AD-158

April-2019

4th Years, M.B.A. Integrated, Sem.-VIII, End Sem.

Quantitative Techniques for Management – II

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

Instructions :   (1)   Statistical Tables and Graph papers shall be provided on demand.

(2)   Non-programmable scientific calculators are allowed.

1.   Attempt any **two** :   **14**

(a)   How will you control the inventories of a manufacturing organization ? Discuss the various inventory costs associated with the organization.

(b)   An aircraft company uses rivets at an approximate consumption rate of 2500 kg per year. The rivets cost ₹ 30 per kg and the company personnel estimate that it costs ₹ 130 to place an order and the inventory carrying cost is 10% per year. How frequently should orders for rivets be placed and what quantities should be ordered ?

(c)   A contractor undertakes to supply diesel engines to a truck manufacturer at the rate of 25 per day. He finds that the cost of holding a completed engine in stock is ₹ 16 per month, and there is a clause in the contract penalizing him ₹ 10 per engine per day late for missing the scheduled delivery date. Production of engines is in batches, and each time a new batch is started, there are setup costs of ₹ 10,000. How frequently should batches be started and what should be the initial inventory level at the time each batch is completed ?

2. Attempt any **two** : **14**

(a) Four jobs 1, 2, 3 and 4 are to be processed on each of the four machines A, B, C and D in the order ABCD. The processing times in minutes are given in the following table. Find, for no passing, the minimum elapsed time and idle time for each machine.

Job M/c.	A	B	C	D
1	58	14	14	48
2	30	10	18	32
3	28	12	16	44
4	64	16	12	42

(b) A steel manufacturing company is concerned with the possibility of a strike. It will cost an extra ₹ 20,000 to acquire an adequate stockpile. If there is a strike and the company has not stockpiled, management estimates an additional expense of ₹ 60,000 on account of lost sales. Should the company stockpile or not if it is to use :

(i) Optimistic criterion (minimum criterion)

(ii) Savage criterion

(iii) Hurwicz criterion for $\alpha = 0.4$

(iv) Laplace criterion

(c) A company is contemplating whether to produce a new product. If it decides to produce the product it must either install a new division which needs a cash outlay of four lakh rupees or work overtime with overtime expense of ₹ 1.5 lakhs. If the company decides to install a new division, it needs the approval of government and the company feels that there is 70% chance of getting the approval. A market survey has revealed the following facts regarding the magnitude of sales for the new product :

Magnitude of Sales	Probability	Resulting Profit (in ₹ lakhs)
High	0.45	15
Medium	0.30	7
Low	0.20	3
Nil	0.05	–5 (loss)

However, by resorting to overtime, even at high magnitude of sales, the resulting profit would be same as at medium magnitude of sales. Solve the problem to suggest the option to be selected, using a Decision Tree.

AD-158 2

3. Attempt any **two** : **14**

   (a) Describe the simulation process. When can simulation be used ?

   (b) An auto mechanic in an automobile repair shop is able to install new carburettor at the rate of about one in every 20 minutes. The service rate follows an exponential distribution. Customer seeking this service arrive at the repair shop on the average of 2 per hour following a Poisson distribution. The customers are served on a "first-in-first-out" basis and come from an infinite population of possible customers. Determine

      (i)   average number of customers in the system.

      (ii) average number of customers waiting to be served.

      (iii) average time a customer spends in the system.

      (iv) average waiting time of a customer before being served.

      (v) probability of zero units in the system.

   (c) 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 customer product, the corporation estimates the following probability distributions :

Annual Demand	Probability	(Price-cost) per unit (₹)	Probability	Investment	Probability
25,000	0.05	3	0.10	27,50,000	0.25
30,000	0.10	5	0.20	30,00,000	0.50
35,000	0.20	7	0.40	35,00,000	0.25
40,000	0.30	9	0.20		
45,000	0.20	10	0.10		
50,000	0.10				
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 :

28, 57, 60, 17, 64, 20, 27, 58, 61, 30

19, 07, 90, 02, 57, 28, 29, 83, 58, 41

18, 67, 16, 71, 43, 68, 47, 24, 19, 97

4. Attempt any **two** :   **14**

   (a) Machine A costs ₹ 36,000. Annual operating costs are ₹ 400 for the first year and then increase by ₹ 3,600 every year. Assuming that machine 'A' has no resale value, determine the best replacement age.

   Machine B which is similar to machine A, costs ₹ 40,000. Annual running costs are ₹ 2,000 for the first year and then increase by ₹ 2,000 every year. It has a resale value of ₹ 15,000, ₹ 10,000 and ₹ 5,000 if replaced at the end of 1st, 2nd and 3rd years respectively. It has no resale value from the 4th year onwards.

