Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐

K 4503

M.B.A. DEGREE EXAMINATION, JANUARY 2008.

First Semester

BA 1603 — APPLIED OPERATIONS RESEARCH FOR MANAGEMENT

(Regulation 2005)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   Define feasible region in linear programming.

2.   What do you mean by duality? Discuss its main advantage.

3.   Distinguish between transportation problem and transshipment problem.

4.   Define travelling salesman problem.

5.   Distinguish between lower bound and upper bound in branch and bound algorithm.

6.   Define saddle point.

7.   Distinguish between state variables and alternatives in dynamic programming.

8.   What is decision tree?

9.   Distinguish between Jokeying and Reneging.

10. Discuss the reasons for replacement of equipments.

PART B — (5 × 16 = 80 marks)

11. (a) Solve the following LP problem using two-phase method.

Minimize $z = 10x_1 + 6x_2 + 2x_3$

Subject to $-x + x_2 + x_3 \geq 1$

$3x_1 + x_2 - x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$

Or

(b) Solve the following LP problem using BIG M method.

Min $z = -3x_1 + x_2 + x_3$

$x_1 - 2x_2 + x_3 \leq 11$

$-4x_1 + x_2 + 2x_3 \geq 3$

$2x_1 - x_3 = -1$

$x_1, x_2, x_3 \geq 0$

12. (a) Solve the following LP problem using graphical method.

Maximize $z = 20x_1 + 10x_2$

Subject to $10x_1 + 5x_2 \leq 50$

$6x_1 + 10x_2 \leq 60$

$4x_1 + 12x_2 \leq 48$

$x_1, x_2 \geq 0$

Also, comment on the nature of optimal solution.

Or

(b) Solve the following linear programming problem using simplex method.

Maximize $z = 10y_1 + 15y_2 + 20y_3$

Subject to $2y_1 + 4y_2 + 6y_3 \leq 24$

$3y_1 + 9y_2 + 6y_3 \leq 30$

$y_1, y_2, y_3 \geq 0$

13. (a) A manufacturing company has three factories F_1, F_2 and F_3 with monthly manufacturing capacities of 7,000, 4,000 and 10,000 units of a product. The product is to be supplied to seven stores. The manufacturing costs in these factories are slightly different but the important factor is the shipping cost from each factory to a particular store. The following table represents the factory capacities, store requirements and unit cost (in rupees) of shipping from each factory to each store. Here, slack is the difference between the total factory capacity and the total requirement.

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		Stores							Factory Capacity
		S_1	S_2	S_3	S_4	S_5	S_6	S_7	
Factory	F_1	5	6	4	3	7	5	4	7,000
	F_2	9	4	3	4	3	2	1	4,000
	F_3	8	4	2	5	4	8	3	10,000
Store Demand		1,500	2,000	4,500	4,000	2,500	3,500	3,000	

Find the optimal transportation plan so as to minimize the transportation cost.

Or

(b) A college is having a degree programme for which the effective semester time available is less and the programme requires field work. Hence, few hours can be saved from the total number of class hours, and can be utilized for the field work. Based on Past experience, the college has estimated the number of hours required to teach each subject by each faculty. The course in its present semester has five subjects and the college has considered 6 existing faculty members to teach these courses. The objective is to assign the best 5 teachers out of these faculty members to teach 5 different subjects so that the total number of class hours required is minimized. The data of this problem is summarized in the following table. Solve this assignment problem optimally.

		Subject				
		1	2	3	4	5
	1	30	39	31	38	40
	2	43	37	32	35	38
Faculty	3	34	41	33	41	34
	4	39	36	43	32	36
	5	32	49	35	40	37
	6	36	42	35	44	42

14. (a) Solve the following integer programming problem :

Maximize $z = 5x_1 + 8x_2$

Subject to $x_1 + 2x_2 \le 8$

$$4x_1 + x_2 \le 10$$

$x_1, x_2 \ge 0$ and integers.

Or

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(b) Consider the following pay off matrix of player A and solve it optimally using the graphical method, though it has saddle point.

Player B

		1	2	3	4	5
Player	1	7	8	4	6	8
	2	−8	6	1	9	6

15. (a) A distance network consists of eleven nodes which are distributed as shown in the following table. Find the shortest path from node 1 and node 11 and the corresponding distance using dynamic programming.

Arc :	1-2	1-3	1-4	2-5	3-5	3-6	3-7	4-7	5-8
Distance :	8	7	1	5	9	2	8	10	12

5-9	6-9	7-9	7-10	8-11	9-11	10-11
7	9	6	13	4	2	15

Or

(b) There are three clerks in the loan section of a bank to process the initial queries of customers. The arrival rate of customers follows Poisson distribution and it is 20 per hour. The service rate also follows Poisson distribution and it is 9 customers per hour.

Find the following :

(i) Average waiting number of customers in the queue as well as in the system.

(ii) Average waiting time per customer in the queue as well as in the system.

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