyday. The distribution of the sale is given below :

Sales (unit) : 27 28 29 30 31 32

Probability : 0.1 0.15 0.2 0.35 0.15 0.05

The production cost and sale price of each unit are ₹ 40 and ₹ 50 respectively. Unsold unit is to be disposed at ₹ 25 per unit. There is a penalty of ₹ 5 per unit if the demand is not met. Using the following Random numbers, estimate the total profit of the company in the next ten days.

Random Numbers : 10, 99, 65, 99, 95, 01, 79, 11, 16, 20

If the company decides to produce 29 units per day what is the effect on the profit ?

- (b) Inter arrival and service durations studied over the past few years for a single channel queuing system revealed the following pattern :

Inter arrival time		Service time	
<u>Minutes</u>	<u>Probability</u>	<u>Minutes</u>	<u>Probability</u>
2	0.19	1	0.15
4	0.22	3	0.28
6	0.32	5	0.30
8	0.17	7	0.17
10	0.10	9	0.10

Using the following random number, simulate the queue behaviour for a period of 60 minutes.

Random Number for arrival : 19, 32, 59, 81, 27, 45, 26, 52, 77, 46, 85, 83, 34, 42, 43, 07, 17, 23

Random Number for service : 08, 27, 74, 96, 48, 07, 65, 78, 92, 49, 12, 63, 10, 06, 97, 53, 48, 75

Also estimate :

- The probability of the server being idle.
- The mean time spent by the customer waiting for service.
- The mean time spent by the customer in the system.
- Average length of the queue.

5. Answer any **two** :

2 × 10 = 20

- (a) Fit a straight line trend to the following data on average monthly domestic demand (in millions of barrels) for motor fuel :

Year :	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Demand :	61	66	72	76	82	90	96	100	103	110	114

What is the forecast of demand for the year 2018 ?

- (b) Fit an equation of the form $y = a + bx + cx^2$ to the data given below :

x :	1	2	3	4	5
y :	25	28	33	39	46

- (c) From the given data find the most likely marks of C++, when the marks in C is 30.

Marks in c :	25	28	35	32	31	36	29	38	34	32
Marks in C++ :	43	46	49	41	36	32	31	30	33	39