DHANAMANJURI UNIVERSITY
Examination- 2025 (June)
Four-year course B.A/B.Sc. 6ᵗʰ Semester (NEP)

Name of Programme   :   B.A. / B.Sc. Mathematics (Honours)

Paper Type   :   CORE (Theory)

Paper Code   :   CMA-317

Paper Title   :   Network analysis and Project Management

Full Marks   :   80

Pass Marks   :   32   Duration: 3 Hours

The figures in the margin indicate full marks for the questions.

(Use of normal calculator is allowed)

1. **Answer the following questions.**   1×3=3

   a) Choose the correct one and rewrite it.

       i) PERT stands Project Evaluation and Review Technique

       ii) CPM identifies non-critical activities

       iii) The activities with zero total floats are known as non-critical activities.

       iv) In PERT the expected duration of each activity
   $$t_e = \frac{t_a + 4t_m + t_p}{4}$$

   b) Choose the correct one and rewrite it.

       i) A connected graph without circuits is called a tree

       ii) A tree with n vertices has n edges

       iii) The sum of the degrees of the vertices of a graph G is the number of edges.

       iv) The number of vertices n in a binary tree is always even.

   c) Path connecting the first initial node to the very last terminal node of -------------- in any project network is called the critical path.

       i) Longest duration

       ii) shortest duration

       iii) zero duration

       iv) dummy activity

$1\times6=6$

2. Answer the following questions:
   a) Define an Activity in a Project.
   b) Define a Project.
   c) Define a connected graph.
   d) When a graph is said to be minimal spanning tree?
   e) Define Simulation.
   f) Define Network scheduling.

3. Answer the following questions (Choose any five): $3\times5=15$
   a) Explain the three main managerial functions for a Project.
   b) Define the three time estimates in PERT.
   c) Write down the basic difference between PERT and CPM.
   d) Prove that a tree G with n vertices has n-1 edges.
   e) Show that the number of vertices of odd degree is always even.
   f) Write the augmenting path algorithm.
   g) Find the shortest path of each station from station A by Dijkstra's algorithm
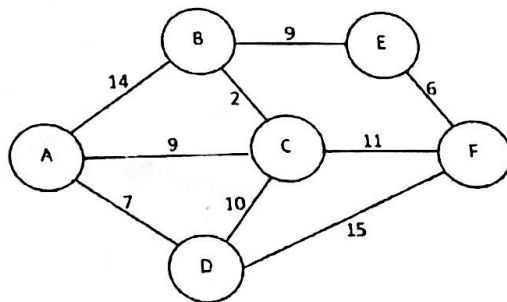
   h) Explain the following terms: Total float, Free float, Independent float.

4. Answer the following questions (choose any five) : $4\times5=20$
   a) Write the objectives of Project Management.
   b) Write a short note on Monte-Carlo Simulation.
   c) Explain PERT Procedure.
   d) Write four specified rules of Network Construction.
   e) Show that G is a tree if and only if there is one and only one path between every pair of vertices.
   f) State Fulkerson's rule for numbering the nodes in a network.

g) The Midwest TV Cable Network Company is in the process of providing cable services to five new housing development areas. The figure below depicts the potential TV linkages among the five areas. Each branch represents the distance in cable (miles)
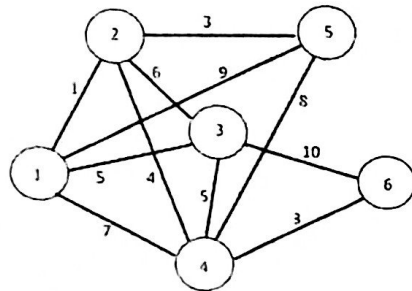
Determine the most economical cable network for the Midwest Company.

h) A salesman is planning to tour cities B,C,D and E starting from his home city A. The inner cities distances are shown in the following table

City	A	B	C	D	E
A	-	103	188	136	38
B	103	-	262	176	52
C	188	262	-	85	275
D	136	176	85	-	162
E	38	52	275	162	-

How should he plan his tour so that (i) he visits each city only once (ii) travels the minimum distance.

5. **Answer the following question: (Choose any one)**   12×1=12

   a) A small project is composed of activities whose time estimate is listed in the table below. Activities are identified by their beginning (i) and ending (j) node numbers.

Activity(i-j)	Optimistic Time	Most likely Time	Pessimistic Time
1-2	1	2	9
2-3	1	4	7
2-4	2	4	12
3-5	2	3	4
4-5	4	5	12

4-6	3	5	7
5-6	1	1	1
3-7	6	8	16
6-7	3	5	13
5-7	5	7	15

Draw the project network. What is the probability that the project will be completed in 25 days.

Z	0.5	0.67	1.00	1.12	1.33
Ø	0.1915	0.2486	0.3413	0.3686	0.4082

b) A project has the following time schedule: optimistic time (a), the most likely time (m) and the pessimistic time (b). Draw the network of the project and find the probability of completing the project in 35 days.

