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FACULTY OF MANAGEMENT STUDIES

UNIVERSITY OF DELHI

MBA Iyr Examination, March-April 2016

MBAFT 6202: Management Science

Time: 3 hours **Maximum marks:** 50

Answer any **FIVE** questions [10 x 5 marks]

1. Vidhi Sharma, manager of the Winter Park Hotel, is considering how to restructure the front desk to reach an optimum level of staff efficiency and guest service. At present, the hotel has five clerks on duty, each with a separate waiting line, during the peak check-in time of 3:00 P.M. to 5:00 P.M. Observation of arrivals during this time show that an average of 90 guests arrive each hour (although there is no upward limit on the number that could arrive at any given time). It takes an average of 3 minutes for the front-desk clerk to register each guest.

Vidhi is considering three plans for improving guest service by reducing the length of time guests spend waiting in line. The first proposal would designate one employee as a quick-service clerk for guests registering under corporate accounts, a market segment that fills about 30% of all occupied rooms. Because corporate guests are preregistered, their registration takes just 2 minutes. With these guests separated from the rest of the clientele, the average time for registering a typical guest would climb to 3.4 minutes. Under plan 1, noncorporate guests would choose any of the remaining four lines.

The second plan is to implement a single-line system. All guests could form a single waiting line to be served by whichever of five clerks became available. This option would require sufficient lobby space for what could be a substantial queue.

The third proposal involves using an automatic teller machine (ATM) for check-ins. This ATM would provide approximately the same service rate as a clerk would. Given that initial use of this technology might be minimal, Vidhi estimated that 20% of customers, primarily frequent guests, would be willing to use the machines. (This might be a conservative estimate if the guests perceive direct benefits from using the ATM, as bank customers do. Citibank reports that some 95% of its Mumbai customers use its ATMs.) Vidhi would set up a single queue for

customers who prefer human check-in clerks. This would be served by the five clerks, although Vidhi is hopeful that the machine will allow a reduction to four.

Questions

(i) Determine the average amount of time that a guest spends checking in. How would this change under each of the stated options?

(ii) Which option do you recommend? Present clearly your arguments in support of your recommendation.

Note: *If you feel some data required for answering questions above are missing, make appropriate assumptions and state them clearly in your answer*

For M/M/1 Queues

$$L_q = \frac{\lambda^2}{\mu(\mu-\lambda)} = \frac{\rho^2}{1-\rho}$$

For M/M/k Queues

$$p_0 = \frac{1}{\sum_{n=0}^{k-1} \frac{1}{n!}\left(\frac{\lambda}{\mu}\right)^n + \frac{1}{k!}\left(\frac{\lambda}{\mu}\right)^k \left(\frac{k\mu}{k\mu-\lambda}\right)}$$

$$L = \frac{\left(\lambda/\mu\right)^k \lambda\mu}{(k-1)!(k\mu-\lambda)^2} p_0 + \left(\frac{\lambda}{\mu}\right)$$

$$p_n = \frac{\left(\frac{\lambda}{\mu}\right)^n}{n!} p_0, \text{ for } n = 1,2,\ldots,k$$

$$p_n = \frac{\left(\frac{\lambda}{\mu}\right)^n}{k!\,k^{n-k}} p_0, \text{ for } n = k, k+1,\ldots$$

Symbols used above have their usual meaning.

2. An appliance dealer must decide how many (if any) new microwave ovens to order for next month. The ovens cost Rs.2200 and sell for Rs.3000. Because the oven company is coming out with a new product line in two months, any ovens not sold next month will have to be sold at the dealer's half price clearance sale. Additionally, the appliance dealer feels he suffers a loss of Rs.250 for every oven demanded when he is out of stock. On the basis of past months' sales data, the dealer estimates the probabilities of monthly demand (D) for 0, 1, 2, or 3 ovens to be .3, .4, .2, and .1, respectively.

The dealer is considering conducting a telephone survey on the customers' attitudes towards microwave ovens. The results of the survey will either be favorable (F), unfavorable (U) or no opinion (N). The dealer's probability estimates for the survey results based on the number of units demanded are:

P(F | D = 0) = .1	P(F | D = 2) .3	P(U | D = 0) = .8	P(U | D = 2) = .1
P(F | D = 1) = .2	P(F | D = 3) .9	P(U | D = 1) = .3	P(U | D = 3) = .1

(i) What is the dealer's optimal decision without conducting the survey?

(ii) What is the EVPI?

(iii) Based on the survey results what is the optimal decision strategy for the dealer?

