UNIVERSITY OF ESWATINI

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION 2021

Title: COMPUTER NETWORKS

Course Code: EEE572

Time Allowed: THREE (3) HOURS

Instructions:

1. Answer any **four (4)** questions

2. Each question carries **25** marks

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This paper consists of five (5) pages

QUESTION 1

(a) Discuss the consequences if a connection fails in the following networks: (i) Mesh topology [1], (ii) Star topology [1], (iii) Bus topology [2], and (iv) Ring topology [2].

(b) What are the two approaches to packet-switching? [2]

(c) The CSMA/CD cannot work in wireless LANs due to two problems, i.e., hidden station problem and exposed station problem. Briefly describe each of the problems using illustrations if possible. [6]

(d) Design a challenge-response mutual authentication exchange based on public key signatures [4]. Does it have any communication or security advantages over the public key encryption scheme? Why or why not? [4]

(e) Design an extended access list that permits all IP traffic from hosts on network 215.23.45.0/24, denies all IP traffic going to subnet 52.54.0.0/16, permits anyone to open a Telnet session with either 14.63.73.66 and 221.63.62.88 (and logs such packets to the console), and denies all other IP traffic. Invoke your list inbound on the E1 of router B. [3]

QUESTION 2

(a) Packet switching is used in layer 3; state the difference between the two approaches that are used, virtual circuit and datagram approach? [6]

(b) Distinguish between forward error correction versus error correction by retransmission. [2]

(c) Polling is one of the controlled access methods. Describe in detail how a host is able to transfer data using this method. [10]

(d) An Ethernet MAC sublayer receives 1510 bytes of data from the upper layer. Can the data be encapsulated in one frame? If not, how many frames need to be sent? What is the size of the data in each frame? [2]

(e) What is the purpose of the NAV? [2]

(f) Define fragmentation and explain why the IPv4 and IPv6 protocols need to fragment some packets. Is there any difference between the two protocols in this matter? [2]

(g) In symmetric-key cryptography, how many keys are needed if Alice and Bob want to communicate with each other? [1]

QUESTION 3

(a) A path in a digital circuit-switched network has a data rate of 1 Mbps. The exchange of 1000 bits is required for the setup and teardown phases. The distance between two parties is 5000 km. Answer the following questions if the propagataion speed is 2×10^8 m:

(i) What is the total delay if 1000 bits of data are exchanged during the data transfer phase? [1]

(ii) What is the total delay if 100,000 bits of data are exchanged during the data transfer phase? [1]

(iii) What is the total delay if 1,000,000 bits of data are exchanged during the data transfer phase? [2]

(iv) Find the delay per 1000 bits of data for each of the above cases and compare them. What can you infer? [2]

(b) What is the Hamming distance? What is the minimum Hamming distance? [3]

(c) Describe the token-passing method and discuss how the right to access the channel is passed from one station to another and how it is also managed. [8]

(d) Match the layers in Bluetooth and the Internet model. [3]

(e) Which fields of the IPv4 header change from router to router? [3]

(f) In symmetric-key cryptography, if every person in a group of 10 people needs to communicate with every other person in another group of 10 people, how many secret keys are needed? [2]

QUESTION 4

(a) Given the dataword 1010011110 and the divisor 10111: (i) Show the generation of the codeword at the sender site (using polynomial division), and then (ii) show the checking of the codeword at the receiver site (assume no error). [8]

(b) What is the difference between congestion control and flow control? What are the congestion control techniques employed by the transport layer (list all of them)? [7]

(c) Summarize the key difference between AH and ESP in IPsec. [2]

(d) Your company has just been assigned the network 198.23.16.0/28. How many subnets and hosts-per-subnet you can create with a subnet mast of 255.255.255.252? State the created subnets? [8]

QUESTION 5

(a) In the ring topology, what happens if one of the stations is unplugged? [2]

(b) Differentiate between Post Office Protocol (POP) and Simple Mail Transfer Protocol (SMTP)? [4]

(c) Why does a message digest provide a better integrity check than the Internet checksum? [4]

(d) In CRC, show the relationship between the following entities (size means the number of bits): (i) the size of the data word and the size of the code word, (ii) the size of the divisor and the remainder, (iii) the degree of the polynomial generator and the size of the remainder, and (iv) the degree of the polynomial generator and the size of the remainder. [4]

(e) Discuss the Stop-and-Wait protocol, showing the Finite State Machine and the flow diagram. [10]

(f) State the difference between virtual-circuit and datagram approach. [1]