

Q 6503

M.B.A. DEGREE EXAMINATION, MAY/JUNE 2006.

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 alternate optima in linear programming.
2. What are the assumptions in linear programming?
3. Assignment problem is special kind of Transportation problem — Justify.
4. Distinguish between transportation problem and transshipment problem.
5. Distinguish between pure and mixed strategies in game theory.
6. Discuss the need for integer programming.
7. State the difference between the state variable and the alternative in dynamic programming.
8. Define simulation.
9. Distinguish between jockeying and balking.
10. Define economic life of an asset.

PART B — (5 × 16 = 80 marks)

11. Consider the following linear programming problem and solve it using its dual solution.

$$\text{Minimize } Z = 40X_1 + 30X_2 + 25X_3$$

subject to

$$4X_1 + 2X_2 + 5X_3 \geq 30$$

$$3X_1 + 6X_2 + X_3 \geq 20$$

$$X_1 + 3X_2 + 6X_3 \geq 36$$

$$X_1, X_2 \text{ and } X_3 \geq 0.$$

12. (a) Consider the following transportation problem and find the optimal distribution using Vogel's approximation method in the first stage to get the initial basic feasible solution.

		Market					Supply
		1	2	3	4	5	
Plant	1	10	2	16	14	10	300
	2	6	18	12	13	16	500
	3	8	4	14	12	10	825
	4	14	22	20	8	18	375
Demand		350	400	250	150	400	

Or

- (b) Alpha Construction company has five crew. The skills of the crew differ from one another because of the difference in the composition of the crew. The company has five different projects on hand. The time (in days) taken by different crew to complete different projects are summarized in the following table. Find the best assignment of the crew to different projects such that the total time taken to complete all the project is minimized.

		Project Execution Time in Days				
		Project				
		A	B	C	D	E
Crew	1	20	30	25	15	35
	2	25	10	40	12	28
	3	15	18	22	32	24
	4	29	8	34	10	40
	5	35	23	17	26	45

13. (a) Consider the following integer linear programming problem and solve it.

$$\text{Maximize } Z = 5X_1 + 10X_2 + 8X_3$$

subject to

$$2X_1 + 5X_2 + X_3 \leq 10$$

$$X_1 + 4X_2 + 2X_3 \leq 12$$

$$X_1, X_2 \text{ and } X_3 \geq 0.$$

Or

- (b) Consider the following payoff matrix of Player A and solve it using the graphical method.

		Player B				
		1	2	3	4	5
Player A	1	7	8	4	6	8
	2	-8	6	1	9	6

14. (a) An organization is planning to diversify its business with a maximum outlay of 4 crores. It has identified three different locations to install plants. The organization can invest in one or more of these plants subject to the availability of the fund. The different possible alternatives and their investment (in crores of rupees) and present worth of returns during the useful life (in crores of rupees) of each of these plants are summarized in the following table. The first row of the table has zero cost and zero return for all the plants. Hence, it is known as "Do-Nothing" alternative. Find the optimal allocation of the capital to different plants which will maximize the corresponding sum of the present worth of returns.

Alternatives	Plant					
	1		2		3	
	Cost	Return	Cost	Return	Cost	Return
1	0	0	0	0	0	0
2	1	12	2	16	2	9
3	2	15	3	20	3	12
4	3	19	4	25	—	—

Or

- (b) The customer arrival time and service time at a single window reservation counter follow uniform distribution. The inter arrival time is 20 ± 2 minutes and the service time is 25 ± 7 minutes. Develop a logical flow-chart to simulate this system for 8 hours to get the following results.

- Utilization of single window counter
- Average waiting time per customer
- Average waiting number of customer.

15. (a) A company is planning to replace an equipment whose first cost is Rs. 1,00,000. The operating and maintenance cost of the equipment during its first year of operation is Rs. 10,000 and it increases by Rs. 2,000 every year thereafter. The resale value of the equipment at the end of the first year of its operation is Rs. 65,000 and it decreases by Rs. 10,000 every year thereafter. Find the economic life of the equipment by assuming the interest rate as 12%.

Or

- (b) The arrival rate of customers at the single window booking counter of a two wheeler agency follows Poisson distribution and the service time follows exponential (negative) distribution and hence the service rate also follows Poisson distribution. The arrival rate and the service rate are 25 customers per hour and 35 customers per hour, respectively. Find the following :
- (i) Utilization of the booking clerk
 - (ii) Average number of waiting customers in the queue
 - (iii) Average number of waiting customers in the system
 - (iv) Average waiting time per customer in the queue
 - (v) Average waiting time per customer in the system.