Seat No. : _____

AG-161

April-2015

M.B.A., IV Year (Integrated)

Quantitative Techniques for Management – II

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

Instructions : (1) Statistical tables will be providing on request.

(2) Non-programmable scientific calculator can be used.

1. Solve following : (any **two**) **20**

(1) A company purchases 10000 items per year for use in its production shop. The unit cost is ₹ 10 per year, holding cost is ₹ 0.80 per month and cost of making a purchase is ₹ 200. Determine the following if no shortages are allowed :

(i) The optimal order quantity

(ii) The no. of orders per year

(iii) The time between orders

(2) The demand for an item in a company is 18000 units per year and the company can produce the item at a rate of 3000 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 year. Determine the optimal manufacturing quantity and the number of shortages. Also determine the manufacturing time and the time between set-ups.

(3) Find the optimal order quantity for a product for which the price breaks are as follows :

Quantity	**Unit cost**
$0 < Q < 500$	₹ 10
$500 \leq Q < 750$	₹ 9.25
$750 \leq Q$	₹ 8.75

The monthly demand for the product is 200 units, storage cost is 2% of the unit cost and cost of ordering is ₹ 100.

2. Solve following : (any **two**) **20**

(1) A book binder has one printing press, one binding machine and one finishing machine and manuscripts of a number of different books. The time required for printing, binding and finishing of each book is known. Determine the order in which the book be presented to minimize the total elapsed time. Also find out the total elapsed time.

(2) A company has recently installed new machinery but has not yet decided on the appropriate number of a certain spare parts required for repairs.

Spare parts cost ₹ 2,000 each but are only available if ordered now. If the plant failed and there was no spare part available, the cost to the business of mending the plant rises to ₹ 15,000. The plant has an estimated life of 10 years and the probability distribution of failures during this time, based on the experience with similar plants, is as follows :

No. of failures over 10 year period :	0	1	2	3	4
Probability :	0.1	0.4	0.3	0.1	0.1

Calculate :

(i) The optimal number of spares that should be purchased now.

(ii) The cost of ordering policy chosen.

(iii) The value of perfect information of the number of failures in ten year life.

(3) The daily demand for the breads in the city can assume one of the following values : 3400, 3600, 3700 and 3800 breads with the probabilities 0.18, 0.12, 0.20 and 0.50. If the stockist stocks more than the need, he can return them at a discount price of ₹ 8 per bread. Assuming that he pays ₹ 8.50 per bread and sells it for ₹ 9.50 per bread, find the optimal stock level by using a decision tree analysis. Also comment on your findings.

3. Solve following : (any **two**) **20**

(1) Workers come to tool store room to receive special tools (required by them) for accomplishing a particular project assigned to them. The average time between two arrivals is 60 seconds and the arrivals are assumed to be in Poisson distribution. The average service time (of the tool room attendant) is 40 seconds. Determine :

(i) Average queue length

(ii) Average no. of workers in system including the worker being attended

(iii) Mean waiting time of an arrival

(2) A dentist schedules all her patients for 30 minutes appointments. Some of the patients take more or less than 30 minutes depending on the type of dental work to be done. The following summary shows the various categories of work, their probabilities and the time needed to complete the work :

Category	**Time required (in minutes)**	**Probability of category**
Filling	45	0.40
Crown	60	0.15
Cleaning	15	0.15
Extraction	45	0.10
Check-up	15	0.20

Simulate the dentist's clinic for four hours and determine the average waiting time for the patient as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival times, starting at 8 a.m. Use the following random numbers for handling the above problem : 40, 82, 11, 34, 25, 66, 17 and 79

(3) An investment corporation wants to study the investment projects based on three factors : market demand in units, price per unit minus cost per unit, and the investment required. These factors are felt to be independent of each other. In analyzing a new consumer product, the corporation estimates the following probability distributions :