   Which machine would you prefer to buy ? Future costs are not to be discounted.

   (b) On January 1 (this year), Bakery A had 40 percent of its local market share while the other two bakeries B and C had 40 percent and 20 percent, respectively, of the market share. Based upon a study by a marketing research firm, the following facts were compiled. Bakery A retains 90 percent of its customers while loses 5 percent of its customers to Bakery B and 5 percent to Bakery C. Bakery B retains 85 percent of its customers while loses 5 percent of its customers to Bakery A and 10 percent to Bakery C. Bakery C retains 83 percent of its customers while loses 10 percent and 7 percent of its customers to Bakery A and B respectively. What will each firm's share be on January 1 after two years ?

   (c) In a city there are three TV channels fighting it out for the top rating for the 6:00 p.m. one-hour news cast. At the end of each week, the leader is the channel with the highest estimated average fraction of the viewing audience during that time slot. Over a period of time, data have been obtained on the relationship between ratings leadership in successive weekly periods. This information is presented in the form of a transition probability table as follows :

<center>

Next week's leader (station)

		A	B	C
	A	0.40	0.35	0.25
This week's leader (station)	B	0.10	0.70	0.20
	C	0.15	0.25	0.60

</center>

   over a long period of time, what proportion of the time will each station lead the weekly ratings ?

5. Attempt any **two** : 14

(a) Is there a difference in the amount of customers' initial deposits when they open savings accounts according to geographic region of the United States ? To test this question, an analyst selects savings and loan offices of equal size from four regions of the United States. The offices selected are located in areas having similar economic and population characteristics. The analyst randomly selects adult customers who are opening their first savings account and obtains the following dollar amounts. Determine whether there is a significant difference between geographic regions. Use $\alpha = 0.05$.

Region 1	Region 2	Region 3	Region 4
1200	225	675	1075
450	950	500	1050
110	100	1100	750
800	350	310	180
375	275	660	330
200			680
			425

(b) A machine produces parts that are occasionally flawed. When the machine is working in adjustment, flaws still occur but seem to happen randomly. A quality control person randomly selects 50 of the parts produced by the machine today and examines them one at a time in the order that they were made. The result is 40 parts with no flaws and 10 parts with flaws. The sequence of no flaws (denoted by N) and flaws (denoted by F) is shown below :

NNN F NNNNNNN F NN FF NNNNNN F NNNN F NNNNNN FFFF NNNNNNNNNNNN

Using $\alpha = 0.05$, determine whether the flaws are occurring randomly.

(c) A firm uses three machines in the manufacture of three products. Each unit of product I requires 3 hours on machine 1, 2 hours on machine 2 and 1 hour on machine 3. Each unit of product II requires 4 hours on machine 1, 1 hour on machine 2 and 3 hours on machine 3. Each unit of product III requires 2 hours on machine 1, 2 hours on machine 2 and 2 hours on machine 3. The contribution margin of the three products is ₹ 30, ₹ 40 and ₹ 35 per unit, respectively. Available for scheduling are 90 hours of machine 1 time, 54 hours of machine 2 time and 93 hours of machine 3 time.

The given situation is formulated as a linear programming problem and solved on Excel solver to produce the following optimal solution shown in the tables. Answer the following questions :

(i) What must be product I's unit contribution in order to introduce it to the firm's product line ?

(ii) What is the effect on the total contribution, if the product III yields a contribution of ₹ 28 ?

(iii) What is the effect on the total contribution, if the time on machine II is increased by 30 hours ?

(iv) Now the company is considering the addition of a new product IV to its line. Product IV requires 2 hours on machine 1, 3 hours on machine 2 and 3 hours on machine 3. What must be product IV's unit contribution in order to profitability add it to the firm's product line.

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Microsoft Excel Answer Report

Target Cell (Max)

Cell	Name	Original Value	Final Value
$E$2	Objective Function	0	1215

Adjustable Cells

Cell	Name	Original Value	Final Value
$B$6	x1	0	0
$C$6	x2	0	12
$D$6	x3	0	21

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
$E$3	Machine 1	90	$E$3<=$F$3	Binding	0
$E$4	Machine 2	54	$E$4<=$F$4	Binding	0
$E$5	Machine 3	78	$E$5<=$F$5	Not Binding	15

Microsoft Excel Sensitivity Report

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$B$6	x1	0	-12.5	30	12.5	1E+30
$C$6	x2	12	0	40	30	22.5
$D$6	x3	21	0	35	45	15

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$E$3	Machine 1	90	7.5	90	22.5	36
$E$4	Machine 2	54	10	54	36	31.5
$E$5	Machine 3	78	0	93	1E+30	15