Equipment acquired at start of year	Replacement cost ($) for given years in operation		
	1	2	3
1	4000	5400	9800
2	4300	6200	8700
3	4800	7100	----
4	4900	----	----

(c) The Optimistic time (t_0), pessimistic time (t_p) and most likely time (t_m) estimates (in weeks) for the activities of a PERT network are given as follows:

Activity	t_o	t_p	t_m
1→2	1	13	7
1→6	2	14	5
2→3	2	26	14
2→4	2	8	5
3→5	7	19	10
4→5	5	17	5
6→7	5	29	8
5→8	3	9	3
7→8	8	32	17

Draw the project network, determine critical path, expected project length and calculate the standard deviation of the project length. (6.5)

[This question paper contains 8 printed pages.]

Your Roll No..............

Sr. No. of Question Paper : 2016 **C**

Unique Paper Code : 62353506

Name of the Paper : SEC – Transportation and Network Flow Problems

Name of the Course : **B.A. Programme**

Semester : V

Duration : 3 Hours Maximum Marks : 55

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.

2. Attempt any **two** parts from each question.

1. (a) Consider the transportation problem with four origins, six destinations and data as follows :

Destination Origin	A	B	C	D	E	F	Supply
1	7	6	5	8	7	8	16
2	2	5	6	7	4	6	12
3	2	2	1	3	3	1	10
4	1	3	4	3	2	5	18
Demand	5	11	3	13	7	17	

(i) Find the initial basic feasible solution using the Least cost method and North-West Corner Method.

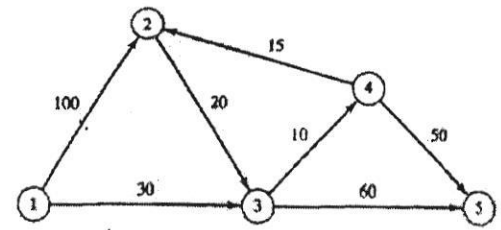
(ii) Compare the solutions obtained in (i). (7)

(b) Given $x_{13} = 50$ units, $x_{14} = 20$ units, $x_{21} = 55$ units, $x_{31} = 30$ units, $x_{32} = 35$ units, and $x_{34} = 25$ units. Is it an optimal solution to the transportation problem :

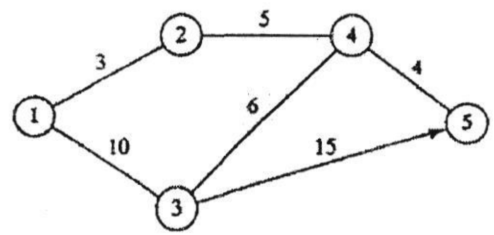
	D_1	D_2	D_3	D_4	Available units
S_1	6	1	9	3	70
S_2	11	5	2	8	55
S_3	10	12	4	7	90
Required Units	85	35	50	45	

(iii) Determine the critical path and critical activities for the project network.

4. (a) The network in the following figure gives the permissible routes and their lengths in miles between city 1 (node 1) and four other cities (nodes 2 to 5). By using Dijkstra's algorithm, determine the shortest routes between city 1 and each of the remaining four cities. (6.5)



(b) Rentcar is developing a replacement policy for its car fleet for a 4-year planning horizon. At the start of each year, a decision is made as to whether a car should be kept in operation or replaced. A car must be in service a minimum of 1 year and maximum of 3 years. The following table provides the replacement cost as a function of the year a car is acquired and the number of years in operation. Formulate the problem as a network in which nodes 1 to 5 represent the start of years 1 to 5. (6.5) on the arcs. Arc (3, 5) is directional, so that no traffic is allowed from node 5 to node 3. All the other arcs allow two-way traffic. (7)



(c) The activities associated with a certain project are given below : (7)

Activity	Predecessors	Time duration (in weeks)
A	—	3
B	A	5
C	A	7
D	B	10
E	C	5
F	D, E	4

(i) Draw the associated network for the project.

(ii) Find the minimum time of completion of the project.

If not modify it to obtain a better feasible solution. (7)

(c) Obtain an optimal solution to the following transportation problem: (7)

Warehouse / Factory	W_1	W_2	W_3	Supply
F_1	2	7	4	5
F_2	3	3	1	8
F_3	5	4	7	7
F_4	1	6	2	14
Demand	7	9	18	

2. (a) A company is producing a single product and is selling it through five agencies situated in different cities. All of a sudden, there is a demand for the product in another five cities not having any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product to needy cities in

such a way that the total travelling distance is minimized. The distance between the surplus and deficit cities (in km) is given by :

Deficit City / Surplus City	A'	B'	C'	D'	E'
A	10	5	9	18	11
B	13	19	6	12	14
C	3	2	4	4	5
D	18.	9	12	17	15
E	11	6	14	19	10

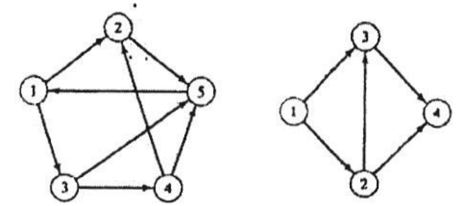
Determine the optimum assignment schedule. (7)

(b) Define Transportation and Assignment problems with example. Is the assignment problem a special case of transportation problem? Justify your answer. (7)

(c) Minimize the total distance traveled by the salesperson. Distance table of five cities is given as below : (7)

	To city				
From city	I	II	III	IV	V
I	∞	120	220	150	210
II	120	∞	80	110	130
III	220	80	∞	160	185
IV	150	110	160	∞	190
V	210	130	185	190	∞

3. (a) For each network in the following figures (i) and (ii), determine a path, a cycle, a tree and a spanning tree. Determine the sets N and A for these networks.



(i) (ii)

Also, draw the network defined by

N = {1, 2, 3, 4, 5, 6}

A = {(1,2), (1,5), (2,3), (2,4), (3,4), (3,5), (4,3), 4,6), (5,2), (5,6)}. (7)

(b) For the network in the following figure, use Floyd's algorithm to find the shortest routes between every two nodes. The distances are given in kilometres