

PARUL UNIVERSITY
FACULTY OF MANAGEMENT
MBA Winter 2018 - 19 Examination

Semester: 2

Subject Code: 06200157

Subject Name: Operations Research

Date: 17/12/2018

Time: 10:30 am to 1:00 pm

Total Marks: 60

Instructions

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 Do as Directed.**A). Multiple choice type questions/Fill in the blanks. (Each of 1 mark)****(05)**

1. In Assignment Problem, optimality is reached when:

a) Number of Lines Drawn = Order of Matrix c) Number of Zeroes = Order of Matrix

b) Number of Lines Drawn \neq Order of Matrix d) Number of Zeroes \neq Order of Matrix

2. In Maximum Likelihood Principle, when the decision table is a cost matrix, we use that strategy corresponding to the event

a) with the highest probability c) with the highest cumulative probability
 b) with the least probability d) with the least cumulative probability

3. Which One of the following is not a Network model Technique?

a) Hurwicz Technique c) Minimum Spanning Tree Technique
 b) Maximal Flow Technique d) Shortest Route Technique

4. If the Primal Problem in LPP Model is having objective: Maximization then

a) Dual has a \geq constraint c) Dual has a \neq constraint
 b) Dual has a \leq constraint d) Primal has a \geq constraint

5. Which one of the following is/are special case/s in Linear Programming?

a) Infeasibility c) Multiple Optimal Solutions
 b) Unboundedness d) All of these

B). Define the following. (Each of 1 mark)**(05)**

1. Degeneracy in Transportation Problem
2. Infeasibility in Linear Programming
3. Traffic Intensity or Utilization Factor in Queuing
4. Hurwicz's Criterion in Decision Theory
5. Dominance Principle in Game Theory

C). Direct questions. (Each of 1 mark)**(05)**

1. What is the Minimum Spanning Tree Technique of Network Models?
2. Give a brief note on Linear Programming Assumption.
3. What is Saddle Point in Game Theory?
4. What is an unbalanced transportation problem?
5. Give the General structure of a Queuing System.

Q.2 Answer the following questions.**A). Discuss the Operations Research Methodology with a block diagram.****(07)**

- B).** A Baker has to decide on the number of cakes to be made in advance to meet the next day's demand – which is uncertain. From past observations, the Baker knows that number of cakes sold on any particular day is 10, 11, 12 or 13 cakes. The cost of making the cake is Rs. 80 per cake. The cakes are sold at Rs. 100 per cake. Any unsold cake is disposed of as animal food at Rs. 30 per cake. You have to help the baker to decide on the strategy to make 10, 11, 12 or 13 cakes in advance. To facilitate this find out the decision using: **(08)**
- (a) Maximin Principle
 (b) Maximax Principle
 (c) Laplace Principle
 (d) Hurwicz Principle (for this take the optimality index $\alpha=0.8$)

Q.3 Answer the following questions.

- A).** Shell Refineries manufacture two kinds of fuel – a diesel variant and a petrol variant. The factory manager is considering an optimal mix of the two variants to be produced. However, there are limitations on the resources – Crude Oil and Naphtha available for making these two variants. These are available from the Oil rigs of the supplier Chevron Oil Wells Ltd. Chevron has committed to supply not more than 60 Million Tons per day of Crude oil and not more than 80 Million Tons per day of Naphtha. The manager has further assessed the requirement of these resources in making the fuel variants. For each Million Ton of Diesel variant 2 Million Ton of Crude Oil and 4 Million Ton of Naphtha is required. For each Million Ton of Petrol variant 4 Million Ton of Crude Oil and 1 Million Ton of Naphtha is required. All these variants get sold in the market with a profitability of 6 Million Dollars per Million Ton of diesel variant and 20 Million Dollars per Million Ton of petrol variant. Formulate this problem as a Linear Programming (LP) model and solve it graphically to help the manager get the optimal production schedule. **(07)**
- B).** Ambaji Cements has three manufacturing plants A,B and C from which it sends Cement bags for sale from its three distribution Warehouse located at P,Q and R. The following is a cost matrix with cost in (Rs '00) and the supply and demand quantity in ('00 units of cement bag): **(08)**

Plant	Distribution Warehouse				Supply
	P	Q	R		
A	3	7	2	50	
B	9	4	5	30	
C	8	6	1	20	
Demand	25	35	40		

Solve this Transportation problem to get initial solution and improve this solution to get optimal transportation schedule.

Q.4 Attempt any two questions. (Each of 7.5 mark) **(15)**

1. The rate of arrival of customers at a railway reservation counter in a remote location follows Poisson distribution with a mean arrival rate of 3 customers per hour. The clerk services each customer's reservation request at the rate of 6 customers per hour. Assume that clerk's service follows exponential distribution and that the assumptions of single server queuing model are satisfied. Then, find:
- (a) What is the probability that exactly 2 customers arrive in a 15 minute interval?
 (b) What is the probability that the system is idle?
 (c) What is the average wait time in the system?
 (d) What is the average length of the queue?
 (e) What is the total time a customer has to spend waiting in the queue for his turn to come?

2. Form the Dual of the following LPP Formulation:

$$\text{Max. } Z = 5x_1 + 2x_2 + 3x_3$$

Subject to Constraints:

$$2x_1 + 5x_2 \leq 10$$

$$3x_1 + 4x_2 - 5x_3 \geq 8$$

$$5x_1 - 2x_3 = 6$$

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

3. The following gives a cost matrix (\$/day) for a worker job allocation options:

		JOB			
		J1	J2	J3	J4
Worker	W1	20	10	23	24
	W2	10	25	12	32
	W3	30	12	14	15
	W4	15	24	26	20

Find the optimal Job-Worker assignment using Hungarian Assignment Method.

4. Dr. Kotler is a marketing consultant and has just arrived in India for a consultancy assignment where different business clients get his consultancy services on different marketing aspects. He schedules the clients for 30 minute appointments. Some of these clients take more or less than 30 minutes depending on the type of marketing consultancy. The following summary shows the various types of consultancy he provides with the probability of their occurrence along with the time required (based on his past visits in India):

Type of Work	Time (minutes)	Probability of Occurrence
Advertising Consultancy	45	0.30
4P Consultancy	60	0.10
Segmentation Consultancy	15	0.15
Branding Consultancy	45	0.20
Digital Marketing Consultancy	15	0.25

Dr. Kotler's consultancy starts at 8:00AM in the morning and he gives appointment for four hours only daily. Simulate the Dr.'s Consultancy services using random numbers 50, 92, 11, 33, 25, 67, 15, 74. Also find the average wait time of the client and the average idle time of Dr. Kotler.