

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-V EXAMINATION – WINTER 2015

Subject Code: 152005**Date: 14/12/2015****Subject Name: Quantitative Techniques in Management****Time: 10:30am to 1:00pm****Total Marks: 70****Instructions:**

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

Q.1 Solve the following LPP with simplex method. **14**

Maximize $Z = 30x_1 + 20x_2$

Subject to:

$-x_1 - x_2 \geq -8$

$-6x_1 - 4x_2 \leq -12$

$5x_1 + 8x_2 = 20$

$x_1, x_2 \geq 0$

Q.2 (a) The maintenance costs and the resale price of machine A whose purchase price is Rs. 12000 are given as: **07**

Year	1	2	3	4	5	6	7
Maintenance cost (Rs.)	2600	3000	3400	4000	4700	5600	6600
Resale price (Rs.)	7000	4500	3250	2600	2400	2400	2400

1. Suggest optimal period for the replacement of the machine.
2. When this machine is 2 years old, another machine B, which is a new model of machine A, is available. The optimal period for this machine B, is 4 years, with an average cost of Rs. 4700. Should machine A be replaced with B? If yes, when?

(b) To stimulate interest and provide an atmosphere for intellectual discussion, the faculty in a college decides to hold special seminars on four topics- Simplex, Transportation, Replacement and Queuing. Such seminars would be held once per week in the afternoons. However, scheduling these seminars (one for each topic, and not more than one seminar per afternoon) has to be done carefully so that the number of students unable to attend is kept to a minimum. A careful study indicates that the number of students who cannot attend a particular seminar on a specific day is as follows: **07**

	Simplex	Transportation	Replacement	Queuing
Monday	50	40	60	20
Tuesday	40	30	40	30
Wednesday	60	20	30	20
Thursday	30	30	20	30
Friday	10	20	10	30

Find an optimal schedule of the seminars. Also find out the total number of students who will be missing at least one seminar, and the day on which there would not be any seminar.

OR

(b) Maxwell Company produces two products A and B. Products are produced and sold on a weekly basis. The weekly production cannot exceed 25 for product A and 35 for product B. This is due to limited available facilities. **07**

The company has total of 60 workers. Product A requires 2 man-weeks of labour, while B requires one man-week of labour. Profit margin of A is Rs. 60 and on B is Rs. 40. Formulate it as a linear programming problem and solve it with graphical method.

- Q.3 (a)** XYZ Enterprises has three plants manufacturing a typical product, located at different locations. Production cost differs from plant to plant. There are five offices of the company located in different regions of the country. The selling prices also differ from region to region. The shipping cost from each plant to each sales office and other information is as under: **10**

Plant	Production Cost per unit (in Rs.)	Sales Office					Capacity (in number of units)
		A	B	C	D	E	
		Shipping cost per unit (in Rs.)					
1	20	1	1	5	9	4	150
2	22	9	7	8	3	6	200
3	18	4	5	3	2	7	125
Demand (in number of units)		80	100	75	45	125	
Selling price per unit (in Rs.)		30	32	31	34	29	

Find out the most profitable distribution pattern for the company.

- (b)** Write a dual of the following LPP: **04**

Maximize $Z = 5x_1 + 3x_2 + 2x_3$

Subject to $2x_1 + 4x_2 + x_3 = 12$

$4x_1 + 3x_2 = 10$

x_1 unrestricted sign; $x_2, x_3 \geq 0$

OR

- Q.3 (a)** Answer the following: **07**

1. Explain the case of degeneracy in transportation problems.
2. Explain the significance of sensitivity analysis in case of simplex problems.

- (b)** A company has developed a new product in its R & D laboratory. The company has the option of setting up production facility to market this product straight away. If the product is successful, then over the three years expected product life, the returns will be Rs. 120 lakh with a probability of 0.70. If the market does not respond favourable, then the returns will be only Rs. 15 lakh with probability of 0.30. **07**

The company is considering whether it should test market this product building a small pilot plant. The chance that the test market will yield favourable response is 0.80. If the test market gives favourable response, then the chance of successful total market improves to 0.85. If the test market gives poor response then the chance of success in the total market is only 0.30.