Annual demand	**Prob.**	**(Price-cost) per unit (in ₹)**	**Prob.**	**Investment**	**Required probability**
25,000	0.05	3.00	0.10	27,50,000	0.25
30,000	0.10	5.00	0.20	30,00,000	0.50
35,000	0.20	7.00	0.40	35,00,000	0.25
40,000	0.30	9.00	0.20		
45,000	0.20	10.00	0.10		
50,000	0.15				
55,000	0.05				

Using simulation process, repeat the trial 10 times. Compute the return on investment for each trial, taking these factors into account. Approximately, what is the highest likely return ? Use the following random numbers for annual demand, (Price-Cost) and the investment required respectively :

Series : 1	28, 57, 60, 17, 64, 20, 27, 58, 61, 30
Series : 2	19, 07, 90, 02, 57, 28, 29, 83, 58, 41
Series : 3	18, 67, 16, 71, 43, 68, 47, 24, 19, 97

4. Solve following : (any **two**) **20**

(1) A manufacturer is offered two machines A and B. A has cost price ₹ 2,500, its running cost is ₹ 400 for each of the first 5 years and increase by ₹ 100 every subsequent year. Machine B, having same capacity as A, costs ₹ 1,250, has running cost of ₹ 600 for 6 years, increasing by ₹ 100 per year thereafter. If money is worth 10% per year, which machine should be purchased ? Scrap value of both machines is negligibly small.

(2) A company has a machine whose cost is ₹ 30,000. Its maintenance cost and resale value at the end of different years are as given below :

Year	1	2	3	4	5	6
Maintenance Cost (₹)	4,500	4,700	5,000	5,500	6,500	7,500
Resale Value (₹)	27,000	25,300	24,000	21,000	18,000	13,000

What is the economic life of machine and what is the minimum average cost ?

(3) The computer centre at Gujarat University has been experiencing computer down time. Let us assume that the trials of an associated Markov Process are defined as one-hour time period and that the probability of the system being in a running state or a down state is based on the state of the system in the previous period. One cause of the down time was traced to a specific piece of computer hardware. Management believes that switching to a different hardware component will result in the following transition probabilities :

	To	
From	Running	Down
Running	0.95	0.05
Down	0.60	0.40

(i) What are the steady state probabilities of the system being in the running and down states ?

(ii) If the cost of the system being down for any period is estimated to be ₹ 500 (including lost profits for time down and maintenance), what is the breakeven cost for the new hardware component on a time-period basis ?

5. Solve following : (any **two**) **20**

(1) Use the Kruskal-Wallis test to determine whether group 1 through 5 come from different populations. Let $\alpha = 0.01$.

1	2	3	4	5
157	165	219	286	197
188	197	257	243	215
175	204	243	259	235
174	214	231	250	217
201	183	217	279	240
203		2103		233
				213

(2) The data shown represent two random samples gathered from two populations. Is there sufficient evidence in the data to determine whether the values of population 1 are significantly larger than the values of population 2 ? Use Mann-Whitney V test and $\alpha = 0.01$

Sample 1	**Sample 2**
224	203
256	218
231	229
222	230
248	211
283	230
241	209
217	223
240	229
255	236
216	227
	208
	214

(3) Following is the solution of the linear programming problem through spreadsheet.

Minimize $Z = 2x_1 + x_2$

Subject to $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \geq 6$

$x_1 + 2x_2 \leq 4$

$x_1, x_2 \geq 0$

Through computer solution find :

(i) Indicate and interpret shadow prices of the resources.

(ii) Examine the sensitivity of the optimal solution to variation in cost contribution per unit for x_1 and x_2 and also variation in the availability of resources.

Microsoft Excel 12.0 Sensitivity Report :

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$ B $ 12	X1 =	0.6	0	2	1	1E+30
$ B $ 13	X1 =	1.2	0	1	1E+30	0.333333333

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$ F $ 6	1ST USAGE	3	0.4	3	1.5	1
$ F $ 7	2ND USAGE	6	0.2	6	3	2
$ H $ 8	<=AVAILABLE	4	0	4	1E+30	0

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