

**Second Semester MBA Degree Examination, June/July 2013**  
**Quantitative Techniques for Management**

Time: 3 hrs.

Max. Marks:100

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

- 1 a. State the general mathematical model of linear programming problem and clearly indicate the terms decision variables, objective function and constraints. **(03 Marks)**
- b. Differentiate between descriptive model, predictive model and normative model. Also mention any three advantages of model building. **(07 Marks)**
- c. Briefly explain the methodology of operations research. **(10 Marks)**
- 2 a. What do you mean by the term "Degeneracy" with reference to transportation problem? How do you overcome the Degeneracy problem? **(03 Marks)**
- b. XYZ company has two grades of inspectors called Grade-A and Grade-B quality inspectors. The inspectors will work 8 hours per day and required to inspect at least 2000 pieces/day. The Grade-A inspector can inspect the pieces at the rate of 40/hour while Grade-B can inspect 30 pieces/hour. The accuracy of Grade-A inspector is 97% while Grade-B is 95%.  
 The company has fixed the wage rate for Grade-A inspector is Rs.5/hour and Rs.4/hour for Grade-B inspector. The error made by any inspector costs Rs.3 to the company irrespective of the Grades. On the payroll of the company 9, Grade-A inspectors and 11, Grade-B inspectors are there at present.  
 Formulate this problem as an LP model so as to minimize the inspection cost. **(07 Marks)**
- c. ABC Enterprise has 3 factories at locations A, B and C which supplies three ware houses at D, E and F. Monthly factory capacities are 10, 80 and 15 units respectively, while monthly ware house requirements are 75, 20 and 50 units respectively. Unit shipping costs (Rs.) are given below:

Factory	Ware house		
	D	E	F
A	5	1	7
B	6	4	6
C	3	2	5

The penalty costs for not satisfying demand at warehouses D, E and F may be taken as Rs.5, Rs.3 and Rs.2 per unit respectively. Obtain the initial basic feasible solution by VAM and hence obtain total cost of shipping. You are also required to test the optimality of the solution. **(10 Marks)**

- 3 a. What are the four basic assumptions underlying linear programming problem? **(03 Marks)**
- b. Using following cost matrix, determine the optimal assignment and hence the cost of such assignment: **(07 Marks)**

Job \ Worker	1	2	3	4	5
A	10	3	3	2	8
B	9	7	8	2	7
C	7	5	6	2	4
D	3	5	8	2	4
E	9	10	9	6	10

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- 3 c. Consider the following 3 machines and 5 jobs flow shop problem:

Job	Processing time		
	Machine 1	Machine 2	Machine 3
1	8	5	4
2	10	6	9
3	6	2	8
4	7	3	6
5	11	4	5

Determine the optimum sequence for the five jobs and minimum elapsed time. Also determine the idle time for all machines. (10 Marks)

- 4 a. With a simple sketch show the difference between looping and dangling errors in a network diagram. (03 Marks)
- b. The project composed of 7 activities and its associated time estimates are given in below table. You are required to draw the project network diagram and also to find the critical path. (07 Marks)

Activity (i-j)	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Days	2	4	3	1	6	5	7

- c. Solve the following LPP graphically and hence obtain optimal solution.  
 Maximize (profit)  $z = 80x_1 + 120x_2$   
 Subject to  $x_1 + x_2 \leq 9$ ;  $20x_1 + 50x_2 \leq 360$ ;  $x_1 \geq 2$ ;  $x_2 \geq 3$ ;  $x_1, x_2 \geq 0$  (10 Marks)
- 5 a. What do you mean by optimal strategy and the value of game with reference to game theory? (03 Marks)
- b. What are the key objectives of sequencing? List any 5 principal assumptions involved in solving sequencing problem. (07 Marks)
- c. Consider the data of a project summarized in below table; and determine along with diagram  
 i) Expected duration and variance of each activity.  
 ii) The probability of completing the project on or before 35 weeks. (10 Marks)

Activity	A	B	C	D	E	F	G	H	I	J
Immediate predecessors	-	-	-	A	A	A	B, C	C	D	E, G
Optimistic time	4	1	2	1	1	1	1	4	2	6
Pessimistic time	4	2	5	4	2	5	2	4	2	7
Most likely time	10	9	14	7	3	9	9	4	8	8

- 6 a. Using a simple sketch, show the general structure of queuing system. (03 Marks)
- b. Solve the following  $3 \times 5$  game using the dominance property and hence obtain the optimal strategies of the players. Also find the value of game. (07 Marks)

Player B

	2	5	10	7	2
Player A	3	3	6	6	4
	4	4	8	12	1

- c. Indian service station is a 4 wheeler's service station and has a central store where service mechanics arrive to take spare parts for the jobs they work upon. The store is manned by one attendant who can attend 8 mechanics in an hour on an average with FCFS basis. The arrival rate of mechanics averages 6 per hour with usual distributions, determine  
 i) Traffic intensity and idle time  
 ii) Expected time spent by mechanic in a system.  
 iii) Expected number of mechanics in the queue.  
 iv) The probability of mechanic on arrival finds that four persons are waiting for their turn. (10 Marks)

- 7 a. List any three features of OR solution. (03 Marks)  
 b. Briefly explain Monte-Carlo simulation procedure. (07 Marks)  
 c. Solve the following game using the graphical method and hence find optimal strategies of the players. Also find the value of the game.

$$\begin{array}{c} b_1 \quad b_2 \\ a_1 \begin{bmatrix} -7 & 6 \\ 7 & -4 \\ -4 & -2 \\ 8 & -6 \end{bmatrix} \\ a_2 \\ a_3 \\ a_4 \end{array}$$

(10 Marks)

- 8 a. List any three advantages of simulation? (03 Marks)  
 b. Obtain the dual of the following primal LPP:

$$\text{Maximize } z = x_1 - 2x_2 + 3x_3$$

$$\text{Subjected to } -2x_1 + x_2 + 3x_3 = 2$$

$$2x_1 + 3x_2 + 4x_3 = 1$$

$$x_1, x_2, x_3 \geq 0$$

(07 Marks)

- c. Dr. Apex is a dentist, who schedules all his patients for 30 minutes appointments. Some of the patients takes more or less than scheduled time of 30 minutes. The summary of various categories of work, time required and associated probabilities are indicated in below table. Simulate the dentist's clinic for four hours and determine average waiting time for the patients. Also find the idle time of the doctor. Assume that all patients arrive exactly to their appointment time and starts the clinic at 8 am. Use the following random numbers to solve the problem.

40, 82, 11, 34, 25, 66, 17, 79

(10 Marks)

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

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