



VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

REG.NO.:

SLOT:F1+TF1

**SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2025-2026**

Programme Name & Branch : B.Tech Computer Science and Engineering
Course Code and Course Name : BCSE308L - Computer Networks
Faculty Name(s) : ALL
Class Number(s) : ALL
Date of Examination : 10.10.2025 AN
Exam Duration : 90 minutes **Maximum Marks: 50**

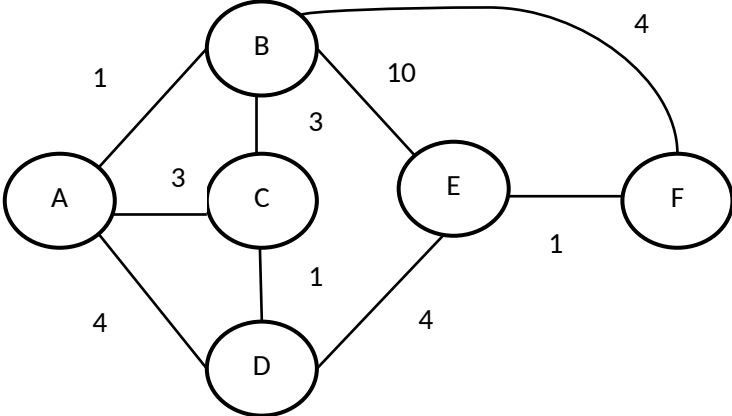
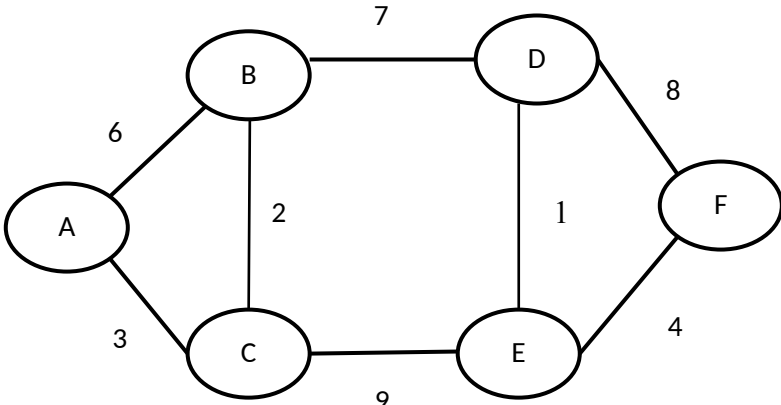
General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes
 CO 3. Identify and analyze error and flow control mechanisms in data link layer.
 CO 4. Design sub-netting and analyze the performance of network layer with various routing protocols.

| Q. No | Question | Module | Marks | CO | BL |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|----|----|
| 1. | a) Slotted ALOHA network transmits 300-bit frames using a shared channel with a 300-kbps bandwidth. Find the frame transmission time and throughput if the system (all stations together) produces. (i). 2000 frames per second when $G=1$ (ii). 700 frames per second when $G=1/2$ (iii). 650 frames per second when $G=1/4$ | 3 | 5 | 3 | 5 |
| | b) Consider the bandwidth of the channel is 2 Mbps, propagation is 22.5 msec and packet size is 1 KB, then find the total time, link efficiency and throughput in stop and wait protocol. | | 5 | | |
| 2. | An Internet Service Provider (ISP) is granted a block of addresses starting with 198.60.4.0/24. The ISP wants to distribute these blocks to 3 organizations with each organization receiving 12 addresses, 25 addresses and 50 addresses. Design the sub-blocks and give CIDR notation for each organization. Find out how many addresses are still available after these allocations. | 4 | 10 | 4 | 4 |
| 3. | a) A university campus network currently operates on IPv4, but due to the rapid increase in IoT devices (smart sensors, cameras, and student mobile devices), the IT team is considering migrating to IPv6. (i) Compare and contrast IPv4 and IPv6 in terms of address space, configuration, header structure, broadcast, security, and efficiency. (ii) In this scenario, explain the problems with continuing IPv4 and the advantages of migrating to IPv6. (iii) Conclude with a recommendation for the campus network. | 4 | 5 | 4 | 3 |
| | b) Find the class of each address from and show its corresponding subnet mask. (i). 01000001 00001011 00001011 11101111 (ii). 11110001 10000011 00011011 11111111 | | 5 | | |



