

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-Vth Examination December 2010****Subject code: 152005****Subject Name: Quantitative Techniques in Management****Date: 21 /12 /2010****Time: 03.00 pm - 05.30 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)** A manufacturing firm has three plants, A, B and C and three warehouses at Delhi, Ahmedabad and Nagpur. Their capacities and requirements are shown in table below. **07**

Plants	Capacities	Warehouses	Requirements
A	40	Delhi	55
B	50	Ahmedabad	45
C	40	Nagpur	30

The transportation costs in Rupees from plants to warehouses are as given below:

	Delhi	Ahmedabad	Nagpur
A	11	9	6
B	12	14	11
C	10	8	10

There is no other condition, any plant can transport the product to any warehouses upto its requirement. Find most economical shipment to minimize the total transportation costs. (Apply stepping stone method).

- (b)** A captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are as follows: **07**

Batsman	Batting Position				
	III	IV	V	VI	VII
A	40	40	35	25	50
B	42	30	16	25	27
C	50	48	40	60	50
D	20	19	20	18	25
E	58	60	59	55	53

Make the assignment so that the expected total average runs scored by those batsmen are maximum.

- Q.2 (a)** (i) Give any three definition of Operation Research and explain. **03**
 (ii) Define and explain the following terms used in linear programming. **04**
1. Objective function
 2. Constraints
 3. Feasible solution
 4. Optimal solution

- (b) Solve the following problem with simplex method.

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$$\begin{aligned} \text{Minimize} \quad & z = 4x + 2y \\ \text{Subject to:} \quad & x + 2y \geq 2 \\ & 3x + y \geq 3 \\ & 4x + 3y \geq 6 \\ & x, y \geq 0 \end{aligned}$$

OR

- (b) A toy manufacturing company has two types of dolls: a basic version doll A and deluxe version B. Each doll of type B takes twice as long as one of types A and the company would have time to make a maximum of 2000 dolls per day if only the basic version A is produced. Supply of plastic is sufficient to produce 1500 dolls per day both A and B combined.

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The deluxe version doll B requires a fancy dress of which there are 600 dresses per day available.

If the company makes a profit of Rs. 3 and Rs. 5 per doll of A and B respectively, how many dolls of types A and B each will have to be produced to maximize the profit?(solve by simplex method)

- Q.3 (a) A finance company has 3 service persons in their main office. Customers are found to arrive in Poisson manner at a rate of 5 per hour for the service from the company. The service time is found to have exponential distribution with a mean of 25 minutes. The customers are processed on FCFS basis. Calculate ;

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1. The average number of customers in the system.
2. The average time a customer spends in the system.
3. The average queue length.
4. The average waiting time for customers.
5. The number of hours per week spent on performing this job.
6. The probability that at least an employee is waiting for customers.

- (b) What is a sequencing problem? Explain and illustrate.

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Determine the optimal sequencing of jobs from the following data and obtain the total elapsed time involved.

Machines	Jobs							
	1	2	3	4	5	6	7	8
M1	7	3	6	8	9	5	4	3
M2	8	8	2	4	7	5	6	8

OR

- Q.3 (a) The Angel Medicals is manned by three salesmen. Any salesman can provide desired service to any customer. The customers arrive at the counter according to Poisson distribution at an average rate of 30 per hour. The service time is exponential with a mean rate of 3 minutes.

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1. What fraction of time are all three attendants busy?
2. What is the mean number of customers waiting to be attended?
3. What average time does a customer spend at the shop?
4. What is the probability that a customer has to wait?

- (b) There are four jobs each of which has to be processed on machines A, B, C, D, E, and F in the order ABCDEF. Processing time in hours is given below. Find out the optimal sequencing of jobs, minimum time required to process these jobs and the idle time for each these machines

07

Jobs	Machines					
	A	B	C	D	E	F
1	15	8	6	14	6	26
2	17	7	9	10	15	12
3	21	7	12	9	11	19
4	18	6	11	12	14	17

- Q.4 (a)** (i) Distinguish between CPM and PERT. Which one is most commonly used? **03**
Justify your answer.
- (ii) Explain the following terms in PERT. **04**
Optimistic time, Normal time, Pessimistic time, Expected time, in respect to activities.
- (b)** The project has the following characteristics: **07**

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Preceding Activity	None	A	A	B	D	D	D	B	C,E	G	F,I,J	K	H,G	M
Duration (in week)	5	2	6	12	10	9	5	9	1	2	3	9	7	8

- (i) Draw a PERT network for this project.
- (ii) Find the various paths and the critical path as well as the project completion time.
- (iii) Prepare an activity schedule showing the ES, EF, LS, LF, and float for each activity.
- (iv) Will the critical path change if activity G takes 10 weeks instead of 5 weeks? If so, what will be the new critical path?

OR

- Q.4 (a)** A small project consisting of eight activities has the following characteristics: **07**
Time Estimates (in weeks)

Activity	Preceding activity	Most Optimistic	Most likely	Most pessimistic
A	None	2	4	12
B	None	10	12	26
C	A	8	9	10
D	A	10	15	20
E	A	7	7.5	11
F	B,C	9	9	9
G	D	3	3.5	7
H	E,F,G	5	5	5

- (i) Draw the PERT network for the project.
- (ii) Determine the critical path.
- (iii) Prepare the activity schedule for the project.
- (iv) If a 30 weeks deadline is imposed, what is the probability that the project will be finished within the time limit?
- (v) If the project manager wants to be 99% sure that the project is completed on the schedule date, how many weeks before that date should he start the project work?
- (b)** For a small project of 12 activities, the details are given below. Draw the network and compute earliest occurrence time, latest occurrence time, critical activities and project completion time. **07**

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Preceding Activity	-	-	-	B,C	A	C	E	E	D,F,H	E	I,J	G
Duration (days)	9	4	7	8	7	5	10	8	6	9	10	2

- Q.5 (a)** The data on the operating costs per year and resale of equipment A whose purchase price is Rs.10,000 are given below: **07**

Year	1	2	3	4	5	6	7
Operating cost (Rs)	1500	1900	2300	2900	3600	4500	5500
Resale value (Rs)	5000	2500	1250	600	400	400	400

- (i) What is the optimum period for replacement?
- (ii) When equipment A is 2 year old equipment B, which is a new model for the same usage is available. The optimum period for replacement is 4 years with an average cost of Rs. 3,600. Should we change equipment A with that of B? If so when?
- (b) In the toy manufacturing, suppose the product acceptance probabilities are not known, but the following data is known. **07**

Product acceptance (strategy)	Anticipated first year profit (Rs. 1000's)		
	Product line		
	Full	Partial	Minimal
Good	8	70	50
Fair	50	45	40
Poor	-25	-10	0

Determine the optimal decision under each of the following decision criteria and show how you arrived at it.

- (i) Maximax (ii) Maxmin (iii) Equal likelihood (iv) Minimax regret

OR

- Q.5** (a) What is the replacement problem? Describe the different factors which are responsible to replace the equipment although it may be running. **07**
- (b) What is decision making? Explain the various steps involved in decision making process. **07**
