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Second Semester MBA Degree Examination, Dec.2013/Jan.2014
Quantitative Techniques for Management

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions.
2. Use of statistical table is permitted.

- 1 a. What is the scope of operations research? (03 Marks)
 b. Briefly explain the major applications of linear programming in management. (07 Marks)
 c. Define operations research. What are the nature and characteristic features of operations research? (10 Marks)
- 2 a. A retired person wants to invest upto an amount of Rs.30,000 in fixed income securities. His broker recommends investing in two bonds: Bond A yielding 7% and bond B yielding 10%. After some consideration, he decides to invest at most Rs.12,000 in bond B and at least Rs.6,000 in bond A. He also wants the amount invested in bond A to be at least equal to the amount invested in bond B. What should his broker recommend if the investor wants to maximize his return on investment? Solve graphically. (12 Marks)
 b. Explain the methodology of operations research. (08 Marks)
- 3 a. Obtain the dual of the given LPP
 Maximise $Z = 8x_1 + 10x_2 + 5x_3$
 Subject to $x_1 - x_3 \leq 4$
 $2x_1 + 4x_2 \leq 1$
 $x_1 + x_2 + x_3 \geq 2$
 $3x_1 + 2x_2 - x_3 = 8$
 $x_1, x_2, x_3 \geq 0$ (05 Marks)
- b. Define the following terms with reference to a PERT chart: i) Total float; ii) Free float; iii) Independent float; iv) Critical activity; v) Critical path. (05 Marks)
- c. Hindustan construction company needs 3, 3, 4 and 5 million cubic feet of fill at four earthen dam sites in Punjab. It can transfer the fill from three mounds A, B and C where 2, 6 and 7 million cubic feet of fill is available respectively. Cost of transporting one million cubic feet of fill from mounds to the four sites in lakhs are given in the table. Solve the problem using transportation algorithm for minimum cost.

		To				
		I	II	III	IV	Availability
From	A	15	10	17	18	2
	B	16	13	12	13	6
	C	12	17	20	11	7
Requirements		3	3	4	5	

(10 Marks)

- 4 a. Explain the terms: i) Pure strategy; ii) Mixed strategy; iii) Two person zero-sum game with reference to game theory. (03 Marks)
- b. A sales manager wishes to assign four sales territories to four sales persons. The sales persons differ in their sales acumen and consequently, the sales expected to be effected in each territory are different for each sales person. The estimates of sales per month for each sales person in each territory are given below.

Sales person	Estimated monthly sales (in lakhs of rupees) in territory			
	W	X	Y	Z
A	120	140	145	130
B	150	140	155	140
C	145	140	142	150
D	148	150	142	145

Suggest optimal assignment of the four sales persons to various territories and the total maximum monthly sales. (07 Marks)

- c. A project schedule has the following characteristics:

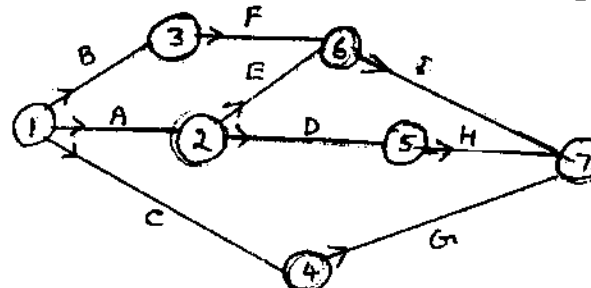
Activity	1-2	1-4	1-7	2-3	3-6	4-5	4-8	5-6	6-9	7-8	8-9
Time	2	2	1	4	1	5	8	4	3	3	5

- i) Construct the PERT network.
- ii) Calculate earliest start time, earliest finish time, latest start time and latest finish time for each activity.
- iii) Find critical path and time duration of the project. (10 Marks)
- 5 a. The following network diagram represents activities associated with a project:

Activities	A	B	C	D	E	F	G	H	I
Optimistic time	5	18	20	16	15	6	7	7	3
Pessimistic time	10	22	40	20	25	12	12	9	5
Most likely time	8	20	33	18	20	9	10	8	4

Determine the following:

- i) Expected activity time and variance.
- ii) The critical path and find the expected project completion time.
- iii) The probability of expected completion time of the project if the original scheduled time of completing the project is 41.5 weeks.
- iv) The duration of the project that will have 95% chance of being completed. (12 Marks)



- b. Solve the following (2 x 4) game graphically: (08 Marks)

		B's strategy		
		B ₁	B ₂	B ₃
A's strategy	A ₁	1	3	11
	A ₂	8	5	2

- 6 a. What is simulation? (03 Marks)
 b. Solve the following game by dominance property: (08 Marks)

		B's strategy			
		b ₁	b ₂	b ₃	b ₄
A's strategy	a ₁	2	-2	4	1
	a ₂	6	1	12	3
	a ₃	-3	2	0	6
	a ₄	2	-3	7	1

- c. Find the sequence that minimizes the total time required in performing the following jobs on three machines in the order ABC. Processing times (in hours) are given in the following table:

Job	1	2	3	4	5
Machine A	8	10	6	7	11
Machine B	5	6	2	3	4
Machine C	4	9	8	6	5

(09 Marks)

- 7 a. List out the assumptions in sequencing. (03 Marks)
 b. Explain the general structures of the queuing system with a neat sketch. (07 Marks)
 c. Dr. xyz is a dentist who 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 actually needed to complete the work:

Category	Filling	Crown	Cleaning	Extraction	Check-up
Time required	45 min	60 min	45 min	45 min	15 min
Probability	0.40	0.15	0.15	0.10	0.20

Simulate the dentists clinic for four hours and determine average waiting time for the patients as well as the idleness of the doctor. Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 9 a.m. Use the following random numbers. 40, 82, 14, 34, 25, 66, 17, 79. (10 Marks)

- 8 a. Define transportation problem. (03 Marks)
 b. Define Monte-Carlo simulation. Describe various steps in Monte-Carlo simulation. (10 Marks)
 c. A repairman finds that the time spent on his job has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they come and if the arrival of sets is a approximately poisson with an average rate of 10 per 8-hour day, what is his expected idle time each day, what is his expected idle time each day? How many jobs are ahead of the average set just brought on? (07 Marks)
