

Name:	ID:
Time: 30 mins	Marks: 25
CSE 316, Quiz 1, Date 26-05-2019	Section: 1

Problem 1.

Marks: 1.5 X 6= 9

- I. Assume eight devices are arranged in a mesh topology. How many bidirectional cables are needed? How many ports are needed for each device?

Sol: Cable links: $n(n-1)/2 = (8 \times 7)/2 = 28$, Number of ports: $(8-1) = 7$ ports /device

- II. Match each of the following to one or more layers of the TCP/IP protocol suite:
- route determination
 - connection to transmission media
 - providing services for the end user

Sol:

- The **network layer** is responsible for route determination.
- The **physical layer** is the only layer that is connected to the transmission media.
- The **application layer** provides services for the end users.

- III. Match the following to one or more layers of the TCP/IP protocol suite:
- creating user datagrams
 - responsibility for handling frames between adjacent nodes
 - transforming bits to electromagnetic signals

Sol:

- User datagrams are created at the **transport layer**.
- The **data-link layer** is responsible for handling frames between adjacent nodes.
- The **physical layer** is responsible for transforming bits to electromagnetic signals.

- IV. In an internet, we change the LAN technology to a new one. Which layers in the TCP/IP protocol suite need to be changed?

Sol: The only two layers that need to be changed are the **data-link layer** and the **physical layer**. The new hardware and software need to be installed in all host, routers, and link-layer switches. As long as the new data-link layer can encapsulate and decapsulate datagrams from the network layer, there is no need to change any protocol in the upper three layers. This is one of the characteristics of the protocol layering.

- V. What is the piece of information in a packet upon which the forwarding decision is made in each of the following approaches to switching? a) datagram approach b) virtual-circuit approach.

Sol:

- In the datagram approach, the forwarding decision is made based on the **destination address** in the packet header.
- In the virtual-circuit approach, the forwarding decision is based on the **label** in the packet header.

List the three phases in the virtual-circuit approach to switching.

Sol: The three phases are **setup phase, data transfer, and teardown phase.**

Problem 2.

Marks: 10

A packet of 5 million bits is being sent on a link from a sender to a receiver with 10 routers in the middle. Each router has a queuing time of $2 \mu\text{s}$. Each node in the system has average processing time of $1 \mu\text{s}$. The length of the link is 2000 km. The speed of light inside the link is $2 \times 10^8 \text{ m/s}$. The link has transmission rate of 5 Mbps. What is the total delay for the packet? Which component of the total delay is dominant? Which one is negligible?

Solution

$\text{Delay}_{\text{pr}} = 11 \times 1 \mu\text{s} = 11 \mu\text{s}$ // Processing delay

$\text{Delay}_{\text{qu}} = 10 \times 2 \mu\text{s} = 20 \mu\text{s}$ // Queuing delay

$\text{Delay}_{\text{tr}} = 5,000,000 / (5 \text{ Mbps}) = 1\text{s}$ // Transmission delay

$\text{Delay}_{\text{pg}} = (2000 \text{ Km}) / (2 \times 10^8) = 0.01 \text{ s}$ // Propagation delay

Total Delay = $\text{Delay}_{\text{pr}} + \text{Delay}_{\text{qu}} + \text{Delay}_{\text{tr}} + \text{Delay}_{\text{pg}}$

Total Delay = $10 \mu\text{s} + 20 \mu\text{s} + 1\text{s} + 0.01 \text{ s} \approx 1.01 \text{ s}$

The transmission time is dominant here because the packet size is huge. Rests of the other delays are all negligible.

Problem 3.

Marks: 6

What are the differences between circuit-switched and packet-switched networks?

Solution:

Circuit Switching	Packet Switching
Dedicated transmission path	No Dedicated transmission path
Continuous transmission of data	Transmission of packet
Path is established for entire conversation	Route is established for each packet
Call setup delay	Packet transmission delay
Message are not stored	Packet are stored until delivery
Fixed bandwidth, bandwidth wastage	Dynamic bandwidth, no bandwidth wastage
No overhead bits after call setup	overhead bits in each packet