TE/sem VI/prod/CBGS/OR/ 07-12-2016

Operation Research

Q.P. Code : 608902

(3 hours) **Max. Marks: 80**

N. B. 1) **Question No. 1** is compulsory.
2) Solve **any three** questions from remaining five questions.
3) Assume suitable data wherever necessary.
4) Figures to right indicate maximum marks.
5) Use graph papers for graphical solution.

1. Attempt **any four** questions. **[20]**

a) Solve the following game using graphical approach.

		B's Strategy			
		b_1	b_2	b_3	b_4
A's Strategy	a_1	8	5	-7	9
	a_2	- 6	6	4	- 2

b) Write a algorithm for Hungarian Assignment Method.

c) There are two jobs J1 and J2 each requiring work on two machines M1 and M2 in this order with the required processing times given as follows;

	Processing time (hours)	
Job	Machine	
	M_1	M_2
J_1	4	10
J_2	8	7

What orders of performance of the jobs will involve the least time? (Use Gantt Chart).

d) How floats are calculated in CPM.

e) What are the various customer's behaviour while joining queue?

2.

a) Solve the following LPP by simplex (Use Big M method). **[10]**

Maximise $Z = 15x_1 + 25x_2$

Subject to $7x_1 + 6x_2 \geq 20$

$8x_1 + 5x_2 \leq 30$

$3x_1 - 2x_2 = 18$

$x_1, x_2 \geq 0$

[TURN OVER

b) A hotel operating 24 hours has the following minimum requirements of servers; [10]

Period	Time	Minimum number of servers required
1.	7 a.m. – 11 a.m.	6
2.	11 a.m. – 3 p.m.	12
3.	3 p.m. – 7 p.m.	8
4.	7 p.m. – 11 p.m.	16
5.	11 p.m. – 3 a.m.	5
6.	3 a.m. – 7 a.m.	3

A server reports to the hotel manager at the beginning of the period and continues to work for 8 hours. The hotel manager wants to find the minimum number of servers available for each period. Formulate this as an LPP to minimise the total number of servers required.

3. a) A company manufacture and sales 3 models of large size pressure cookers for canteen use. While market demand impose no constraints, supplies of aluminium limited to 750 kgs per weeks and availability of machines limited to 500 hours per week restrict the product-mix. The resource usages of the 3 models are given below. [14]

	Model		
	M_1	M_2	M_3
Aluminium/unit	6	3	5
Machine-time/unit	3	4	5
Contribution Rs./unit	60	20	80

Using the information in optimal solution tableau, determine whether and how the current solution would be sensitive to the following changes. Treat each of the conditions given below independently.

i) An additional 150 kg of aluminium would become available.

ii) Following the reduction in selling price of M_3, its contribution margin decrease by Rs. 15/-.

b) Write the dual of the following LPP. [6]

Minimise $Z = 10x_1 + 20x_2$

Subject to
$$3x_1 + 2x_2 \geq 18$$
$$x_1 + 3x_2 \geq 8$$
$$2x_1 - x_2 \leq 6$$
$$x_1, x_2 \geq 0$$

4. **a)** At a cycle shop with one person repairing the cycles, on an average a customer arrives at every five minutes and on an average the service time is 4 minutes per customer. Suppose the inter-arrival time and the service time are exponentially distributed, determine, **[10]**

   i) Probability that a customer will be able to avail some service immediately is 0.2.

   ii) Probability that the customers will have to stand alone in the queue is 0.6.

   iii) Expected length of non-empty queue.

   b) A firm is using a machine whose purchase prise is Rs. 13000/-. The installation charges is Rs. 3600/- and the machine has a scrap value of only Rs. 1600/- because the firm has a monopoly of this type of work. The maintenance cost in various years is given in following table; **[10]**

Year	:	1	2	3	4	5	6	7	8	9
Cost (Rs.)	:	250	750	1000	1500	2100	2900	4000	4800	6000

The firm wants to determine after how many years should the machine be replaced on economic consideration, assuming that the machine replacement can be done only at the year ends.