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| | | | | |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|-----|
| | <p>(iii). 126.23.120.8 (iv). 190.5.15.111 (v). Find the error, if any, in the following IPv4 addresses 11101011.5.15.8 and explain it.</p> | | | |
| 4. | <p>Consider a network shown in below figure. Compute least cost path from router F to all destination using Dijkstra's algorithm. Explain the process.</p>  <pre> graph LR A --- 1 B A --- 3 C A --- 4 D B --- 10 E B --- 3 C B --- 4 F C --- 1 D D --- 4 E E --- 1 F </pre> | 5 | 10 | 4 5 |
| 5. | <p>Consider a network which consists of 6 nodes. Each node in the network is represented as router. Each router maintains routing table indicating next hop router to be used to relay the packet to its destination. All routers in the network uses the Bellman Ford Algorithm to update their routing table. Compute least cost path from one router to another router.</p>  <pre> graph LR A --- 6 B A --- 3 C B --- 2 C B --- 7 D C --- 9 E D --- 1 E D --- 8 F E --- 4 F </pre> | 5 | 10 | 4 5 |

① a

$$\text{Frame transmission time } T_f = \frac{300 \text{ bits}}{300 \times 10^3 \text{ bits/s}}$$

$$\text{Slots per second} = \frac{1}{T_f} = 1000 \text{ slots/s}$$

$$\textcircled{a} G_1 = 1, S = G_1 \times e^{-G_1} = (1 \times e^{-1}) = 0.368$$

Throughput is $2000 \times 0.368 = 736$ frames
Only 736 out of 2000 frames will probably survive

$$\textcircled{b} G_1 = \frac{1}{2}, S = \frac{1}{2} e^{-1/2} = 0.303$$

$$\text{Throughput} = 700 \times 0.303 \approx 212$$

$$\textcircled{c} G_1 = \frac{1}{4}, S = \frac{1}{4} e^{-1/4} = 0.195$$

$$\text{Throughput} = 650 \times 0.195 = 126.75 \approx 127 \text{ frames}$$

① b

$$\text{Bandwidth} = 2 \text{ Mbps}$$

$$\text{Propagation delay } (T_p) = 22.5 \text{ ms}$$

$$\text{packet size} = 1 \text{ KB}$$

$$\text{Transmission Delay } (T_d) = \frac{\text{packet size}}{\text{Bandwidth}}$$

$$= \frac{1 \text{ KB}}{2 \text{ Mbps}} = \frac{2^{10} \times 8 \text{ bits}}{2 \times 10^6 \text{ bit/sec}}$$

$$= \frac{8192}{2 \times 10^6} = 0.004096 \text{ s}$$

$$T_d = 4.096 \text{ ms}$$

$$\text{Total time} = T_d + 2T_p$$

$$= 0.004096 + 2(0.0225)$$

$$= 0.049096 \text{ s}$$

$$T_{\text{total}} = 49.096 \text{ ms}$$

$$\text{Link Efficiency } (\eta) = \frac{T_d}{T_d + 2T_p}$$

$$= \frac{0.004096}{0.004096 + (2 \times 0.0225)}$$

$$= \frac{0.004096}{0.049096}$$

$$= 0.0834$$

$$\eta = 8.34\%$$

$$\eta = 8.34\%$$

$$\text{Throughput} = \eta \times \text{Bandwidth} = 0.0834 \times 2 \times 10^6$$

$$= 166,800 \text{ bps}$$

$$= 166.8 \text{ Kbps} //$$

(2) Starting address 198.60.4.0/24

$$N = 2^{(32-24)} = 2^8 = 256 \text{ addresses in this block}$$

The first address is 198.60.4.0/24

The last address is 198.60.4.255/24

(a) The number of addresses in the largest subblock, which requires 50 addresses, is not power of 2
 we allocate next power of 2 is 64

The subnet mask for this subnet can be

$$n_1 = 32 - \log_2 64 = 26$$

$$CIDR = 198.60.4.0/26$$

The first address in this block is 198.60.4.0

Last address is 198.60.4.63

(b) The number of addresses in the second largest subblock which requires 25 addresses,
 next power of 2 is 32

$$n_2 = 32 - \log_2 32 = 27$$

$$CIDR = 198.60.4.64/27$$

First address = 198.60.4.64

Last address = 198.60.4.95

(c) Subblock which requires 12 addresses,
 next power of 2 is 16, $n_3 = 32 - \log_2 16 = 28$

$$CIDR = 198.60.4.96/28$$

F.A = 198.60.4.96

L.A = 198.60.4.111

Remaining block

$$\text{Used} : 64 + 32 + 16 = 112$$

$$\text{Remaining} : 256 - 112 = 144 \text{ addresses}$$

(3 a)

