Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER– IV• EXAMINATION – SUMMER 2015

Subject Code: 2640003 **Date:15/05/2015**

Subject Name: Operations Research

Time: 10:30 am - 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.**

Q.1 **(a)** Do as directed. **07**

(i) Name linear components of LP Problem.

(ii) Write the necessary condition to find initial basic feasible solution of a transportation problem?

(iii) What do you mean by unbalanced assignment problem?

(iv) How to compute the estimated time of activity in PERT?

(v) Explain the term 'carrying cost' used in inventory.

(vi) List behavior patterns of arrived impatient customers in queuing.

(vii) Write the necessary conditions to convert m-machine and n-jobs sequencing problem into 2-machine n-jobs to apply Jhonson's rule.

(b) (i) Write the dual of the following primal LP problem. **04**

Min $Z_x = 7X_1 + 4X_2 + 6X_3$

Subject to

$4X_1 + 3X_2 + 2X_3 \geq 2$

$3X_1 + 2X_2 + 5X_3 = 3$

$5X_1 + 4X_2 + 6X_3 \leq 7$

$2X_1 + 5X_2 + 3X_3 \geq 6$

$X_1, X_2 \geq 0$, X_3 unrestricted

(ii) Determine whether the following two-person zero-sum game is strictly determinable and fair. Find the value of the game and optimal strategy, if any. Payoff matrix of player A is given below. **03**

Player A	Player B			
	B1	B2	B3	B4
A1	1	7	3	4
A2	5	6	4	5
A3	7	2	0	3

Q.2 **(a)** Solve the following LP problem using graphical method. **07**

Min $Z_x = 20\ X_1 + 10\ X_2$

Subject to

$X_1 + 2X_2 \leq 40,\quad 3X_1 + X_2 \geq 30,\quad 4X_1 + 3X_2 \geq 60,$

$X_1, X_2 \geq 0$

(b) Solve the following LP problem using simplex method. **07**

Min $Z_x = 60\ X_1 + 50\ X_2$

Subject to

$2X_1 + X_2 \geq 80, \quad X_1 + 2X_2 \geq 60$

$X_1, X_2 \geq 0$

OR

(b) (i) A farmer has 500 acres of land on which he can grow corn, wheat and rice. Each acre of corn costs Rs 100 for preparation, requires 7 men-days of work and yields a profit of Rs. 30. Each acre of wheat costs Rs 120 to prepare, requires 10 men-days of work and yields a profit of Rs. 40. Each acre of rice costs Rs 70 to prepare, requires 8 men-days of work and yields a profit of Rs. 20. Considering that the farmer has Rs 9000 for preparation and 6000 men-days of work, formulate LP problem to determine how many acres should be allocated to each crop in order to maximize profits. **04**

(ii) Explain the need of slack, surplus and artificial variable in solving LP problem using simplex method. **03**

Q.3 **(a)** Following table shows the supply capacity of 3 plants and demand of 4 warehouses along with the transportation cost per unit item. Find initial feasible solution using least cost method. Find an optimal transportation schedule and its cost. If it has an alternate optimal solution, show it. **07**

Plants	Warehouses				Supply
	I	II	III	IV	
A	5	10	4	5	10
B	6	8	7	2	25
C	4	2	5	7	20
Demand	25	10	15	5	

(b) The casual medical officer of a hospital has received four requests for ambulance van facility. Five vans are available for assignment and their response times (in minutes) are given in the following table. Assign the vans so as to minimize total response time. **07**

Incidents	Vans				
	I	II	III	IV	V
A	9	3	6	5	4
B	8	6	3	2	7
C	4	3	7	6	5
D	3	7	9	8	6

OR

Q.3 **(a)** What do you mean by unbalanced transportation problem and unbalanced assignment problem? How can you convert them into balanced problem? **07**

(b) Write the mathematical form of transportation. Represent assignment problem as a special case of transportation problem. **07**

Q.4 **(a)** The precedence relations and time for various tasks of a project are given in the following table. Determine the minimum project completion time, critical tasks and compute total float and free float for tasks. **07**

Tasks	A	B	C	D	E	F	G	H	I
Time (Days)	8	10	8	10	16	17	18	14	9
Predecessor	-	-	-	A	A	B, D	C	C	F, G

(b) Five jobs are to be processed on machines A, B and C in the order A,B,C. Refer the processing time in (Hours) in the following table and determine the sequence of jobs to minimize total elapsed time. Compute the machine idle time also. **07**

	Jobs				
	I	II	III	IV	V
Machine A	5	7	9	6	5
Machine B	2	1	4	5	3
Machine C	3	7	5	6	7

OR

Q.4 **(a)** A project involving 7 activities (i, j) and their time (weeks) estimates are listed in the following table. Determine the expected project length. What is the probability that the project will take more than 21 weeks to complete? **07**

Activity (i,j)	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Optimistic	1	1	2	1	2	2	3
Most likely	1	4	2	1	5	5	6
Pessimistic	7	7	8	1	14	8	15

(b) Two jobs are to be processed on four machines A,B,C and D. The technological order of processing jobs on machines and their processing times (hours) are as shown below. Determine optimal sequence of jobs on each of the machines and show the job idle time. **07**

Job 1	m/c order	A	B	C	D
	Processing time	4	6	7	3
Job 2	m/c order	D	B	A	C
	Processing time	8	7	4	5

Q.5 **(a)** The purchase price of a machine is Rs 7000. Its maintenance cost (Rs) and resale value (Rs) per year are given in the following table. When should the machine be replaced? **07**

Year	1	2	3	4	5	6	7	8
Maintenance cost	900	1200	1600	2100	2800	3700	4700	4900
Resale value	4000	2000	1200	600	500	400	400	400

(b) (i) A product is manufactured at the rate of 250 pieces per day and its demand rate is 50 pieces per day. The setup cost of the machine is Rs 2000 and the storage cost is Rs 0.25 per piece per day. Assuming 300 working days per year, determine the economic batch size of quantities for each production cycle and optimal number of production cycles. **04**

(ii) A self-service store employs one cashier at its counter. Nine customers arrive in one minute, while the cashier can serve ten customers in one minute. Assuming Poisson distribution of arrival and exponential distribution of service time, determine average number of customers in the system and average time a customer spends in the system. **03**

OR

Q.5 **(a)** Discuss about various forms of inventory in detail. **07**

(b) (i) Explain the ways of selecting customers from the queue for service. **04**

(ii) Write the advantages and disadvantages of simulation. **03**

****