

Sem II Operations Research

CEM  
CEM 202

QP Code : 5265

(3 Hours)

[Total marks :80

Answer any four questions.

Legible handwriting & practical examples will be appreciated.

Assume suitable data, mention your assumption clearly.

Q.1

(20)

- a What is operations research? List out its applications. 04
- b What do you mean by primal and dual linear programming problem? Mention what is shadow price in this context. 04
- c Point out the difference between : 04
- Transportation problem and transshipment problem.
  - Transportation problem and assignment problem.
- d State Bellman's principle of optimality. A salesman located in a city A decided to travel to city B. He had certain database as given below. Other cities through which the salesman has to pass through are numbered 2 to 9. Help the salesman to find the shortest route from city A to city B. 08

From City	To City	Distance (km)	From City	To City	Distance (km)
1	2	04	5	8	04
	3	06		9	08
	4	03	6	8	03
2	5	07		9	07
	6	10	7	8	08
	7	05		9	04
3	5	03	8	10	07
	6	08	9	10	09
	7	04		The city of origin A is city 1 and destination city B is city 10.	
4	5	06			
	6	10			
	7	03			

Q.2

(20)

- a Find the sequence that minimizes the total time required in performing the following jobs on three machines in the order ABC. Processing time (in hours) are given in the table below: 12

Job →	1	2	3	4	5
Machine A	08	10	06	07	11
Machine B	05	06	02	03	04
Machine C	04	09	08	06	05

Also calculate the total elapsed time and idle times for each of the machine.

TURN OVER

- b A company has three production facilities  $S_1, S_2$  and  $S_3$  with production capacity of 7, 9 and 18 units (in 100's) per week of a product, respectively. These units are to be shipped to four warehouses  $D_1, D_2, D_3$  &  $D_4$  with requirements of 5, 6, 7 and 14 units (in 100's) per week, respectively. The transportation costs (in Rupees) per unit between factories to warehouses are given in the table below:

	$D_1$	$D_2$	$D_3$	$D_4$	Supply (Availability)
$S_1$	19	30	50	10	07
$S_2$	70	30	40	60	09
$S_3$	40	08	70	20	18
<b>Demand (Requirement)</b>	<b>05</b>	<b>08</b>	<b>07</b>	<b>14</b>	<b>34 / 34</b>

Formulate a Linear programming model to minimize the transportation cost

- 3 a For the data given in Q2b, Find initial solution using Vogel's approximation method and optimal solution using Modified Distribution method. (20)  
14
- b Use the graphical method to solve the following Linear programming problem; 06  
Maximize  $Z = 2x_1 + x_2$   
Subject to the constraints :  
 $x_1 + 2x_2 \leq 10$ ,  $x_1 + x_2 \leq 06$ ,  $x_1 - x_2 \leq 02$ ,  $x_1 - 2x_2 \leq 01$  and  $x_1, x_2 \geq 0$ .

- 4 a Five men are available to do five different jobs. From past records, the time (in hours) that each man takes to do each job is known and is given in the following table : (20)  
08

JOBS →		I	II	III	IV	V
M E N	A	2	9	2	7	1
	B	6	8	7	6	1
	C	4	6	5	3	1
	D	4	2	7	3	1
	E	5	3	9	5	1

Find out how men should be assigned the jobs in way that will minimize the total time taken.

- b In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the interarrival time follows an exponential distribution and the service time (time taken to hump a train) distribution is also exponential with an average of 36 minutes. Calculate : 06
- Expected queue size (line length).
  - Probability that the queue size exceeds 10.
- If the input of trains increases to an average of 33 per day, what will be the change in i) and ii) ?
- c Define simulation. Enlist its types. Briefly write down the steps involved in a simulation process. 06

TURN OVER

3

- a Maximize  $Z = 60x - x^2$  in the interval  $(0,100)$  with an accuracy of 0.1% by using Fibonacci method, using  $n = 4$ . 1101. (20) 08
- b Enlist the steps involved in decision making process. Mention the different types of decision making environments. 06  
 Explain dynamic programming. Explain stage, state and return function in this context. 06 (20)
- a Mr X flies quite often from town A to town B. He can use the airport bus which costs him Rs 25, but if he takes it, there is 0.08 chance that he will miss the flight. The stay in a hotel will cost him Rs 270 with a 0.96 chance of being ontime for the flight. For Rs 350, he can use a taxi which has a 0.99 chance of him reaching ontime for the flight. If Mr X catches the plane on time, he will conclude a business transaction that will produce a profit of Rs 10 thousand, otherwise he will lose it. Help Mr X to select the right option on the basis of EMV criterion. 08
- b Find minimum of " $f = x(x-1.5)$ " in the interval of  $(0,1)$  to within 10% of the exact value. 07
- c Write the introduction and procedure of Golden section method. 05