Answer All Questions   Time: 03 Hours

i) The table below shows the data for the activities of a small project.

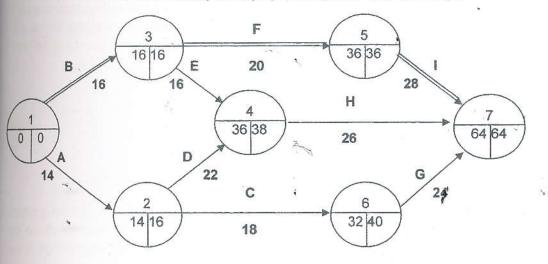| Activity	Duration (days)		
	Optimistic	Most likely	Pessimistic
1-2	2	8	14
1-3	5	9	13
2-4	4	4	4
2-6	2	8	14
3-4	8	15	22
3-5	2	4	8
4-5	3	5	10
5-6	2	5	8

a) Draw the Network and find the expected project completion time.

b) What is the probability that it would take 6 days more than the expected duration?

c) Find the project completion time which will have 99% confidence.

(10 Marks)

ii) Consider the project Network shown in below. With given normal activity time, the critical path for this network is 1-3-5-7 and the expected project completion time is 64 days.

The normal and crash times and normal and crash costs for this Network are shown in the below Table.

Table: Normal and crash data

Activity	Times (days)		Costs (Rs.)	
	Normal	Crash	Normal	Crash
A	14	12	1,800	2,250
B	16	12	2,250	2,700
C	18	14	2,700	3,300
D	22	16	3,300	4,200
E	16	10	2,550	3,600
F	20	14	3,000	3,900
G	24	20	3,900	4,500
H	26	22	4,200	4,500
I	28	20	4,500	6,000

Required

Crash the relevant activities step by step and determine the optimal project completion time and cost.

(10 Mark

(Total 20 Mark

2) i) Purchasing Officer of Sun Company suggested to management that "frequently purchasing goo
consume more time and losing discount offer. Therefore, buying entire annual demand in sin
order creates a lot of benefits to the company"

You are required to critically analyse the statement of Purchasing Officer of Sun Company.

(03 Mark

ii) Product phone is purchased by Asus PLC for resale and the 5,000 units of annual demand is sprea
evenly throughout the year. Incremental ordering costs are Rs.500 per order and the normal un
cost is Rs.35, 000. However, the suppliers of phone are now offering quantity discounts for larg
orders. The details of these are:

Quantity ordered	Unit price (Rs.)
Up to 999	35,000
1,000 to 1,999	34,500
2,000 and over	34,000

The purchasing manager feels that full advantage should be taken of discounts and purchase shoul
be made at Rs.34,000 per unit using orders for 2,000 units or more. Holding costs for phone ar
calculated at Rs.125 per unit per year and this figure will not be altered by any change in th
purchase price per unit.

Required:

Advise Asus PLC on the correct size of order for the purchase of phone.

(07 Marks

(Total 10 Marks

i) Write a short note on transportation problem.

(04 Marks)

ii) A manufacturing industry supplies a commodity from three warehouses W1, W2, W3 to the four markets M1, M2, M3 and M4. The following table gives the cost per unit for sending the commodity to each market from each warehouse. The last column shows supply and the last row shows the demand. The manufacturing industry wants to determine the optimal distribution schedule.

Warehouse	Market				Supply
	M1	M2	M3	M4	
W1	21	16	25	13	11
W2	17	18	14	23	13
W3	32	27	18	41	19
Demand	6	10	12	15	

a) Find the initial allocation using least cost cell method and the corresponding transportation cost.

b) Find the optimal allocation using stepping stone method and the corresponding optimal transportation cost.

(18 Marks)

(Total 22 Marks)

i) Explain how to view an assignment problem in terms of a transportation problem.

(04 Marks)

ii) A company has three employees and four machines and wish to assign employees to minimize total cost. The following table showing the cost in units of Rs. 100 incurred by each employee on each machine given below.

Machine Employee	M1	M2	M3	M4
A	8	11	12	10
B	5	16	13	8
C	5	10	23	15

a) Determine the optimal assignment and calculate the total cost

b) Formulate the mathematical model for the problem.

(18 Marks)

(Total 22 Marks)

3

5)   **i)**   A Company produces two toys A and B from two resources—labour and plastic. The compa
has 80 hours of labour and 36 kg of plastic available each day. Demand for toy A is limited
6 per day. Each toy A requires 8 hours of labour and 2 kg of plastic, whereas a toy B requi
10 hours of labour and 6 kg of profit. The profit derived from each toy A is Rs. 400 and fr
each toy B, Rs. 100. The company wants to determine the number of toys A and B to prod
each day in order to maximize profit.

a) Formulate a linear programming model for this problem.

b) Solve this model by using graphical analysis.

c) How much labour and plastic will be unused if the optimal numbers of toy A and toy B a
produced?

(10 Mark

ii)   The Munchies Cereal Company makes a cereal from several ingredients. Two of t
ingredients, oats and rice, provide vitamins A and B. The company wants to know how ma
grams of oats and rice it should include in each box of cereal to meet the minimu
requirements of 48 milligrams of vitamin A and 12 milligrams of vitamin B while minimizi
cost. One gram of oats contributes 8 milligrams of vitamin A and 1 milligram of vitamin
whereas one gram of rice contributes 6 milligrams of A and 2 milligrams of B. One gram
oats costs Rs. 5, and one gram of rice costs Rs. 3.

a) Formulate a linear programming model for this problem.

b) Express the model formulated in part (a) in standard form.

c) Find the solution for this problem using simplex method.

(16 Mark

(Total 26 Marks