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| Course: CS-3001 – Computer Networks | | | | Date: 14 February 2025 |
| Session: S’25 | Quiz–1–AI-A | Time: 20 minutes | | Day: Tuesday |

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

1. Which of the following statements best describes the fundamental role of a protocol in computer networks?
   1. It specifies how devices establish a physical connection.
   2. It dictates how applications are developed for networking purposes.
   3. **It defines the format and order of messages exchanged between network entities.**
   4. 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?

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| * 1. DSL | * 1. Fiber-to-the-home (FTTH) |
| * 1. **4G LTE** | * 1. Ethernet |

1. Packet-switched network differs from a circuit-switched network primarily because:
   1. It allocates dedicated bandwidth to each connection.
   2. **It uses a store-and-forward mechanism for data transmission.**
   3. It guarantees zero packet loss.
   4. It eliminates queuing delay completely.
2. What is the primary function of an Internet Exchange Point (IXP)?
   1. It enables direct communication between end-user devices.
   2. **It facilitates the peering of Internet Service Providers (ISPs).**
   3. It enhances encryption in online communication.
   4. It controls Internet traffic congestion at the transport layer.
3. Which of the following types of delay in a computer network is highly variable and depends on traffic conditions?

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| * 1. Transmission delay | * 1. Propagation delay |
| * 1. **Queuing delay** | * 1. Processing delay |

1. Which of the following best defines the "network edge"?
   1. The core of the Internet is where ISPs interconnect.
   2. The outermost part of a network where end systems reside.
   3. The hardware inside a router that directs traffic.
   4. The interface where ISPs control Internet access
2. Which type of delay is minimized in circuit-switched networks compared to packet-switched networks?

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| * 1. Transmission delay | * 1. Propagation delay |
| * 1. **Queuing delay** | * 1. Processing delay |

1. Which factor contributes to queuing delays in a network?
   1. The distance between the sender and receiver.
   2. The time required to move a packet from one node to another.
   3. **The time a packet waits in the buffer due to network congestion.**
   4. The time needed for error detection and correction.
2. Which Internet access technology generally provides the lowest latency for home users?

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| * 1. DSL | * 1. Satellite Internet |
| * 1. **Fiber-to-the-Home (FTTH)** | * 1. Cable Modem |

1. What is a major disadvantage of packet-switched networks compared to circuit-switched networks?

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| * 1. Wasted bandwidth during idle time | * 1. Lack of scalability |
| * 1. **Potential packet loss and variable delays** | * 1. Fixed resource allocation |

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| 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 *R*1 and *R*2, 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.)

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| 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 *R*1 = 500 kbps, *R*2 = 2 Mbps, and *R*3 = 1 Mbps.

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

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| **500 kbps** |

1. 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?

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| **64 seconds** |

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

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| 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.

1. 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?

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

1. Suppose *d*prop is greater than *d*trans. At time *t* = *d*trans, where is the first bit of the packet?

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

1. Suppose *s* = 2.5 × 108, *L* = 1500 bytes, and *R* = 10 Mbps. Find the distance *m* so that *d*prop equals *d*trans.

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| **Distance m=300 km** |