5. **a)** A work project consists of twelve activities labelled A through L. Upon being asked to specify the order in which the jobs had to be done, the manager answered as follows: **[10]**
A, B and C are the first activities of the project and can start simultaneously and immediately; A and B precedes D while B precedes E, F and H. Activities F and C precedes G while E and H precedes I and J. C, D, F and J precedes K which in turn, precedes L. Further, I, G and L are the terminal activities of the project. The completion time of the various activities are listed as follows;

Activity:	A	B	C	D	E	F	G	H	I	J	K	L
Time (days):	6	4	10	1	1	3	14	6	9	2	7	5

   i) Draw a network diagram corresponding to this project.

   ii) Obtain the lengths of all the paths and determine critical path.

   b) You are given the following network wherein the numbers indicate the distance between various pairs of nodes. Use dynamic programming to determine the shortest path between the origin and destination. What is the second shortest path and what is the distance involved? **(Refer figure)** **[10]**

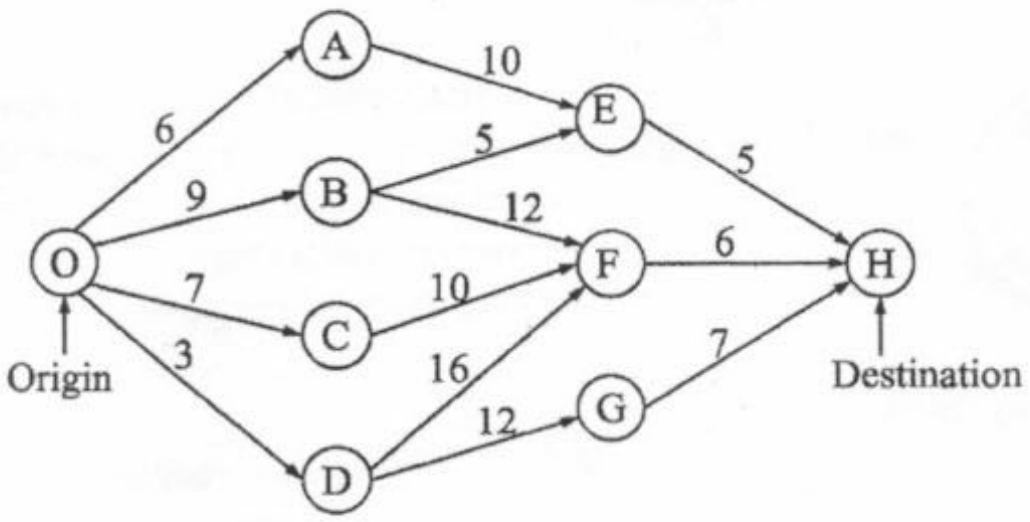

Fig. For Q.5 (b)

6. a) Consider the case of a dealer of a certain product for which the probability distribution of daily demand and the probability distribution of the lead time, both developed empirically by observations made over long span of period are as follows: **[10]**

Probability distribution of daily demand

Units demanded:	3	4	5	6	7	8	9	10	11	12
Probability:	0.02	0.08	0.11	0.16	0.19	0.13	0.10	0.08	0.07	0.06

Probability distribution of lead time

Lead time (Days):	2	3	4	5
Probability:	0.20	0.30	0.35	0.15

Re-order quantity 40 unit, re-order level 20 units and beginning inventory balance 30 units. Simulate the problem for 5 days.

Random numbers for demand distribution: 68, 13, 9, 20, 73, 7, 92, 99, 93,18.

Random numbers for lead time distribution: 47, 74, 25, 21, 47, 61, 18, 35.

b) Determine the optimal solution to the problem given below. Obtain the initial solution by VAM. **[10]**

		To Market				
		M_1	M_2	M_3	M_4	Supply
From Plant	P_1	6	4	9	1	40
	P_2	20	6	11	3	40
	P_3	7	1	0	14	50
	P_4	7	1	12	6	90
Demand		90	30	50	30	