

GUJARAT TECHNOLOGICAL UNIVERSITY**MCA (INTEGRATED) - SEMESTER-IV EXAMINATION – WINTER 2020****Subject Code:2648602****Date:05/02/2021****Subject Name:Operations Research****Time:02:00 PM to 04:00 PM****Total Marks: 56****Instructions:**

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks

- Q1. (a)** Define Operation Research and explain briefly its application? **07**
- (b)** i) What is Replacement? Explain with example the failure mechanism of item? **03**
- ii) Define Linear Programming Problem with its advantages? **04**
- Q2. (a)** Find the Initial basic feasible solution to the following transportation problem using NWC, LCM and VAM. **07**

Sources	Destinations				Supply
	D1	D2	D3	D4	
S1	2	3	11	7	6
S2	1	0	6	1	1
S3	5	8	15	9	10
Demand	7	5	3	2	

- (b)** There are four (4) workmen and four (4) jobs in a factory. The studies carried out shows that time taken by various workmen for different jobs are given in matrix: **07**

Workers	Jobs			
	A	B	C	D
1	45	40	51	67
2	55	40	61	53
3	49	52	48	64
4	41	45	60	55

Find the assignment of workmen to jobs that will minimize the total time taken.

- Q3. (a)** What is Inventory? Explain Different Inventory Cost Component? **07**
- (b)** A company that operates for 50 weeks in a year is concerned about its stock of copper cable. The cost Rs. 240 a meter and there is a demand for 8000 meters a week. Each replenishment cost is Rs. 1,050 for administration and Rs. 1,650 for delivery, while holding costs are estimated at 25 % of value held a year. Assuming no shortage are allowed. **07**
- i) Calculate EOQ.
 - ii) Calculate Total variable Inventory Cost.
 - iii) Total Cost.
- Q4. (a)** A manufacture has to supply his customer with 24,000 units of his product per year. This demand is fixed and known. Since the unit used by the customer is assembly- line operation and the customer has no shortage space for the units, the manufacture must shift a day's supply each day. If the manufacture fails to **07**

supply the required units, he will lose the account and probably his business. Hence the cost of shortage is assumed to be infinite and consequently, none will be tolerated. The inventory holding cost amounts to 0.10 per unit per month, and the set-up cost per run is Rs. 350. Find the optimum lot size and the length of optimum production run.

- (b) A company management and the labour union are negotiating a new three year settlement. Each of these has 4 strategies: 07

1. Hard and aggressive bargaining
2. Reasoning and logical approach
3. Legalistic Strategy
4. Conciliatory approach.

Union Strategies	Company Strategies			
	1	2	3	4
I	20	15	12	35
II	25	14	8	10
III	40	2	10	5
IV	-5	4	11	0

What strategy will the two sides adopt? Also determine the value of the game.

- Q5. (a) In a railway marshalling yard, goods train arrive at a rate of 30 trains per day. 07
Assuming that the interarrival time follows an exponential distribution and service time distribution is also exponential with an average of 36 minutes.

- A. Find the expected size of queue.
- B. Find the probability that the queue size exceeds 10.

- (b) The major elements of the project have been identified, as follows, along with their durations and immediately preceding element. 07

Activity	Description	Duration (Week)	Immediate Predecessor
A	Design new premises	14	-
B	Obtain tenders from the customers	4	A
C	Select the Contractor	2	B
D	Arrange the details with selected Contractor	1	C
E	Decide which equipment is to be used	2	A
F	Arrange storage of equipment	3	E
G	Arrange disposal of other equipment	2	E
H	Order New equipment	4	E
I	Take delivery of new equipment	3	H,L
J	Renovation take place	12	K
K	Remove old equipment for storage or disposal	4	D,F,G
L	Cleaning after the contractor has finished	2	J
M	Return old equipment for storage	2	H,L

(A) Draw the network diagram

(B) Indicate the critical path

Q6. (a) Solve the game whose payoff matrix is given below:-

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Player A	Player B			
	B1	B2	B3	B4
A1	3	2	4	0
A2	3	4	2	4
A3	4	2	4	0
A4	0	4	0	8

(b) Consider a single server queuing system with Poisson input and exponential service time. Suppose the mean arrival rate is 3 calling unit per hour, the expected service time is 0.25 hour and maximum permissible calling units in the system in two. Derive the steady-state probability distribution of the number of the calling units in the system, and then calculate the expected number in the system.

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Q7. (a) Solve LP Problem by Graphical method

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Minimize $Z=40 X_1 + 24 X_2$ Total cost
 Subject to, $20 X_1 + 50 X_2 \geq 4,800$ Material I requirement
 $80 X_1 + 50 X_2 \geq 7,200$ Material II requirement
 $X_1, X_2 \geq 0$ Non negative condition.

(b) A company manufactures around 200 mopeds. Depending upon the availability of the raw materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds. Whose probability distribution is given below:

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Production/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 a specially designed three- storeyed lorry that can accommodate only 200 mopeds. Using 15 random number: 82,89,78,24,53,61,18,45,04,23,50,77,27,54 and 10, simulate the mopeds waiting in the factory?

- A. What will be the average number of mopeds waiting in the factory?
 B. What will be the number of empty spaces in the lorry?

Q8. (a) Solve the LP Problem by Simplex Method

07

Maximize $Z=30 X_1 + 40 X_2$
 Subject to, $60 X_1 + 120 X_2 \leq 12,000$
 $8 X_1 + 5 X_2 \leq 600$
 $3 X_1 + 4 X_2 \leq 500$
 $X_1, X_2 \geq 0$

(b) Use Big –M Method to solve the following LP Problem.

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Maximize $Z= X_1 + 2X_2 + 3X_3 - X_4$
 Subject to the constraints
 i) $X_1 + 2X_2 + 3X_3 =15$
 ii) $2X_1 + X_2 + 5X_3 =20$
 iii) $X_1 + 2X_2 + X_3 + X_4= 10$
 $X_1, X_2, X_3, X_4 \geq 0$