As before, the returns from a successful market will be Rs. 120 lakh and from an unsuccessful market only Rs. 15 lakh. The installation cost to produce for the total market is Rs. 40 lakh and the cost of the test marketing pilot plant is Rs. 5 lakh. Draw a decision tree diagram; carry out necessary analysis to determine the optimal decisions.

Q.4

A project consists of following activities with the corresponding time estimates: **14**

Activity	Immediate Predecessor	Time (Days)		
		Optimistic	Most likely	Pessimistic
A	-	1	1	7
B	-	1	4	7
C	-	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D,E	3	6	15
H	F,G	1	2	3

With the above information

1. Draw PERT network
2. Find the expected time for each activity
3. Determine the earliest event times and latest allowable times
4. Determine the critical path
5. Determine the total slack for each activity
6. What is the probability that the project will be completed in 22 days?
7. What project duration will have 95% chance of completion?

(use of table for area under the normal curve is permitted)

OR

Q.4 (a) A Hotel has 4 banquet halls that can be used for all functions including **07**

weddings. The halls were all about the same size but the facilities in each hall differed. During a heavy marriage season, 4 parties approached the Manager to reserve a hall for the marriage to be celebrated on the same day. These marriage parties were told that the first choice among these 4 halls would cost Rs. 100000 for the day. They were also required to indicate the second, third and fourth preferences and the price that they would be willing to pay. Marriage party A & D indicated that they will not be interested in halls 3 & 4. Other particulars are given in the following table:

Marriage Party	Revenue per hall (in Rs.)			
	1	2	3	4
A	100000	90000	X	X
B	80000	100000	80000	50000
C	70000	100000	60000	80000
D	100000	80000	X	X

Suggest the Manager on allocation that will maximize the revenue to the hotel. (X indicates that the party is not interested in that hall)

(b) A ready-made garments manufacturer has to process 7 items through two **07**

stages of production, viz., cutting and sewing. The time taken by each of these items at the different stages are given below:

Item	1	2	3	4	5	6	7
Cutting time (hrs)	5	7	3	4	6	7	12
Sewing time (hrs)	2	6	7	5	9	5	8

1. Find an order in which these items are to be processed so as to minimize the total processing time.
2. Suppose a third stage of production is added, viz., ironing and packing, with processing time as under:

Item	1	2	3	4	5	6	7
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Ironing & packing time (hrs)	10	12	11	13	12	10	11
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Find an order in which these seven items are to be processed so as to minimize the time taken to process all the items through all the three stages.

Q.5 (a) The following is the data for a shop floor with 3 machines and 6 jobs: **07**

Job	1	2	3	4	5	6
Machine A	12	10	9	14	7	9
Machine B	7	6	6	5	4	4
Machine C	6	5	6	4	2	4

The order of processing jobs is ACB. The company is currently following the sequence as 5-3-6-2-1-4. Do you think this sequence is optimal? If no, find out the optimal sequence and determine the total minimum elapsed time.

(b) A large computer installation contains 2000 components of identical nature which are subject to failure as per probability distribution that follows: **07**

Month end	1	2	3	4	5
% failure to date	10	25	50	80	100

Components which fail have to be replaced for efficient functioning of the system. If they are replaced as and when failures occur, the cost of replacement per unit is Rs. 45. Alternatively, if all components are replaced in one lot at periodic intervals, the cost of component replaced is Rs. 15. However in this case also individual replacement (at Rs. 45 per unit) of failed component has to be carried out between group replacements. Assess which policy of replacement would be economical assuming that the failures are occurring towards the end of month.

OR

Q.5 (a) A service station store is located in a workshop. Service mechanics arrive to take spare parts for the jobs they work upon. The mechanics wait in queue if necessary and are served on a first-come-first-served basis. The store is manned by one attendant who can attend 8 mechanics in an hour on an average. The arrival rate of the mechanics averages 6 per hour. Assuming that the pattern of mechanics' arrival is Poisson distributed and the servicing time is exponentially distributed, determine **07**

1. Expected time spent by a mechanic in the system
2. Expected time spent by a mechanic in the queue
3. Expected number of mechanics in the queue

(b) What are the applications of Operation Research? Explain with the help of real life examples. **07**
