

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech. (CHE-N)/SEM-8/CHE-804B/2011**

**2011**

**OPERATIONS RESEARCH**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

*( Graph sheet(s) will be supplied by the institution. )*

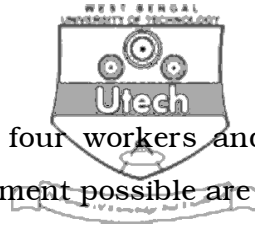
**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :

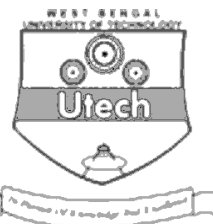
10 × 1 = 10

- i) The transportation problem deals with the transportation of
  - a) a single product from several sources to a destination
  - b) a multi-product from several sources to several destinations
  - c) a single product from several sources to several destinations
  - d) a single product from a source to several destinations.



- ii) In an assignment problem involving four workers and three jobs that total number of assignment possible are
- a) 4
  - b) 3
  - c) 7
  - d) 12.
- iii) Floyd's algorithm is used to find out the shortest path between
- a) any two nodes of the network
  - b) the source node and any other nodes
  - c) any node and destination node
  - d) any pair of nodes of unidirectional network.
- iv) If the dual has an unbounded solution, then primal has
- a) an unbounded solution
  - b) a infeasible solution
  - c) a feasible solution
  - d) none of these.
- v) Dynamic problem deals with the
- a) Multi-stage decision making problems
  - b) Single stage decision making problems
  - c) Time dependent decision making problems
  - d) Problems which fix the levels of different decision variables so as to maximize profit or minimize the loss.





**GROUP – B**  
**( Short Answer Type Questions )**

Answer any *three* of the following.

$3 \times 5 = 15$

2. A company makes two kinds of leather-belts A and B. Their respective unit profits are Rs. 4 and Rs. 3. One belt of type A requires 2 hours and type B requires 1 hour of time in making. The total man-hours available are 1000 per day. Due to insufficient supply of leather, the company can make only 800 belts per day. Only 400 buckles for type A and 700 buckles for type B are available. Formulate the problem as an L.P.P. and solve it graphically.

3. Find out the dual of the problem :

Maximize  $Z = 2x_1 + 3x_2 - 4x_3$

subject to,  $3x_1 + x_2 + x_3 \leq 2$

$$-4x_1 + 3x_2 \geq 4$$

$$x_1 - 5x_2 + x_3 = 5$$

$$x_1 \geq 0, x_2 \geq 0 \text{ and } x_3, \text{ is unrestricted in sign.}$$

4. Solve the following by graphical method :

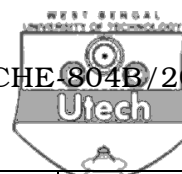
Max  $Z = 5x + 8y$

subject to  $3x + 2y \leq 36$

$$x + 2y \leq 20$$

$$3x + 4y \leq 42$$

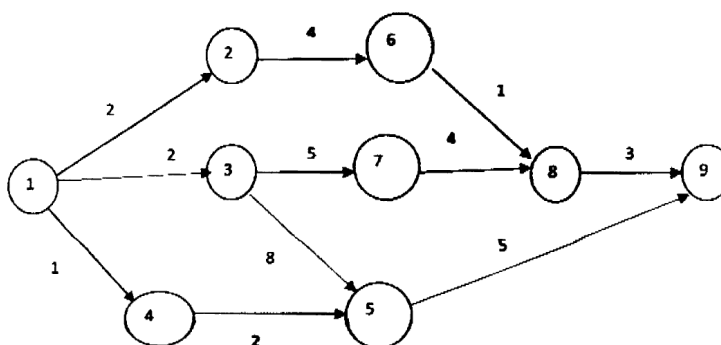
$$x, y \geq 0.$$



5. Solve the following transportation problem :

	A	B	C	Available
I	6	8	4	14
II	4	9	8	12
III	1	2	6	5
Requirement	6	10	15	31

6. Find the critical path of the following graph :



### GROUP – C

#### ( Long Answer Type Questions )

Answer any *three* of the following. 3 × 15 = 45

7. a) Solve the following L.P.P :

$$\text{Minimize } Z = 3x_1 + 2x_2$$

$$\text{subject to } x_1 + x_2 \leq 4$$

$$x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0.$$

- b) Find the dual of

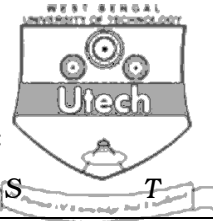
$$\text{Minimize } Z = x_1 + x_2$$

$$\text{subject to } 2x_1 + x_2 \geq 8$$

$$3x_1 + 7x_2 \geq 21,$$

$$x_1, x_2 \geq 0.$$

Also solve the dual using the simplex method. 7 + 8



8. a) Solve the following assignment problem :

