Seat No. : _______________

AE-156

April-2015

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

Quantitative Technology

Time : 3 Hours] **[Max. Marks : 100**

Instruction : Statistical table will be provided on request.

1. Answer any **two** : **$10 \times 2 = 20$**

(a) A pastry shop makes pastries and sells them at ₹ 30 per dozen in special boxes containing one dozen each. The cost of pastries to the bakery is ₹ 15 per dozen. At the end of the week, the slightly stale pastries are sold off at ₹ 10 per dozen. The salaries, rent and other overhead expenses attributable to the pastry production are ₹ 2 per dozen. Fresh pastries are sold in special box which cost 50 paise each. Stale pastries are wrapped in ordinary paper. The probability distribution of demand for pastries in the past is as follows :

Demand in dozens	:	0	1	2	3	4	5
Probability	:	.02	.15	.18	.5	.1	.05

(i) Construct pay off matrix.

(ii) Compute expected profit.

(iii) What is the optimum stock level ?

(b) A mobile phone dealer finds that the procurement cost of a mobile is ₹ 120 and the cost of one mobile phone shortage is ₹ 450. For one particular model of a mobile phone, the probability distribution of weekly sales is as follows :

Weekly Sales	:	0	1	2	3	4	5	6
Probability	:	.12	.13	.15	.20	.20	.15	.05

How many units per week should the dealer buy ? Also find EVPI.

(c) From the following matrix, the elements of which indicate profits, obtain the decisions using following principles of decision making :

(i) Maximum

(ii) Laplace

(iii) Hurwiez (weight .7)

Action

		A_1	A_2	A_3	A_4	A_5
Event	E_1	26	22	13	22	18
	E_2	26	22	34	30	20
	E_3	18	22	18	18	20
	E_4	22	22	18	18	18

How yours answers in (ii) and (iii) would be different if the matrix represents costs ?

2. Answer any **two** : **10 × 2 = 20**

(a) Derive EOQ formula for the purchase model without shortage.

(b) The demand for an item is 24,000 per year. Its production rate is 4000 per month. The carrying cost is ₹ 0.25/unit/month and the set up cost is ₹ 800 per set up. The shortage cost is ₹ 15/unit/year.

Find :

(i) Economic batch quantity

(ii) Maximum inventory

(iii) Maximum stock out

(iv) Total cycle time

(c) Company X is committed to supply 24,000 bearings per annum to Company Y on a daily basis. It is estimated that it costs 10 paise as inventory holding cost per bearing per month. Set-up cost per run of bearing manufacturing is ₹ 324.

(i) What should be the optimal run size for bearing manufacturer ?

(ii) What should be the interval between two consecutive optimum runs ?

(iii) Find out minimum inventory cost.

3. Answer any **two** : **10 × 2 = 20**

(a) Define the following :

(i) Queue structure

(ii) Queue length

(iii) System length

(iv) Waiting time in the queue

(v) Server idle time

(b) Arrival time of telephone calls at a telephone booth are according to Poisson distribution, with an average time of 9 minutes between two consecutive arrivals. The length of the telephone call is assumed to be exponentially distributed with mean 3 minutes.

(i) Determine the probability that a person arriving at the booth will have to wait.

(ii) Find the average queue length that is formed time to time.

(iii) Find the fraction of a day that the phone will be in use.

(iv) What is the probability that an arrival will have to wait more than 10 minutes before the phone is free.

(c) A repairman is to be hired to repair machines which breakdown at an average rate of 3/hour. The breakdowns follow Poisson distribution. Non-productive time of a machine is considered to cost ₹ 10 per hour. Two repairmen have be interviewed. One charges ₹ 5/hour and services machine at the rate 4/hour. Other demands ₹ 7/hour and services at the rate 6/hour. Which repairman should be hired ?

4. Answer any **two** : **10 × 2 = 20**

(a) Write the advantages and limitations of simulation.

(b) A company manufactures around 200 scooters. Depending upon the availability of raw materials and other conditions the daily production varies from 196 to 204 scooters, whose probability distribution is given below :

Production/day :	196	197	198	199	200	201	202	203	204
Probability :	.05	.09	.12	.14	.20	.15	.11	.08	.06

The finished scooters are transported to a lorry that can accommodate only 200 scooters. Using following random numbers simulate the process to find out :

(i) Average number of scooters waiting in the factory.

(ii) Average number of empty spaces in the lorry.

Random Number : 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54, 10

(c) A dentist schedules all his patients for 30 minutes appointments. Some patients take more or less than 30 minutes depending on the type of dental work to be done :

Category of Service	**Time Required (minutes)**	**Probability**
Filling	45	.40
Crown	60	.15
Cleaning	15	.15
Extraction	45	.10
Check up	15	.20

Simulate the dentists clinic for four hours. Determine the average waiting time of the patient as well as doctor's idle time. Assume all patients show up at the clinic exactly at their scheduled arrival time. Use following sequence of random numbers :

40 82 11 34 25 66 17 79

5. Answer any **two** : **$10 \times 2 = 20$**

(a) A company that manufactures steel observed the production of steel (in metric tonnes) represented by the time series as given below :

Year :	2008	2009	2010	2011	2012	2013	2014
Production of Steel :	60	72	75	65	80	85	95

Find the linear equation that describes the trend in the production of steel by the company. Estimate the production of steel in 2016.

(b) Given the following data :

x_1 :	20	25	15	20	26	24
x_2 :	3.2	6.5	2.0	0.5	4.5	1.5
x_3 :	4.0	5.2	7.5	2.5	3.4	1.5

Obtain the least square equation to predict the value of x_1 from x_2 and x_3. Predict x_1 when $x_2 = 3.2$ and $x_3 = 3.0$

(c) The prices of a commodity during 2009-2014 are given below. Fit a parabola to these data. Estimate the price of the commodity for the year 2016.

Year :	2009	2010	2011	2012	2013	2014
Price :	100	107	128	140	181	192