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 : $10 \times 1 = 10$

   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.

vi) The solution of transportation problem with 6-source and 9-destination is feasible if the number of allocations are

a) 14 b) 13

c) 54 d) 6.

vii) Which of the following is correct ?

a) CPM is event oriented

b) CPM is deterministic in nature

c) Events marking the start of activities are called head events

d) It is not possible for a network to have more than one critical path.

viii) Which of the following is correct ?

a) Dual of the Dual is Primal

b) Dual of the Primal is Primal.

ix) Artificial variable is needed for

a) Initial basic feasible solution

b) Initial non-basic feasible solution.

x) To find the shortest path we use

a) CPM

b) Floyd's algorithm.

xi) Among the following which one is the better method ?

a) North-West corner method

b) VAM method.

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 7 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, $3x_1 + x_2 + x_3 \leq 2$

$-4x_1 + 3x_2 \geq 4$

$x_1 - 5x_2 + x_3 = 5$

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

4. Solve the following by graphical method :

Max $Z = 5x + 8y$

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

$x + 2y \leq 20$

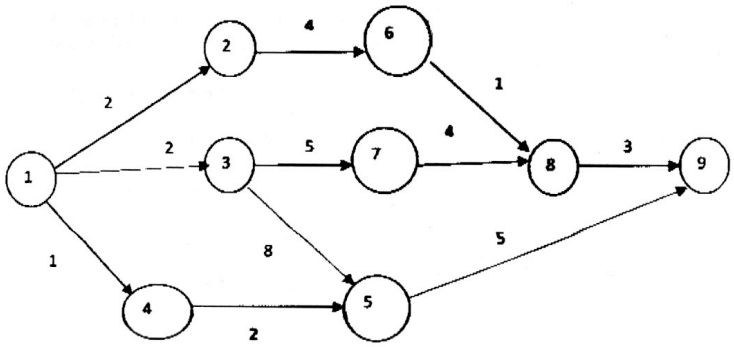
$3x + 4y \leq 42$

$x, y \geq 0$.

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 :

Minimize $Z = 3x_1 + 2x_2$

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

Minimize $Z = x_1 + x_2$

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 :

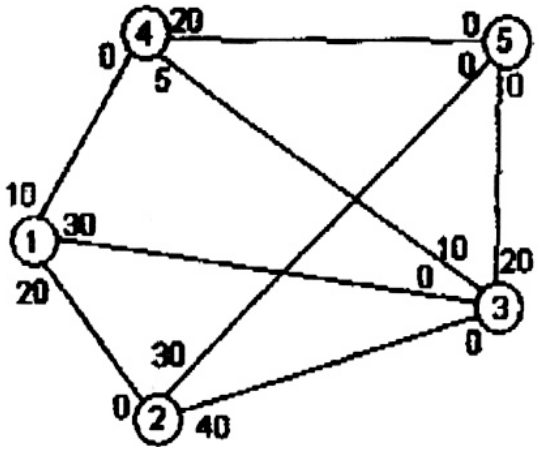
	P	*Q*	*R*	*S*	*T*
A	13	8	16	18	19
B	9	15	24	9	12
C	12	9	4	4	4
D	6	12	10	8	13
E	15	17	18	12	20

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

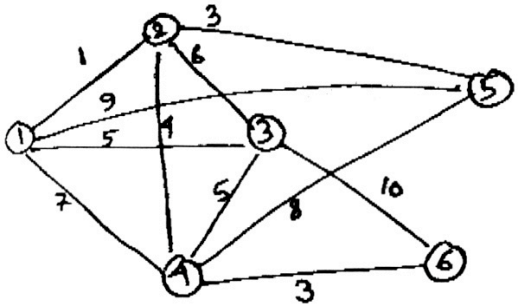
	P	*Q*	*R*	*S*	Availability
A	22	46	16	40	8
B	42	15	50	18	8
C	82	32	48	60	6
D	40	40	36	83	3
Requirements	2	2	5	6	

6 + 9

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

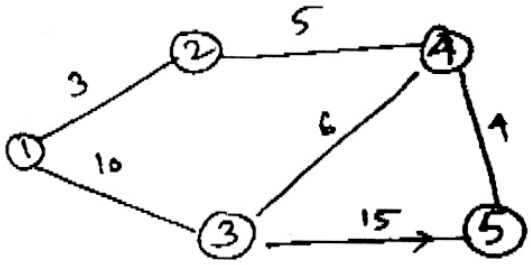


b) Find the minimum spanning tree from the following graph.

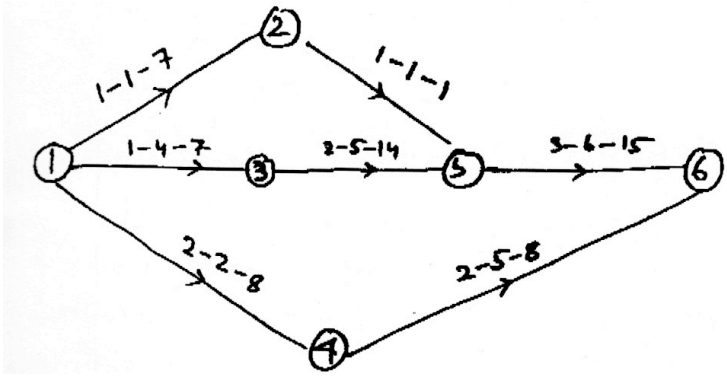


8 + 7

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 $\{ P (Z = 1{\cdot}33) = 0{\cdot}9082 \}$. 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