GUJARAT TECHNOLOGICAL UNIVERSITY
MCA- SEMESTER V – EXAMINATION – WINTER 2020

Subject Code: 4659310   **Date: 05/01/2021**

Subject Name: Operation Research

Time:10.30 am to 12.30 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.

Q-1(A)   **(A) Define the Follwing**   (07)
1. Operation Research
2. Feasible Solution
3. Degeneracy in Transportation problem
4. Free Float
5. Saddle Point
6. Artificial Variables
7. Unrestricted Variables

  (B)   A company is producing a single product and selling it through five agencies   (07)
situated in different cities. All of a sudden, there is a demand for the product in
five more cities that do not have any agency of the company. The company is
faced with the problem of deciding on how to assign the existing agencies to
dispatch the product to the additional cities in such a way that the travelling
distance is minimized. The distances (in km) between the surplus and deficit
cities are given in the following distance matrix.

| Define City Surplus City	I	II	III	IV	V
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110
E	55	35	70	80	105

Determine the optimum Assignment schedule

Q-2 (A) 1. The Production department for a company requires 3500kg. of row material (04)
for manufacturing a particular item per year. it has been estimated that the cost
of placing an order is Rs 35 & the cost of carrying inventory is 25 percentage of
the investment in the inventories. The price is Rs 10 per kg. The purchase
manager wishes to determine an ordering policy for raw material.
Calculate (1) The Optimal lot size (2) the optimal order cycle time (3) Total
Inventory Cost

2. What are the advantages and limitations of Game Theory (03)

(B) The following network diagram represents activities associated with a projec (07)

Activities :	A	B	C	D	E	F	G	H
Optimistic time, t_0 :	5	18	26	16	15	6	7	7
Pessimistic time, t_p :	10	22	40	20	25	12	12	9
Most likely time, t_m :	8	20	33	18	20	9	10	8
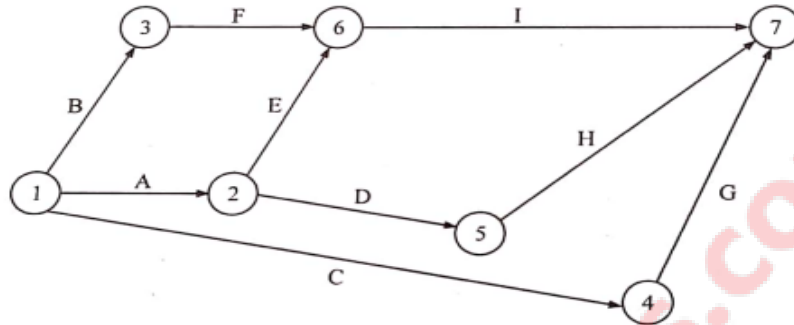
Determine the following:

(a) Expected completion time and variance of each activity

(b) The earliest and latest expected completion times of each event.

(c) The critical path.

(d) The probability of expected completion time of the project if the original scheduled time of completing the project is 41.5 weeks.

(e) The duration of the project that will have 95 per cent chance of being completed.

Q-3(A) 1. Construct the dual of following prime problem (03)

Maximize $Z = 3x_1 - x_2 + x_3$

Subject to constraints,

$4x_1 - x_2 \le 8$,

$8x_1 + x_2 + 3x_3 \le 8$,

$5x_1 - 6x_3 \le 12$,

$x_1, x_2, x_3 \ge 0$

2. Difference between AOA & AON Network (04)

(B) Completely describe the various costs involved with "Inventory Control". (07)

Q-4 (A) There are nine jobs, each of which must go through two machines P and Q in the order PQ, the processing times (in hours) are given below: (07)

Machine	Job(s)								
	A	B	C	D	E	F	G	H	I
P	2	5	4	9	6	8	7	5	4
Q	6	8	7	4	3	9	3	8	11

Find the sequence that minimizes the total elapsed time T. Also calculate the total idle time for the machines in this period.

| (B) | A 24 hour supermarket has the following minimal requirements for cashiers: | | | | | | | (07) |

Period	1	2	3	4	5	6
Time of the day (24 hour clock)	3-7	7-11	11-15	15-19	19-23	23-3
Minimum number required	7	20	14	20	10	5

Period 1 follows immediately after period 6. A cashier works eight consecutive hours, starting at the beginning of one of the six time periods. Determine a daily employee worksheet which satisfies the requirements with the least number of personnel. Formulate the problem as an LPP.

Q-5(A) What is Simulation and what are the advantages and disadvantages of simulation (07)

(B) At barber's shop, the customers arrive at the average interval of 6 minutes and the barber takes on an average 5 minutes for serving the person. (07)
Calculate: i. Counter utilization level ii. Average no. of customers in service iii. Average no. of customers in queue iv. Average waiting time of the customers in the system v. Expected average waiting time in the queue vi. Probability that the barber is idle vii. Probability of finding more than 3 customers in the system

Q-6 (A) What are the types of failure in Replacement Models (07)

(B) Solve the following LP Problem using Simplex Method (07)
$$\text{Max } Z = 3x1 + 2x2$$
Subject to $\quad x1 + x2 \le 4$
$$X1 - x2 \le 2$$
And $x1, x2 \ge 0$

Q-7(A) Use the Graphical method to solve the following LP problem (07)
$$\text{Minimize } Z = 20x1 + 10x2$$
Subject to the constraints
(i) $x1 + 2x2 \le 40$
(ii) $3x1 + x2 \ge 30$
(iii) $4x1 + 3x2 \ge 60$

(B) What do you mean by CPM, Give one example and explain how to calculate Critical Path (07)

Q-8(A) Difference between Transportation and Assignment problem with Suitable Example (07)

(B) Determine an initial basic feasible solution to the following transportation problem by using NWCM.

	D1	D2	D3	D4	Supply
S1	6	4	1	5	14
S2	8	9	2	7	16
S3	4	3	6	2	5
Demand	6	10	15	4	