City University of Hong Kong
Department of Electronic Engineering

EE3009 Data Communications & Networking
Test 1

15 March 2019
Duration: 45 minutes
Total marks: 45

1. A link has capacity 50 Mbps, and is shared by users under circuit switching mode. Each user requires a bandwidth of 5 Mbps. What is the maximum number of users that can be supported?

   [2 marks]

2. 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 link capacity is sufficient to serve the total bandwidth required by users?

      [4 marks]

3. For the following access technologies, classify each one as home access, enterprise access, or wide area wireless access: DSL over telephone line, cable network, 1 Gbps switched Ethernet, and 4G.

   [4 marks]

4. Suppose a process in Host C has a UDP socket with port number 6789. Suppose Host A and Host B each sends 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]

5. UDP is regarded as a best-effort transport layer protocol. Explain what does this mean.

   [2 marks]

6. A transmitter is sending a packet of length 2,000 bytes to the receiver via a switch. Both links (the link between the transmitter and the switch, and link between the switch and receiver) have distance 2,500 km, and transmission rate 2 Mbps. The propagation speed is 2.5×10^8 m/s. How long does it take for the whole packet to reach the receiver?

   [3 marks]

7. 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]

8. 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]

9. 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]

10. 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?

    [7 marks]

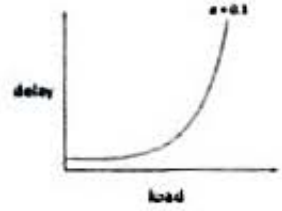
11. IPv4 addresses are being exhausted. Name three approaches to address this problem.

    [3 marks]

12. What is the function of Address Resolution Protocol?

    [2 marks]

13. The following figure shows the relationship between delay and load in Ethernet, with normalized delay bandwidth product a=0.1. Sketch the relationship for a=0.2, and a = 0.01.



    [2 marks]

14. Name the two operation modes of 802.11 WLAN.

    [2 marks]

END