(i)

| | IPv4 | IPv6 |
|------------------|----------------------|-----------------------------------------|
| Address space | 32 bit | 128-bit |
| Configuration | Manual or DHCP | Auto Configuration |
| Header Structure | Complex, 20-60 bytes | Simplified, fixed 40 bytes |
| Security | IPsec optional | IPsec built-in |
| Broadcasting | Supports broadcast | no broadcast, only multicast / anycast. |

- (ii)
- * Address exhaustion requires NAT for IoT devices.
 - * Manual Configuration increases administrative workload.
 - * Security (IPsec) is optional

Advantages of IPv6

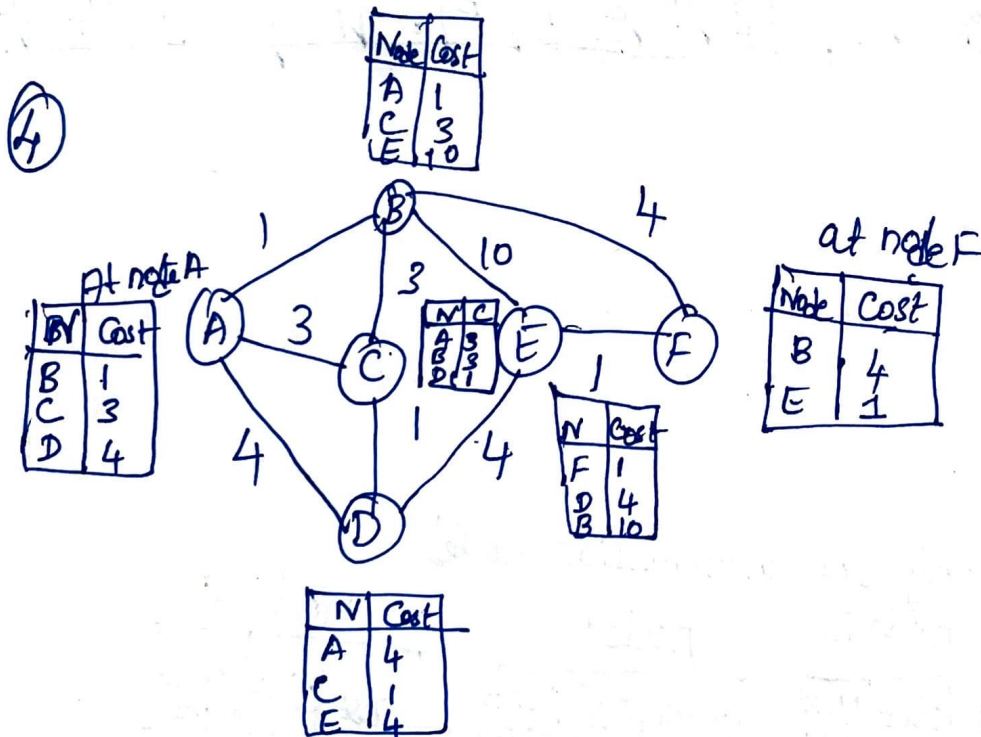
- * Vast address space \rightarrow every IoT device can have unique global address.
- * Eliminates NAT
- * Eliminates NAT
- * Auto Configuration reduces IT manager effort
- * Stronger security

(iii)

IPv6 migration is strongly recommended because it ensures scalability, simplifies n/w management, provides enhanced security.

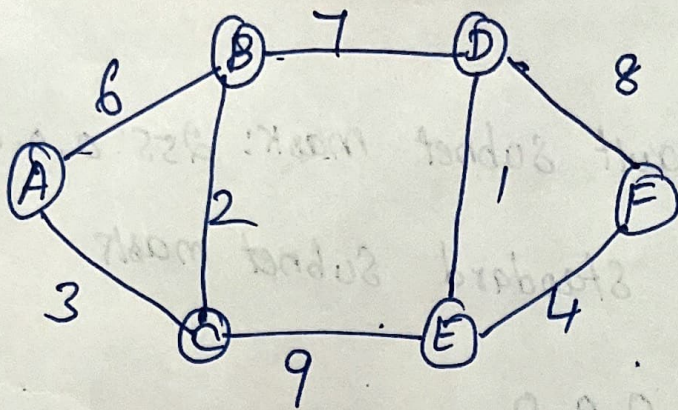
3b)

