

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – WINTER • 2014****Subject Code: 152005****Date: 08-12-2014****Subject Name: Quantitative Techniques in Management****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 project consists of 10 activities, each of which requires either, or both of two types of resources R_1 and R_2 for its performance. The duration of activities and their resource requirements are as follows: **14**

Activity	Duration (Days)	Resource Requirement	
		R_1	R_2
1-2	3	3	2
1-3	2	6	-
1-4	6	4	-
2-6	4	-	4
3-5	2	2	2
4-5	1	4	-
4-8	4	4	-
5-7	3	3	2
6-7	2	1	3
7-8	4	4	5

Resource availability R_1 : 7 units, R_2 : 5 units

Determine the duration of the project under the given resource constraint. If the resources were not a problem, how long would the project take to complete in normal course?

- Q:2 (a)** 1. Solve the following LPP graphically and write your comment. **05**

Maximize $Z = 20x_1 + 30x_2$

Subject to:

$$2x_1 + x_2 \leq 40$$

$$4x_1 - x_2 \leq 20$$

$$x_1 \geq 30$$

$$x_1, x_2 \geq 0$$

02

2. Differentiate Infeasibility and unboundedness in LPP solution.

- (b)** 'Every linear programming problem has a mirror image in a form of another linear programming problem called, its dual.' Do you agree? Explain the primal and dual relationship in detail. How is the knowledge of this relationship beneficial? **07**

OR

- (b)** The following table represents the initial simplex table for LPP. **07**

Table:1

Basis		x_1	x_2	S_1	S_2	A_1	A_2	b_i
A_1	-M	7	6	-1	0	1	0	20
S_2	0	8	5	0	1	0	0	30
A_2	-M	3	-2	0	0	0	1	18
Δ_j		$15+10M$	$25+4M$	-M	0	0	0	

Write down the original LP problem and its standardized form represented by the above table. Also prepare the immediate successive simplex table (table:2).

- Q:3 (a)** The solicitor's firm employs typists on hourly piece-rate basis for their daily work. There are five typists and their charges are different. According to an earlier understanding only one job was given to one typist and the typist was paid for a full hour, even if he worked for a fraction of an hour. Find the best cost allocation for the following data. **07**

Typist	Rate per hour	No. of pages typed/Hour
A	5	12
B	6	14
C	3	8
D	4	10
E	4	11

Job	No. of Pages
P	199
Q	175
R	145
S	298
T	178

- (b)** Solve the following transportation problem to minimize transportation cost: **07**

From/To	A	B	C	Supply
X	4	8	8	76
Y	16	24	16	82
Z	8	16	24	77
Demand	72	102	41	

OR

- Q:3 (a)**
1. Compare the Stepping Stone and MODI methods of testing the optimality of a solution to a transportation problem. Give suitable illustrations. **03**
 2. What is degeneracy in transportation problem? How does the problem of degeneracy arise in a transportation problem? How can we deal with this problem? **04**

- (b)** The travelling salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then return to his starting point. The travelling cost (in '000 Rs) of each city from particular city is given below: **07**

		To city				
From city		A	B	C	D	E
	A	-	2	5	7	1
	B	6	-	3	8	2
	C	8	7	-	4	7
	D	12	4	6	-	5
	E	1	3	2	8	-

What should be the sequence of visit of the salesman so that the cost is minimum?

- Q:4 (a)** A book binder has printing press, one binding machine and the manuscripts of number of different books. The times required to perform the printing and binding operation for each book are known. **07**

1. Determine the order in which the books should be processed in order to

minimize the total time required to process all the books.

Book	Processing time (in minutes)				
	1	2	3	4	5
Printing time	40	90	80	60	50
Binding time	50	60	20	30	40

2. Suppose that an additional operation is added to the process described above, viz. finishing. The times required for operations are given below:

Book	Finishing time (in minutes)				
	1	2	3	4	5
Finishing time	80	100	60	70	100

What is the order in which the books should be processed and also find the total elapsed time.

- (b) A manufacturer is offered two machines, Machine A and Machine B. Machine A has a cost price of Rs. 2,500 and its running cost is Rs. 400 for each of the first five years and increased by Rs. 100 for every subsequent year. Machine B, having the same capacity as A, costs Rs. 1250 and has running cost of Rs. 600 for six years, increasing by Rs. 100 per year thereafter. If money is worth 10% per year, which machine should be purchased? Both machines have negligible salvage value. 07

OR

- Q:4 (a) Use graphical method to minimize the time required to process the following jobs on the machines i.e. for each machine specify the job which should be done first. Also calculate the total elapsed time to complete both jobs. 07

Job 1	Sequence	A	B	C	D	E
	Time (hrs)	7	9	5	13	5
Job 2	Sequence	B	C	A	D	E
	Time (hrs)	11	9	7	5	13

- (b) The large cricket stadium has four giant light stands, which together have 1,000 bulbs of a certain type. From the past data, it was observed that the failure rates of these special bulbs are as shown in the following table: 07

End of week	1	2	3	4	5
Cumulative Probability	0.15	0.3	0.5	0.7	1.0

The cost of replacing individual bulb is Rs. 6, while the cost of replacing an the entire lot of bulb is Rs. 3 per bulb. It is decided to replace all the bulbs simultaneously at fixed intervals of time and also replace the individual bulbs that fail in between. Assuming that all the bulbs failing during a week might fail at any time of the week and that the group replacements can be made only at the end of the week, you are required to determine the optimal interval between the group replacements. Also establish if the policy as determined by you adopted is superior to the policy of replacing bulbs as and when they fail, are being nothing like 'group replacement'.

- Q:5 (a) A businessman has two independent investments, A and B available to him, but he lacks the capital to undertake both of them simultaneously. He can choose to take 07

A first and then stop, or it is successful then takes B or vice versa. The probability of success of A is 0.7, while for B it is 0.4. Both investments require initial capital outlay of Rs. 2000 and both return nothing if the venture is unsuccessful. Successful completion of A will return Rs. 3000 (over cost), successful completion of B will return Rs. 5000 (over cost). Draw the decision tree and determine the best strategy.

- (b) What is queuing theory? Explain the general structure of the queuing system and explain. Illustrate some queuing situations. 07

OR

- Q:5 (a)** A large steel manufacturing company has three options with regard to production: (1) produce commercially (2) build pilot plant (3) stop producing steel. The management has estimated that their pilot plant, if build has 0.8 chance of high yield and 0.2 chance of low yield. If the pilot plant does show a high yield, management assigns a probability of 0.75 that the commercial plant will also have a high yield. If the pilot plant shows low yield, there is only 0.1 chance that the commercial plant will show a high yield. Finally, management's best assignment of the yield on a commercial size plant without building a pilot plant first has 0.6 chance of high yield. A pilot plant will cost Rs. 3 Lakh, The profits earned under high and low yield conditions are Rs. 1,20,00,000 and -Rs. 12,00,000 respectively. Find the optimum decision for the company. 07

- (b) Explain the following terms related to queuing theory. 07
1. Queue length
 2. System length
 3. Waiting time in queue
 4. Total time in the system
 5. Server idle time
 6. Relationship between waiting cost and service cost