Activity	1-2	1-3	2-5	3-4	4-5	5-8	4-6	4-7	6-9	8-9	7-10	9-10
a	3	1	6	8	0	5	6	3	1	3	8	2
m	5	2	8	12	0	7	9	6	2	5	15	5
b	7	3	12	17	0	9	12	8	3	8	20	6

Given:

Z	0.5	0.67	1.00	1.33	0.75
Ø	0.1915	0.2486	0.3413	0.4082	0.2734

6. **Answer the following questions. (Choose any one)** 6×1=6
   a) Write the algorithm for the determination of the critical path.
   b) Construct the network for a project in which activities has the following precedence
   i) A, C and D can start immediately.
   ii) E>B, C
   iii) F, G>D
   iv) H, I>E, F
   v) J>I, G
   vi) K>H
   vii) B>A

7. **Answer the following question. (Choose any one)** 12×1=12
   a) Described the advantages of simulation model. A company manufactures 30 items per day. The sale of these items

depends upon demand, which has the following distribution.

Sales (units)	27	28	29	30	31	32
Probability	0.10	0.15	0.20	0.35	0.15	0.05

The production cost and the sale price of each unit are Rs.40 and Rs.50, respectively. Any unsold product is to be disposed of at a loss of Rs. 15 per unit. There is a penalty of Rs. 5 per unit if the demand is not met. Using the following random numbers, estimate total profit/loss for the company for the next 10 days: 10, 99, 65, 99, 95, 01, 79, 11, 16, 20.

If the company has decided to produced 29 item per day. What is the advantage or disadvantage to the company? 2+10=12

b) The Reliance Company is in the process of providing pipeline network that connects nine offshore natural gas wellheads with an inshore delivery point. The location of wellhead 1 is the closest to the shore, so it is equipped with adequate pumping and inventory capacity to pump the output of the remaining eight wellheads to the delivery point. The mileages of the feasible links (nodes 1 to 9) connecting to the inshore delivery point are shown in the network below:
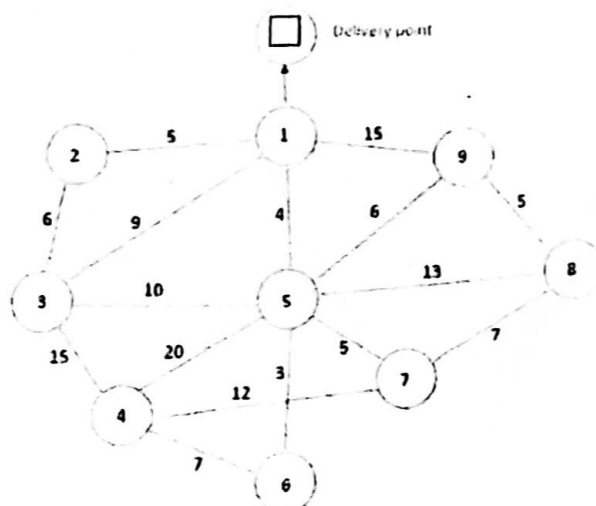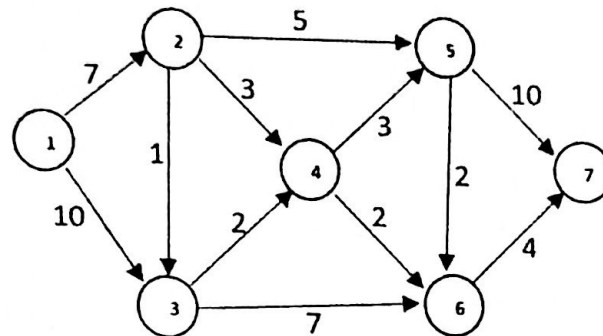
Determine the most economical pipeline network for the Reliance Company that links the offshore wellhead to the inshore delivery point.
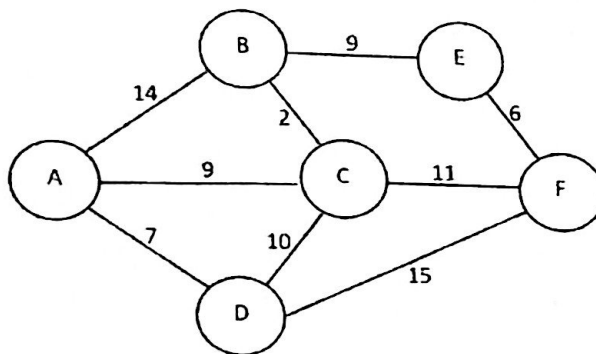
8. **Answer the following question. (Choose any one)**

12

$6 \times 1 = 6$

a) For the network shown below, use the augmenting path method to find the flow pattern giving the maximal flow. Node 1 represent the sources and the node 7 is the sink.

b) Find the shortest path of each station from station A by Dijkstra's algorithm

c) A tourist car operator finds that during the past few months, the use of car has varied so much that the cost of maintaining the car varied considerably. During the past 200 days, the demand for the car fluctuated as given below:

Trips per week	0	1	2	3	4	5
Frequency	16	24	30	60	40	30

Using random numbers: 82, 95, 18, 96, 20, 84, 56, 11, 52, 03; .
Simulate the demand for ten week period.

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