- (i) Class A, default subnet mask: 255.0.0.0
- (ii) Class E, no standard subnet mask
- (iii) Class A, 255.0.0.0
- (iv) Class B, 255.255.0.0
- (v) Error, the first octet is given in binary and others are decimal. (invalid representation)



| Iteration | Tree | A | B | C | D | E | Minimum Cost |
|-----------|--------------------|---|---|---|---|---|------------------------------------------------|
| Initial | {F} | ∞ | 4 | ∞ | ∞ | ① | F → E = 1 |
| 1 | {F, E} | ∞ | ④ | ∞ | 5 | - | F → B = 4 |
| 2 | {F, E, B} | 5 | - | 7 | ⑤ | - | F → B → A = 4 + 1 = 5 F → B → C = 4 + 3 = 7 |
| 3 | {F, E, D, B} | ⑤ | - | 6 | - | - | F → B → A = 5 |
| 4 | {F, E, D, B, A} | - | - | ⑥ | - | - | F → E → D → C = 1 + 4 + 1 = 6 |
| 5 | {F, E, D, C, B, A} | - | - | - | - | - | |

5



Maximum step
 $n-1 = 6-1 = 5$

Step 1

| At node A | | | node B | | | node C | | | node D | | | node E | | |
|-----------|------|----------|--------|------|----------|--------|------|----------|--------|------|----------|--------|------|----------|
| Dest | Dist | Next hop | Dest | Dist | Next hop | Dest | Dist | Next hop | Dest | Dist | Next hop | Dest | Dist | Next hop |
| A | 0 | A | A | 6 | A | A | 3 | A | A | ∞ | - | A | ∞ | - |
| B | 6 | B | B | 0 | B | B | 2 | B | B | 7 | B | B | ∞ | - |
| C | 3 | C | C | 2 | C | C | 0 | C | C | ∞ | - | C | ∞ | - |
| D | ∞ | - | D | 7 | D | D | ∞ | - | D | 0 | D | D | 1 | D |
| E | ∞ | - | E | ∞ | - | E | 9 | E | E | 8 | E | E | 0 | E |
| F | ∞ | - | F | ∞ | - | F | ∞ | - | F | ∞ | - | F | 4 | F |

At node F

| Dest | Dist | Next hop |
|------|------|----------|
| A | ∞ | - |
| B | ∞ | - |
| C | ∞ | - |
| D | 8 | D |
| E | 4 | E |
| F | 0 | F |

Step 2 (Consider only one intermediate node)

| node A | | | node B | | | node C | | | node D | | |
|--------|------|----------|--------|------|----------|--------|------|----------|--------|------|----------|
| Dest | Dist | Next hop | Dest | Dist | Next hop | Dest | Dist | Next hop | Dest | Dist | Next hop |
| A | 0 | A | A | 5 | C | A | 3 | A | A | 13 | B |
| B | 5 | C | B | 0 | B | B | 2 | B | B | 7 | B |
| C | 3 | C | C | 2 | C | C | 0 | C | C | 9 | B |
| D | 13 | B | D | 7 | D | D | 9 | B | D | 0 | D |
| E | 12 | C | E | 8 | D | E | 9 | E | E | 1 | E |
| F | ∞ | - | F | 15 | D | F | 13 | F | F | 5 | E |

| Dest | Dist | Next hop | Dest | Dist | Next hop |
|------|------|----------|------|------|----------|
| A | 12 | C | A | ∞ | - |
| B | 8 | D | B | 15 | D |
| C | 9 | C | C | 13 | E |
| D | 4 | D | D | 4 | 0 |
| E | 4 | F | E | 4 | 0 |
| F | 4 | F | F | 4 | 0 |

Step 3 (Consider two intermediate nodes)

node A

| Dest | Dist | Next hop |
|------|------|----------|
| A | 0 | A |
| B | 5 | C |
| C | 3 | C |
| D | 12 | C, B |
| E | 12 | E |
| F | 16 | C, E |

node B

| Dest | Dist | Next hop |
|------|------|----------|
| A | 5 | C |
| B | 0 | B |
| C | 2 | C |
| D | 7 | D |
| E | 8 | E |
| F | 12 | D |

node C

| Dest | Dist | Next hop |
|------|------|----------|
| A | 3 | A |
| B | 2 | B |
| C | 0 | C |
| D | 9 | D |
| E | 9 | E |
| F | 13 | E |

node D

| Dest | Dist | Next hop |
|------|------|----------|
| A | 12 | B, C |
| B | 7 | B |
| C | 9 | B, D |
| D | 0 | D |
| E | 1 | E |
| F | 5 | F |

node E

| Dest | Dist | Next hop |
|------|------|----------|
| A | 12 | C |
| B | 8 | D |
| C | 9 | C |
| D | 1 | D |
| E | 0 | E |
| F | 4 | F |

node F

| Dest | Dist | Next hop |
|------|------|----------|
| A | 16 | E |
| B | 12 | E |
| C | 13 | E |
| D | 5 | E |
| E | 4 | E |
| F | 0 | F |