

GUJARAT TECHNOLOGICAL UNIVERSITY**B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012****Subject code: 172004****Date: 27/12/2012****Subject Name: Production Optimization Techniques****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

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

Q:1

Use Big M method to solve the following LP problem

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$$\text{Maximize } Z = x_1 + 2x_2 + 3x_3 - x_4$$

Subject to the constraints :

$$x_1 + 2x_2 + 3x_3 = 15$$

$$2x_1 + x_2 + 5x_3 = 20$$

$$x_1 + 2x_2 + x_3 + x_4 = 10$$

$$x_1, x_2, x_3, x_4 \geq 0$$

Q:2

- (a) Find the optimum solution of the following transportation problem in which the cells contain the transportation cost in rupees.

07

	W_1	W_2	W_3	W_4	W_5	Available
F_1	7	6	4	5	9	40
F_2	8	5	6	7	8	30
F_3	6	8	9	6	5	20
F_4	5	7	7	8	6	10
Requirement	30	30	15	20	5	

- (b) A company has 3 factories manufacturing the same product and 5 sale agencies in different parts of country. Production costs differ from factory to factory and the sales prices from agency to agency. The shipping cost per unit product from each factory to each agency is known. Given the following data, find the production and distribution schedules most profitable to the company.

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Factory	Production cost/unit (Rs.)	Max. capacity (No. of units)
1	18	140
2	20	190
3	16	115

Factory	Agencies (Shipping cost (Rs.))					
		1	2	3	4	5
	1	2	2	6	10	5
	2	10	8	9	4	7
	3	5	6	4	3	8
	Demand	74	94	69	39	119
	Sales price	35	37	36	39	34

OR

- (b) A manufacturer wants to ship 22 loads of his product as shown below. The matrix gives the transportation cost form sources of supply to the destinations. 07

Sources	Destinations						
		D ₁	D ₂	D ₃	D ₄	D ₅	Supply
	S ₁	50	80	60	60	30	8
	S ₂	40	70	70	60	50	5
	S ₃	80	40	60	60	40	9
	Demand	4	4	5	4	8	

What shipping schedule should be used in order to minimize the total transportation cost?

- Q:3** (a) A company plans to assign 5 salesmen to 5 districts in which it operates. Estimates of sales revenue in thousands of rupees for each salesman in different districts are given in the following table. In your opinion, what should be the placement of the salesmen if the objective is to maximize the expected sales revenue? 07

Salesman	District				
	D ₁	D ₂	D ₃	D ₄	D ₅
S ₁	40	46	48	36	48
S ₂	48	32	36	29	44
S ₃	49	35	41	38	45
S ₄	30	46	49	44	44
S ₅	37	41	48	43	47

- (b) Find the sequence that minimizes the total elapsed time required (T) in completing the following jobs. Each job is processed in the order ABC. Also calculate T. 07

Job	1	2	3	4	5	6	7
Machine A	10	8	12	6	9	11	9
Machine B	6	4	6	5	3	4	2
Machine C	8	7	5	9	10	6	5

OR

- Q:3** (a) An airline that operates 7 days a week has the time table shown below. Crew must have a minimum layover of 5 hours between flights. Obtain the pairing of flights that minimizes layover time away from home assuming that the crew can be based at either of the two cities. The crew will be based at the city that results in smaller layover. 07

Delhi-Ahmedabad			Ahmedabad -Delhi		
Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
A	7.00 AM	8.00 AM	P	8.00 AM	9.15 AM
B	8.00 AM	9.00 AM	Q	8.30 AM	9.45 AM
C	1.30 PM	2.30 PM	R	12 Noon	1.15 PM
D	6.30 PM	7.30 PM	S	5.30 PM	6.45 PM

- (b) Determine the optimal sequence of performing 5 jobs on 4 machines. The machining of each job is required in the order ABCD and the process timings are as follows: 07

Jobs	Machine			
	A	B	C	D
1	8	3	4	7
2	9	2	5	5
3	6	4	5	8
4	12	5	1	9
5	7	1	2	3

Q:4

The following table shows, for each activity of a project, the normal and crash times as also the normal and crash costs. The contracts includes a penalty clause of Rs. 200 per day in excess of 19 days. The overhead cost is Rs. 400 per day. **14**

Activity	Time (Days)		Cost (Rs)	
	Normal	Crash	Normal	Crash
1-2	6	4	600	1,000
1-3	4	2	600	1,400
2-4	5	3	500	1,500
2-5	3	1	450	650
3-4	6	4	900	2,000
4-6	8	4	800	3,000
5-6	4	2	400	1,000
6-7	3	2	450	800

- (a) Draw the project network and determine the critical path
 (b) Find the cost of completing the project in normal time.
 (c) Crash the project activities and determine the cost of completing the project in the minimum time.
 (d) What is the optimal duration of the project and what is the cost involved?

OR

- Q:4** (a) A business man has an option of selling a product in domestic market or in export market. The available relevant data are given below. **07**

Items	Export market	Domestic market
Probability of selling	0.6	1.0
Probability of keeping delivery schedule	0.8	0.9
Penalty of not meeting the delivery schedule (Rs.)	50,000	10,000
Selling price (Rs.)	9,00,000	8,00,000
Cost of third part inspection (Rs.)	30,000	Nil
Probability of collection of sale amount	0.9	0.9

If the product is not sold in expert market, it can always be sold in domestic market. There are no other implications like interest and time. Draw the decision tree using data given above.

- (b) A large computer installation contains 2,000 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 and individually replace only such failures as occur between group replacements, the cost of component replaced is Rs. 15. Assess which policy of replacement would be economical.

- Q:5** (a) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the interarrival time and the serve time follows an exponential distribution with an average of 36 minutes. Calculate: **07**

- (a) Expected queue size.

(b) Probability that the queue size exceed 10.

If the input of trains increases to an average of 33 per day, what will be change in (a) and (b).

- (b) 1. What are different types of inventories? Explain. **07**
2. What function does inventory perform? State the two basic inventory decisions management must make as they attempt to accomplish the functions of inventory just described by you.

OR

- Q:5** (a) Goods trucks arrive randomly at a stockyard with a mean of 8 truck/hour. A crew of four operatives can unload a truck in 6 minutes. Trucks waiting in queue to be unloaded are paid a waiting charge at a rate of Rs. 60 per hour. Operatives are paid a wage rate of Rs. 20 per hour. It is possible to augment the crew strength to 2 or 3 (of four operatives per crew) when the unloading time will be 4 minutes or 3 minutes respectively per truck. Find the optimal crew size. **07**
- (b) 1. With the help of quantity-cost curve, explain the significance of EOQ. **07**
What are the limitations of using the formula for an EOQ?
2. Discuss the assumptions underlying the basic EOQ formula. Also state the economic order quantity model, discuss its sensitivity, and explain its major extensions.