(iv) What is the maximum amount he should pay for this survey?

3.(a) A company is taking bids on four construction jobs. Three people have placed bids on the jobs. Their bids (in Lakhs of Rupees) are given in the following table ('*' indicates that the person did not bid for the given job).

Person	Job			
	1	2	3	4
A	50	46	42	40
B	51	48	44	*
C	*	47	45	45

(i) Assuming each person can do only one job, determine the minimum cost assignment of persons to jobs using Hungarian method.

Can the same method you used to solve (i) be applied if the stated assumption is relaxed? Formulate the assignment problem as a linear programming model, when Persons B and C can do as many as two jobs while A can only do one job.

(b) An office supply store open 5 days a week must determine the best inventory policy for boxes of copier paper. Weekly demand is nearly constant at 250 boxes and when orders are placed, then entire shipment arrives at once. The cost per box is Rs.220 and the inventory holding cost is 30%. Orders are placed at a cost of Rs.400 each, including preparation time and communication charges, and the lead time is 2 days.

(i) Find the optimal order quantity.

(II) What is the reorder point?

(III) How often should an order be placed?

(Iv) What is the cycle time?

4.(a) Two companies share the market for a product. Each is now planning its new marketing plans for the next year in an attempt to wrest some sales away from the other company. Each company is considering three possibilities:

Strategy 1: better packaging of the product,

Strategy 2: increased advertising, and

Strategy 3: a discount on price.

The costs of the three alternatives are quite comparable and sufficiently large that each company will select just one. The estimated effect of each combination of alternatives on the increased percentage of the sales for company 1 is as follows:

		Company 2		
		Strategy 1	Strategy 2	Strategy 3
Company 1	Strategy 1	3	-1	3
	Strategy 2	5	4	-1
	Strategy 3	4	0	3

Each company must make its selection before learning the decision of the other company. Determine the best strategy for each company.

(b) A city is served by three cable TV companies: Xcellent Cable, Your Cable, and Zephyr Cable. A survey of 1000 cable subscribers shows this breakdown of customers from the beginning to the end of August.

Company on August 1	Company on August 31		
	Xcellent	Your	Zephyr
Xcellent	300	50	50
Your	10	200	40
Zephyr	40	80	230

(i) Construct the transition matrix.

(ii) What was each company's share of the market at the beginning and the end of the month?

(iii) If the current trend continues what will the market shares be?

5.(a) Canning Transport is to move goods from three factories to three distribution centers. Information about the move is given below. Give the network model and the linear programming model for this problem.

Source	*Supply*	*Destination*	*Demand*
A	200	X	50
B	100	Y	125
C	150	Z	125

Shipping costs are:

	Destination		
Source	X	Y	Z
A	3	2	5
B	9	10	--
C	5	6	4
	(Source B cannot ship to destination Z)		

(b) An investment company is planning to invest Rs. 1 Crore in various securities for a period of one year. It has collected the necessary information in this regard which is as follows:

Securities	Face Value (Rs.)	Present Market Value (Rs.)	Dividend / Interest	Market value after one year (Rs.)	Risk for one rupee Investment
Equity #1	10	25	20%	40	4
Equity #2	100	150	30%	160	5
Deben-tures	1000	980	15% (Com-pounding half yearly)	1005	2
Govt. Bonds	5000	4990	9% (tax free)	5000	0

The management has decided the following policies about the investment programme:

(a) Investment in equities should not exceed more than 60% of total investment

(b) Investment in Govt. bonds must be at least Rs. 10 lakhs

(c) Total risk points should not exceed 20,000.

(d) Once an investment is made it will not be realized before one year

Formulate this problem as a goal-programming problem.

6. The following table gives the list of activities and other details for a project.

Activity	Preceding Activity	Duration (In days)	Crashed duration and cost per day of crashing
A	--	10	7 days; Rs. 10,000
B	A	4	3 days; Rs. 12,000
C	A	7	5 days; Rs.9,000
D	B	12	8 days; Rs. 15,000
E	B	9	7 days; Rs. 11,000
F	C	13	9 days; Rs. 10,000
G	C	7	5 days; Rs. 12,000
H	D	8	5 days; Rs. 18,000
I	E, F	10	9 days; Rs. 22,000
J	G, H	11	7 days; Rs. 27,000
K	F, J	7	5 days; Rs. 19,000

The indirect cost is Rs. 50,000 per day.

(i) Draw a network diagram of the project after checking/removing redundancy

(ii) Calculate the time-cost optimal tradeoff project duration and corresponding cost.