

CN [Day - 2]

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Question 1: Consider a network of 5 nodes A, B, C, D, and E connected as follows (with edge weights representing cost):

- A–B: 3
- A–C: 1
- B–D: 1
- C–D: 4
- C–E: 2
- D–E: 2

What is the shortest path from A to E using Dijkstra's Algorithm, and what is the total cost?

Answer:

Using Dijkstra's Algorithm

Start from source node A.

Node	Distance from A	Previous Node	Visited
A	0	—	Y
B	∞	—	N
C	∞	—	N
D	∞	—	N
E	∞	—	N

Update neighbors of A

- A–B = 3 \rightarrow Update B: Distance = 3, Previous = A
- A–C = 1 \rightarrow Update C: Distance = 1, Previous = A

Node	Distance	Previous	Visited
A	0	—	Y
B	3	A	N
C	1	A	N

Node	Distance	Previous	Visited
D	∞	—	N
E	∞	—	N

Visit next closest node \rightarrow C (Distance = 1)

- $C-D = 4 \rightarrow$ Distance via C = $1 + 4 = 5 \rightarrow$ Update D
- $C-E = 2 \rightarrow$ Distance via C = $1 + 2 = 3 \rightarrow$ Update E

Node	Distance	Previous	Visited
A	0	—	Y
B	3	A	N
C	1	A	Y
D	5	C	N
E	3	C	N

Visit next closest node \rightarrow B (Distance = 3)

- $B-D = 1 \rightarrow$ Distance via B = $3 + 1 = 4 \rightarrow$ Update D (better than 5)

Node	Distance	Previous	Visited
A	0	—	Y
B	3	A	Y
C	1	A	Y
D	4	B	N
E	3	C	N

Visit E (Distance = 3)

- $E-D = 2 \rightarrow$ Distance via E = $3 + 2 = 5 \rightarrow$ Not better than current D = 4 \rightarrow No update

Node	Distance	Previous	Visited
A	0	—	Y
B	3	A	Y
C	1	A	Y

Node	Distance	Previous	Visited
D	4	B	N
E	3	C	Y

Visit D (Distance = 4)

No better paths found

Final Shortest Path Tree from A

- B via A (cost 3)
- C via A (cost 1)
- E via C (cost 3)
- D via B (cost 4)

Shortest Path from A to E:

- Path: A → C → E
- Cost: A-C = 1, C-E = 2 → Total = 3

Final Answer:

- Shortest Path from A to E: A → C → E
- Total Cost: 3

Question 2: An Ethernet LAN uses CSMA/CD. If the minimum frame size is 512 bits and the channel speed is 10 Mbps, what is the minimum time for transmission to ensure collision detection?

Answer:

Given:

- **Minimum frame size** = 512 bits
- **Channel speed** = 10 Mbps (megabits per second) = 10×10^6 bits/sec

Formula:

$$\text{Minimum Transmission Time} = \frac{\text{Frame Size (Bits)}}{\text{Channel Speed (bps)}}$$

Calculation:
$$\frac{512 \text{ bits}}{10^7 \text{ bps}} = 51.2 \mu\text{s}$$

Minimum time for transmission to ensure collision detection = 51.2 microseconds (μs)