Roll No: _____ Name: _____

Course: CS-3001 – Computer Networks Date: 14 February 2025

Session: S'25 Quiz–1–AI-A Time: 20 minutes Day: Tuesday

Task #1: MCQs [CLO1] **[5 Marks]**

1. Which of the following statements best describes the fundamental role of a protocol in computer networks?
   a. It specifies how devices establish a physical connection.
   b. It dictates how applications are developed for networking purposes.
   c. It defines the format and order of messages exchanged between network entities.
   d. It describes how hardware components interact with the operating system.
2. Which of the following technologies is an example of a wide-area wireless access technology?
   a. DSL b. Fiber-to-the-home (FTTH)
   c. 4G LTE d. Ethernet
3. Packet-switched network differs from a circuit-switched network primarily because:
   a. It allocates dedicated bandwidth to each connection.
   b. It uses a store-and-forward mechanism for data transmission.
   c. It guarantees zero packet loss.
   d. It eliminates queuing delay completely.
4. What is the primary function of an Internet Exchange Point (IXP)?
   a. It enables direct communication between end-user devices.
   b. It facilitates the peering of Internet Service Providers (ISPs).
   c. It enhances encryption in online communication.
   d. It controls Internet traffic congestion at the transport layer.
5. Which of the following types of delay in a computer network is highly variable and depends on traffic conditions?
   a. Transmission delay b. Propagation delay
   c. Queuing delay d. Processing delay
6. Which of the following best defines the "network edge"?
   a. The core of the Internet is where ISPs interconnect.
   b. The outermost part of a network where end systems reside.
   c. The hardware inside a router that directs traffic.
   d. The interface where ISPs control Internet access
7. Which type of delay is minimized in circuit-switched networks compared to packet-switched networks?
   a. Transmission delay b. Propagation delay
   c. Queuing delay d. Processing delay
8. Which factor contributes to queuing delays in a network?
   a. The distance between the sender and receiver.
   b. The time required to move a packet from one node to another.
   c. The time a packet waits in the buffer due to network congestion.
   d. The time needed for error detection and correction.
9. Which Internet access technology generally provides the lowest latency for home users?
   a. DSL b. Satellite Internet
   c. Fiber-to-the-Home (FTTH) d. Cable Modem
10. What is a major disadvantage of packet-switched networks compared to circuit-switched networks?
    a. Wasted bandwidth during idle time b. Lack of scalability
    c. Potential packet loss and variable delays d. Fixed resource allocation

Task #2: CLO1 **[5 Marks]**

Suppose there is exactly one packet switch between a sending host and a receiving host. The transmission rates between the sending host and the switch and between the switch and the receiving host are $R1$ and $R2$, respectively. Assuming that the switch uses store-and-forward packet switching, what is the total end-to-end delay to send a packet of length L? (Ignore queuing, propagation delay, and processing delay.)

$$\frac{L}{R_1} + \frac{L}{R_2}$$

Task #3: CLO1 **[5 Marks]**

Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links of rates $R1$ = 500 kbps, $R2$ = 2 Mbps, and $R3$ = 1 Mbps.

a) Assuming no other traffic in the network, what is the throughput for the file transfer? [1 mark]

500 kbps

b) Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?

64 seconds

c) Repeat (a) and (b), but now with *R*2 reduced to 100 kbps.

$$Throughput = min(R_1, R_2, R_3) = 100\ kbps$$
$$Time = \frac{32 \times 10^6}{100 \times 10^3} = 320 seconds$$

Task #4: CLO1 **[5 Marks]**

This elementary problem begins to explore propagation delay and transmission delay, two central concepts in data networking. Consider two hosts, A and B, connected by a single link of rate *R* bps. Suppose that the two hosts are separated by *m* meters, and suppose the propagation speed along the link is *s* meters/sec. Host A is to send a packet of size *L* bits to Host B.

a) Suppose Host A begins to transmit the packet at time $t = 0$. At time $t = d_{trans}$, where is the last bit of the packet?

Last bit is just transmitted from Host A into the link.

b) Suppose d_{prop} is greater than d_{trans}. At time $t = d_{trans}$, where is the first bit of the packet?

It is still in transit along the link between Host A and Host B, not yet arrived at Host B.

c) Suppose $s = 2.5 \times 10^8$, L = 1500 bytes, and R = 10 Mbps. Find the distance m so that d_{prop} equals d_{trans}.

Distance m=300 km