

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (NEW) - EXAMINATION – SUMMER 2018

Subject Code: 2163201
Date: 28/04/2018
Subject Name: Operation Research
Time: 10:30 AM to 01:00 PM
Total Marks: 70
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- | | MARKS |
|--|-----------|
| Q.1 (a) Discuss in brief the areas of application of Operation Research. | 03 |
| (b) Use simplex method to solve following LPP
$Maximize\ z = 45x_1 + 80x_2$
Subject to the constraints
$5x_1 + 20x_2 \leq 400, 10x_1 + 15x_2 \leq 450, x_1, x_2 \geq 0$ | 04 |
| (c) Explain the Phases of OR study. | 07 |
| Q.2 (a) What is the degeneracy in simplex method? How it can be resolved? | 03 |
| (b) Solve the following LPP using graphical method.
$Minimize\ z = 4x + 5y$
Subject to the constraints
$x + y \geq 1, x + 2y \leq 4, y \leq 4, x \leq 4, x, y \geq 0$ | 04 |
| (c) Solve the following LPP using Two phase method.
$Maximize\ z = 60x_1 + 48x_2$
Subject to the constraints
$4x_1 + 2x_2 \geq 8, 2x_1 - 4x_2 \geq 6, x_1, x_2 \geq 0$ | 07 |
| OR | |
| (c) Solve the following LPP using BIG – M method.
$Minimize\ z = 40x_1 + 20x_2$
Subject to the constraints
$2x_1 + 5x_2 \geq 48, 8x_1 + 5x_2 \geq 72, x_1, x_2 \geq 0$ | 07 |
| Q.3 (a) Discuss the Northwest and Least cost method for finding initial basic solution. Give its advantage and disadvantage. | 03 |
| (b) A company has three plants at location A, B and C which produce the same product. It has to supply this to buyers located at P, Q and R. The weekly plant capacities for A, B and C are 250, 800 and 350 units respectively, while the buyer requirements are 700, 200 and 500 for P, Q and R respectively. The unit shipping costs (in Rs) are given as: | 04 |

Plant	Buyers		
	P	Q	R
A	8	4	10
B	9	7	9
C	6	5	8

Determine the distribution for the company so as to minimize the cost of transportation using Least Cost Method.

- (c) ABC company is engaged in manufacturing 5 brands of packed snacks. It has five manufacturing setups, each capable of manufacturing any of its brands one at a time. The costs to make a brand on these setups vary according to following table. 07

	S1	S2	S3	S4	S5
B1	4	6	7	5	15
B2	7	3	6	9	5
B3	8	5	4	6	9
B4	9	12	7	11	10
B5	7	5	9	8	11

Find the optimum assignment on these setups resulting in the minimum cost?

OR

- Q.3** (a) Classify the Assignment problem in detail. 03
 (b) Solve the following transportation problem using Vogel's Approximation Method. 04

To	D1	D2	D3	D4	Available Units
From					
F1	10	9	11	10	200
F2	12	10	8	7	60
F3	8	9	11	12	40
Demand	100	50	60	40	

[D stands for destination. F stands for factory.]

- (c) Define the simulation model. Distinguish between deterministic and stochastic simulation mode. 07
- Q.4** (a) Discuss the differences between CPM and PERT. 03
 (b) What is critical path? State the necessary and sufficient condition of critical path. Can a project have multiple critical paths? 04
 (c) Determine the critical path for the following network. What is the total time required for the project. Also find the free float and independent float for each activity. 07

Activity	1-2	1-3	2-4	3-4	3-5	4-6	5-6
Duration	2	8	4	1	2	5	6

OR

- Q.4** (a) Enlist the components of the Queuing System. Define Balking in Queuing System. 03
 (b) What do you mean by Minimum Spanning Tree? Discuss any algorithm for finding minimum spanning tree. 04
 (c) A researcher studying the 'Q' theory at a counter of a railway station has concluded that the inter-arrival rate at a desk is 3 minutes while the inter-service, both following Poisson distribution, is 2 minutes. Answer the following questions using the given facts. 07
 1) What is the average waiting time of a customer in the system?
 2) How many customers are there waiting in the queue?
 3) The management is ready to start a new counter if the average waiting time in the system is 8 minutes; find the arrival rate (per hour) of the customers.
- Q.5** (a) Explain Individual replacement versus group replacement. 03
 (b) Determine the age at which the following type of machine be replaced: 04
 Cost price = Rs 8,000
 Operating Costs = Rs 1000 for the first Year, increasing by Rs 500 every year
 Resale Value = Rs 4000 for first year, decreasing by Rs 500 every year.

- (c) A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has 07

been varying from 196 mopeds to 204 mopeds, whose probability is as given below:

Production(Per day)	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished mopeds are transported in 3-storied lorry that can accommodate only 200 mopeds. Use the following random numbers: 82, 89, 78, 24, 53, 61, 18, 45, 4, 23, 50, 77, 27, 54, 10. Simulate the mopeds waiting in the factory for next 15 days.

1. What will be the average no. of mopeds waiting in the factory?
2. What will be the average no. of empty spaces in the lorry?

OR

- Q.5**
- (a) What is simulation? What are the advantages and limitations of simulation? **03**
 - (b) What is replacement problem? Describe some important replacement situations and policies. **04**
 - (c) A toll booth owner is presently using a manual system having service rate of 10 vehicles per minutes. On an average 8 vehicles are coming in minute. Calculate: **07**
 1. Utilization factor of booth operator
 2. Idle time for booth operator in a day having working hour of 8 hours
 3. Number of persons waiting in the system
 4. Number of persons waiting in the queue
 5. Average waiting time in the queue

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