

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– VI (New) EXAMINATION – WINTER 2019****Subject Code: 2163201****Date: 04/12/2019****Subject Name: Operation Research****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

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

		MARKS
Q.1*	(a) Discuss areas of application of operation research.	03
	(b) A firm is engaged in producing two products, A and B. Each unit of product A requires 2 kg of raw material and 4 labor hours for processing, whereas each unit of product B requires 3 kg of raw material and 3 hours of labor, of the same type. Every week, the firm has an availability of 60 kg of raw material and 96 labor hours. One unit of product A sold yields Rs 40 and one unit of product B sold gives Rs 35 as profit. Formulate this problem as linear programming problem to determine as to know how many units of each of the products should be produced per week so that the firm can earn the maximum profit. Assume that there is no marketing constraint so that all that is produced can be sold.	04
	(c) Explain methodology of operation research.	07
Q.2	(a) Illustrate graphically 1) No feasible solution 2) Unbounded solution	03
	(b) Solve graphically the following LPP: Maximize $z=8x_1 + 16x_2$ Subject to, $x_1 + x_2 \leq 200$, $x_2 \leq 125$, $3x_1 + 6x_2 \leq 900$, $x_1, x_2 \geq 0$	04
	(c) Explain simplex method for solving linear programming problem.	07
OR		
	(c) Solve the following LPP using simplex method. Maximize $z=3x_1 + 5x_2$ Subject to, $x_1 + 2x_2 \leq 2000$, $x_1 + x_2 \leq 1500$, $x_2 \leq 600$, $x_1, x_2 \geq 0$	07
Q.3	(a) Discuss North-West and Least cost method for finding initial basic solution.	03
	(b) Discuss assignment algorithm.	04
	(c) Using Big-M method solve the following problem Minimize $z=60x_1 + 80x_2$ Subject to, $20x_1 + 30x_2 \geq 900$, $40x_1 + 30x_2 \geq 1200$, $x_1, x_2 \geq 0$	07

OR

- Q.3** (a) Discuss Vogel's approximation method for finding initial basic solution. **03**
 (b) Write the dual of the following LPP **04**
 Minimize $z = 10x_1 + 20x_2$
 Subject to,
 $3x_1 + 2x_2 \geq 18$, $x_1 + 3x_2 \geq 8$, $2x_1 - x_2 \leq 6$, $x_1, x_2 \geq 0$
 (c) Using the two-phase method solve the following problem **07**
 Minimize $z = 150x_1 + 150x_2 + 100x_3$
 Subject to,
 $2x_1 + 3x_2 + x_3 \geq 4$, $3x_1 + 2x_2 + x_3 \geq 3$, $x_1, x_2, x_3 \geq 0$
- Q.4** (a) Define interfering float, free float and independent float. **03**
 (b) Discuss various methods to generate random numbers. **04**
 (c) A tailor specializes in ladies' dresses. The number of customers approaching the tailor appears to be Poisson distributed with a mean of 6 customers per hour. The tailor attends the customers on a first come first served basis and the customers wait if the need be. The tailor can attend the customers at an average rate of 10 customers per hour with the service time exponentially distributed. **07**
 Find
 1) The utilization parameter
 2) The probability that the system is idle
 3) The average time that the tailor is free on a 10-hour working day
 4) The probability of exactly one customer in queuing system
 5) Expected number of customers in tailor's shop
 6) Expected number of customers waiting for tailor's service
 7) Expected time customer will spend in tailor's shop

OR

- Q.4** (a) A firm is using a machine whose purchase price is Rs 13000. The installation charges amount to Rs 3600 and the machine has a scrap value of Rs 1600. The maintenance cost in various years is given in the following table. **03**
- | | | | | | | | | | |
|----------|-----|-----|------|------|------|------|------|------|------|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Cost(Rs) | 250 | 750 | 1000 | 1500 | 2100 | 2900 | 4000 | 4800 | 6000 |
- Determine after how many years the machine should be replaced assuming that machine replacement can be done only at the year ends.
- (b) What is simulation? What are the advantages and disadvantages of simulation? **04**
 (c) Information on the activities required for a project is as follows **07**
- | | | | | | | | | | | | |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Name | A | B | C | D | E | F | G | H | I | J | K |
| Activities Node | 1-2 | 1-3 | 1-4 | 2-5 | 3-5 | 3-6 | 3-7 | 4-6 | 5-7 | 6-8 | 7-8 |
| Duration(Days) | 2 | 7 | 8 | 3 | 6 | 10 | 4 | 6 | 2 | 5 | 6 |
- Draw the network and calculate the earliest start (ES), earliest finish (EF), latest start (LS) and latest finish (LF) time for each of the activities. Also find critical path and time required to complete the project.

- Q.5 (a)** A firm owns facilities at 7 places. It has manufacturing plants at places A, B, C with daily output of 500, 300 and 200. It has warehouses at places P, Q, R, S with daily requirement of 180, 150, 350, 320 units respectively. Per unit shipping charge is given below **03**

To:	P	Q	R	S
From A	12	10	12	13
From B	7	11	8	14
From C	6	16	11	7

Find the transportation cost by Vogel's approximation method.

- (b)** A production supervisor is considering how he should assign the four jobs that are to be performed, to four of the workers. He wants to assign the jobs to workers such that the aggregate time to perform the jobs is the least. The information for the time taken is given below **04**

Worker	Job			
	A	B	C	D
1	45	40	51	67
2	57	42	63	55
3	49	52	48	64
4	41	45	60	55

Solve this assignment problem using Hungarian Assignment Method.

- (c)** A bakery keeps stock of popular brand of cake. Previous experience shows that the daily demand pattern is given below **07**

Daily Demand	0	10	20	30	40	50
Probability	0.01	0.2	0.15	0.5	0.12	0.02

Use the following sequence of random numbers to simulate demand for next 10 days and also find average demand per day.

Random Numbers:- 25, 39, 65, 76, 12, 05, 73, 89, 19, 49

OR

- Q.5 (a)** Explain various elements of queuing system. **03**
(b) Explain group replacement policy with suitable example. **04**
(c) Discuss PERT, CPM and difference between PERT and CPM. **07**