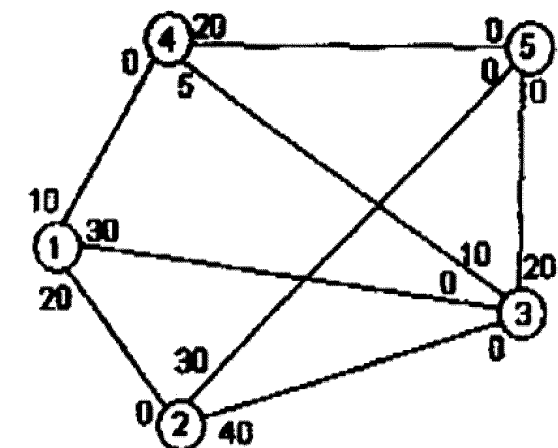
	<i>P</i>	<i>Q</i>	<i>R</i>	<i>S</i>	<i>T</i>
<i>A</i>	13	8	16	18	19
<i>B</i>	9	15	24	9	12
<i>C</i>	12	9	4	4	4
<i>D</i>	6	12	10	8	13
<i>E</i>	15	17	18	12	20

b) Solve the following transportation problem and check the optimality :

	<i>P</i>	<i>Q</i>	<i>R</i>	<i>S</i>	Availability
<i>A</i>	22	46	16	40	8
<i>B</i>	42	15	50	18	8
<i>C</i>	82	32	48	60	6
<i>D</i>	40	40	36	83	3
Requirements	2	2	5	6	

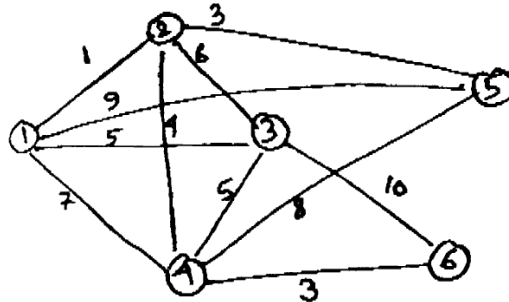
6 + 9

9. a) Find the maximum flow in the network :



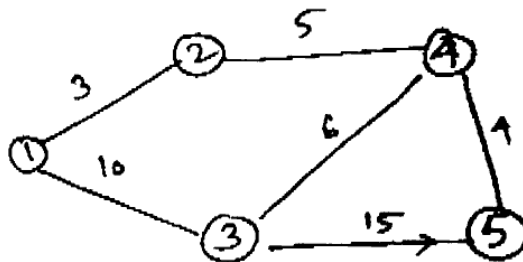


- b) Find the minimum spanning tree from the following graph.

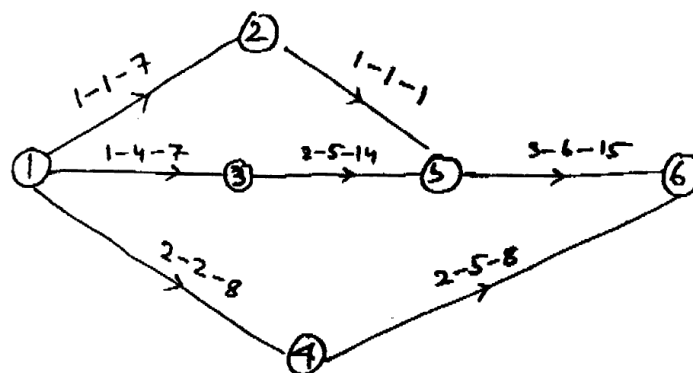


8 + 7

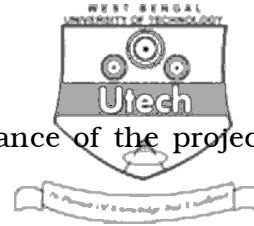
10. a) Find the shortest distance between nodes 1 to 5 by Dijkstra's algorithm.



b)



- i) Determine the expected project length.



- ii) Calculate the S.D. and the variance of the project length.
- iii) What is the probability that the project will complete
  - I) at least 4 weeks earlier than expected time ?
  - II) no more than 4 weeks later than expected time ?

Given that  $\{ P ( Z = 1.33 ) = 0.9082 \}$ . 6 + 9

11. a) In a railway station the trains are arriving at a rate of 30 trains per day. Assuming that the arrivals and service time satisfy exponential distribution where service time is 36 minutes, find
- i) the mean queuing length
  - ii) The probability that queuing size exceeds 10.
- If the train increases to 33 per day then what will be the change in (i) and (ii) ?
- b) A contractor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that, when he starts a production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for one year is Rs. 2 and set-up cost of production run is Rs. 180. How frequently should production run be made ? 8 + 7

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