City University of Hong Kong
Department of Electronic Engineering

EE3009 Data Communications & Networking
Test 1

14 October 2020
Duration: 60 minutes
Total marks: 60

1. Why are standards important for protocols?

   [2 marks]

2. Consider sending a packet from a source host to a destination host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are variable and why?

   [6 marks]

3. What advantages does a circuit-switched network have over a packet-switched network?

   [2 marks]

4. A link has capacity 50 Mbps, and is shared by users under circuit switching mode. Each user requires a bandwidth of 10 Mbps. What is the maximum number of users that can be supported?

   [2 marks]

5. A link has capacity 50 Mbps, and is shared by eight users under packet switching mode. Each user requires a bandwidth of 10 Mbps, and only transmits 40% of the time.
   a. What is the probability that two users are transmitting, and the remaining users are not transmitting? When two users are transmitting, what fraction of the link capacity will be used by these two users?

      [3 marks]
   b. What is the probability that the total bandwidth required by users exceeds the link capacity?

      [4 marks]

6. For each of the following access technology, state whether it is used by residential users or institutional users for accessing the Internet:
   a. Ethernet
   b. Cable network
   c. Digital subscriber line

      [3 marks]

7. Suppose a process in Host C has a UDP socket with port number 6789. Suppose both Host A and Host B each send a UDP segment to Host C with destination port number 6789. Will both of these segments be directed to the same socket at Host C? If so, how will the process at Host C know that these two segments originated from two different hosts?

   [2 marks]

8. Is it possible for an application to enjoy reliable data transfer when the application runs over UDP? If so, how?

[2 marks]

9. A client PC is to download a file from a server, what transport layer protocol should be used to establish a connection between them? Justify your answer.

[3 marks]

10. A transmitter is sending a packet of length 1,000 bytes to the receiver over a link of distance 2,500 km, propagation speed 2.5×10^8 m/s and transmission rate 2 Mbps. How long does it take for the whole packet to reach the receiver?

[2 marks]

11. The path from Host A to Host B has three links, of rate R_1 = 500 kbps, R_2 =100 kbps, and R_3 = 1Mbps. Assume no other traffic in the network, what is the throughput between Host A and Host B?

[2 marks]

12. A host in an organization has an IP address 150.32.64.34 and a subnet mask 255.255.240.0.
    a. What is the address of this subnet?

    [2 marks]

    b. What is the range of IP addresses that a host can have on this subnet?

    [2 marks]

13. A small ISP owns the following networks: 128.56.24.0/24, 128.56.25.0/24, 128.56.26.0/24, 128.56.27.0/24. Perform CIDR aggregation of these networks.

[3 marks]

14. Consider sending a 1,600–byte datagram, with 20-byte header and 1580-byte payload, into a link that has an MTU of 500 bytes. Suppose the original datagram is stamped with the identification number 291. What are the values in the various fields (ID, total length, fragment offset and more bit) in each fragment?

[8 marks]

15. IPv4 addresses are being exhausted. Name three approaches to address this problem.

[3 marks]

16. What is the role of Internet Control Message Protocol?

[2 marks]

17. How does generalized forwarding differ from destination-based forwarding?

[7 marks]

END