

Seat No. : _____

ZO-135

May-2014

M.B.A., Sem.-II

Management Science

Time : 3 Hours]

[Max. Marks : 100

Instruction : Graphs and statistical tables will be providing on request.

1. Explain the following : (any **four**) **20**

- (1) Importance of Integer Programming problem in the real life application.
- (2) Give usage of the network models in the business applications.
- (3) What you mean by (M/M/1) : (∞ /FIFO)
- (4) Shadow prices.
- (5) What is the main role of management science in real world ?

2. Solve the following : (any **two**) **20**

- (1) A manufacturing company produces product 1, 2 and 3. The three products have the following resource requirements and produce the following profit.

Product	Labor (hr./unit)	Material (lb./unit)	Profit (\$/unit)
1	5	4	3
2	2	6	5
3	4	3	2

At present the firm has a daily labor capacity of 240 available hours and a daily supply of 400 pounds of material. Management has developed the following set of goals, arranged in order of their importance to the firm.

- (i) Because of recent labor relations difficulties, management wants to avoid underutilization of normal production capacity.
- (ii) Management has established a satisfactory profit level of \$ 500 per day.
- (iii) Overtime is to be minimized as much as possible.
- (iv) Management wants to minimize the purchase of additional materials to avoid handling and storage problems.

Formulate this as a goal programming problem to determine the number of each product to produce to best satisfy the goals.

- (2) A restaurant has an ice cream counter where it sells two main products, ice cream and frozen yogurt, each in a variety of flavors. The restaurant makes one order for ice cream and yogurt each week and the store has enough freezer space for 115 gallons total of both products. A gallon of frozen yogurt costs \$ 0.75 and a gallon of ice cream costs \$ 0.93 and the restaurant budget \$ 90 each week for these products. The manager estimates that each week the restaurant sells at least twice as much ice cream as frozen yogurt. Profit per gallon of ice cream is \$ 4.15 and profit per gallon yogurt is \$ 3.60. Formulate this as a linear programming problem and find out graphical solution.
- (3) A company produces two products A and B, which have profits of ₹ 9 and ₹ 7 respectively. Each unit of product must be processed on two assembly lines, where the required production times are as follows.

Product	Hours/Unit	
	Line 1	Line 2
A	12	4
B	4	8
Total Hours	60	40

- (i) Formulate a linear programming model to determine the optimal product mix that will maximize profit.
- (ii) Identify the amount of unused resources.
- (iii) What will be the effect on the optimal solution if the production time on line 1 were reduced to 40 hours ?
- (iv) What will be the effect on the optimal solution if the profit for product B were increased from ₹ 7 to ₹ 15 ? and to ₹ 20 ?

3. Solve the following : (any two)

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- (1) Solve the following transshipment problem.

Sources	Destinations						Supply
	S ₁	S ₂	S ₃	S ₄	D ₁	D ₂	
S ₁	0	6	24	7	24	10	200
S ₂	10	0	6	12	5	20	250
S ₃	15	20	0	8	45	7	200
S ₄	18	25	10	0	30	6	450
D ₁	15	20	60	15	0	10	-
D ₂	10	25	25	23	4	0	-
Demand	-	-	-	-	550	550	

- (2) The flight timings between two cities X and Y, are as given in the following tables. The minimum lay over time of any crew in either of the cities is 2 hours. Determine the base city for each crew so that the sum of the lay over times of all the crew members in non-base cities is minimized.

Flight Number	Departure Time (From city X)	Arrival Time (To city Y)	Flight Number	Departure Time (From city Y)	Arrival Time (To city X)
101	5.00 am	6.15 am	201	6.30 am	7.30 am
102	9.00 am	10.15 am	202	9.00 am	10.00 am
103	1.00 pm	2.15 pm	203	3.30 pm	4.30 pm
104	6.00 pm	7.15 pm	204	10.00 pm	11.00 pm

- (3) A salesman makes all sales in three cities X, Y and Z only. It is known that he visits each city on a weekly basis and never visits the same city in successive weeks. If he visits city X in a given week, then he visits city Z in the next week. However, if he visits city Y or Z, he is twice as likely to visit city X than the other city. Obtain the transition probability matrix. Also determine the proportionate visits by him to each of the cities in the long run.

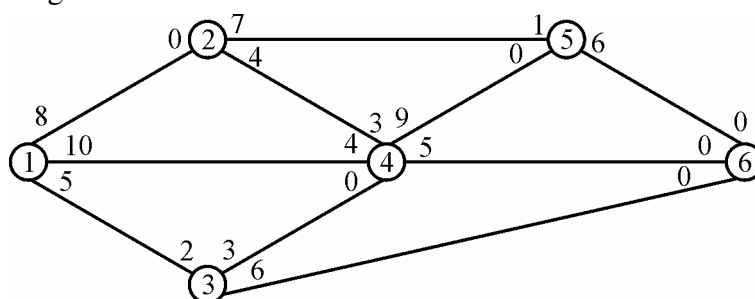
4. Solve the following : (any two)

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- (1) The Petroco service station has one pump for regular unleaded gas, which (with one attendant) can service 10 customers per hour. Cars arrive at a regular unleaded pump at a rate of 6 per hour. Determine the average queue length, the average time a car is in the system and the average time the car must wait. If the arrival is increase 10 cars per hour, what will be the effect on the average queue length ?
- (2) Solve following game problem.

	B1	B2	B3	B4	B5
A1	1	-1	3	-1	5
A2	-2	2	-2	4	-2
A3	1	-3	3	-3	5
A4	-4	2	-4	4	-4
A5	1	-5	3	-5	5

- (3) Given the following network with the indicated flow capacities of each branch, determine the maximum flow from source node 1 to destination node 6 and the flow along each branch.



5. Solve the following :

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An investment company wants to study the investment projects based on market demand, profit and the investment required, which are independent of each other. The following probability distributions have been estimated for each of the three factors :

Annual Demand (Units in thousands)	25	30	35	40	45	50	55
Probability	0.05	0.10	0.20	0.30	0.20	0.10	0.05
Profit per unit (₹)	3.00	5.00	7.00	9.00	10.00		
Probability	0.10	0.20	0.40	0.20	0.10		
Investment required (in thousands of ₹)	2750	3000	3500				
Probability	0.25	0.50	0.25				

Using the simulation process repeat the trial 10 times, compute the return on investment on each trial taking these factors into consideration. What is the most likely return ?

(30, 12, 16), (59, 09, 69), (63, 94, 26), (27, 08, 74), (64, 60, 61), (28, 28, 72),
(31, 23, 57), (54, 85, 20), (64, 68, 18), (32, 31, 87).

In each bracket above the first random number is for annual demand, the second one is for profit and the last one is for the investment required.