Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER–IV- EXAMINATION – WINTER 2018

Subject Code: 640003 Date: 22/11/2018

Subject Name: Operations Research (OR)

Time: 10.30 am to 1.00 pm Total Marks: 70

Instructions:

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

Q.1 Define the following terms: **14**

(i) Operations Research
(ii) Objective Function
(iii) Events
(iv) EOQ
(v) Idle Time on a Machine
(vi) Failure
(vii) Optimal solution

Q.2 **(a)** Use graphical method to solve the following LP problem. **07**

Maximize $Z=15x_1 + 10x_2$

Subject to constraints

(i) $4x_1 + 6x_2 \leq 360$
(ii) $3x_1 + 0x_2 \leq 180$
(iii) $0x_1 + 5x_2 \leq 200$

And $x_1, x_2 \geq 0$

(b) Solve the following LP problem using Simplex Method. **07**

Max $z = 3x_1 + 2x_2 + 5x_3$

Subject to the constraints

(i) $x_1 + 2x_2 + x_3 \leq 430$
(ii) $3x_1 + 2x_3 \leq 460$
(iii) $x_1 + 4x_2 \leq 420$

And $x_1, x_2, x_3 \geq 0$

OR

(b) A company makes two products (say, P and Q) using two machines (say, A and B). Each unit of P that is produced requires 50 minutes processing time on machine A and 30 minutes processing time on machine B. Each unit of Q that is produced requires 24 minutes processing time on machine A and 33 minutes processing time on machine B. Machine A is going to be available for 40 hours and machine B is available for 35 hours. The profit per unit of P is $25 and the profit per unit of Q is $30. Formulate this problem as an LP model to determine the production quantity of each product in such a way as to maximize the total profit, given that the available resources should not be exceeded. **07**

Q.3 **(a)** Construct the dual of the problem **07**

$\text{Min}_z = 3x_1 - 2x_2 + 4x_3$

Subject to

$3x_1 + 5x_2 + 4x_3 \geq 7,$
$6x_1 + x_2 + 3x_3 \geq 4,$
$7x_1 - 2x_2 - x_3 \leq 10,$

$$x_1 - 2x_2 + 5x_3 \geq 3,$$
$$4x_1 + 7x_2 - 2x_3 \geq 2,$$

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

(b) Explain the various steps involved in solving transportation problem using (i) North West Corner Method (ii) Least Cost Method. **07**

OR

Q.3 **(a)** Find the initial basic feasible solution of the following transportation problem: **07**

(i) NWCM (ii) LCM

Plants	Ware houses				
	D1	D2	D3	D4	Supply
S1	19	30	50	10	7
S2	70	30	40	60	9
S3	40	8	70	20	18
Demand	5	8	7	14	

(b) A book binder has one printing press, one binding machine and manuscripts of a number of books. The time required for performing the printing and binding operations on each book are shown below. The binder wishes to determine the order in which the book should be processed, so that the total time required to process all books is minimized. **07**

Book	1	2	3	4	5	6
Printing time (Hours)	30	120	50	20	90	110
Binding time (Hours)	80	100	90	60	30	10

Q.4 **(a)** What is Simulation? Explain the advantages and disadvantages of Simulation. **07**

(b) i) Define the terms: (I) Saddle Point (II) Value of the Game (III) Fair Game **03**

ii) Find the range of values of p and q which will render the entry(2,2) a saddle point for the game **04**

	Player B		
	2	4	5
	10	7	q
	4	p	6

OR

Q.4 **(a)** Explain the structure of the Queuing System. **07**

(b) An Accounts Officer has 4 subordinates and 4 tasks. The subordinates differ in efficiency. The tasks also differ in their intrinsic difficulty. His estimates of the time each would take to perform each task are given in the matrix below. How should the tasks be allocated one to one man, so that the total man hours are minimized? **07**

	Task				
subordinate		I	II	III	IV
	1	8	26	17	11
	2	13	28	4	26
	3	38	19	18	15
	4	19	26	24	10

Q.5 **(a)** What is Replacement? Explain the types of failures with example. **07**

(b) A small assembly plant assembles PCs through 9 interlink stages according to the following precedence / process. **07**

Stages	From	1	1	1	2	2	3	4	5	6	6	7	8
	To	2	3	4	4	5	6	6	7	7	8	8	9

	Hours	4	12	10	8	6	8	10	10	0	8	10	6

(i) Draw an Arrow Diagram (Network) representing the above assembly work.
(ii) Tabulate Earliest Start, Earliest Finish, Latest Start and Latest Finish time for all the stages.
(iii) Find the Critical Path and the Assembly Duration.
(iv) Tabulate the Total Float, Free Float and Independent Float.

OR

Q.5 **(a)** Explain the difference between PERT and CPM. **07**

(b) The production department of a company requires 3,600 kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs. 36 and the cost of carrying inventory is 25% of the inventories. The price is Rs. 10 per kg. Help the purchase manager to determine an ordering policy for raw material. **07**

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