UNIVERSITY OF ESWATINI

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION 2020

Title: COMPUTER NETWORKS

Course Code: EEE572/EE572

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) What is the advantage of a server storing only hashes of passwords rather than the passwords themselves? [2]

(b) A pure ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. What is the throughput if the system (all stations together) produces 250 frames per second? [2]

(c) Explain how a packet propagates within the network in relation to layer 2 and 3? [8]

(d) Design a challenge-response mutual authentication exchange based on public key signatures. Does it have any communication or security advantages over the public key encryption scheme? Why or why not? [8]

(e) A large number of consecutive IP address are available starting at 198.16.0.0. Suppose that four organizations, A, B, C, and D, request $4000, 2000, 4000$ and 8000 addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the w.x.y.z/s notation. [4]

(f) ARP and RARP both map address from one space to another. In this respect, they are similar. However, their implementations are fundamentally different. In what major way do they differ? [1]

QUESTION 2

(a) Suppose N people want to communicate with each other of $N-1$ people using symmetric key encryption. All communication between any two people, i and j is visible to all other people in the group of N. How many keys are required in this system? If public key encryption is used, how many keys are required? [4]

(b) Fig. 2 shows the exchange of data and control frames in time. Discuss the exchange time line? How does the NAV helps to avoid collisions? [12]

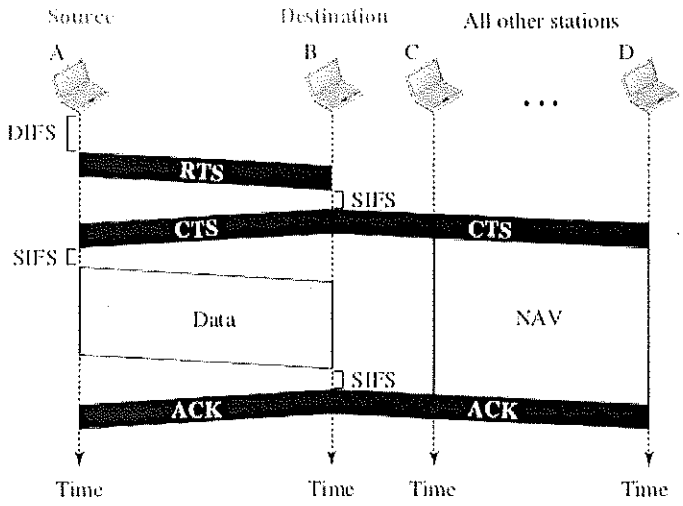

Fig. 1: CSMA/CA and NAV

(c) What are the main differences between a BSS and ESS, in wireless LANs [4]

(d) An access-list was written with the four statements shown below. Write a single access list statement that will combine all the statements? [2]

```
access-list 10 permit 172.29.16.0 0.0.0.255
access-list 10 permit 172.29.17.0 0.0.0.255
access-list 10 permit 172.29.18.0 0.0.0.255
access-list 10 permit 172.29.19.0 0.0.0.255
```

(e) It is possible to use a hash function to construct a block cipher with a structure similar to DES. Because a hash function is one way and a block cipher must be reversible (to decrypt), how is this possible? [3]

QUESTION 3

(a) What function does the Key Distribution Center (KDC) server? [2]

(b) Explain the difference between connectionless networks and connection-oriented networks? [5]

(c) Carrier sense multiple access with collision avoidance (CSMA/CA) was invented for wireless networks in order to minimize collision rate. Discuss how collision is avoided through the use of interframe space, contention window, and acknowledgements? [8]

(d) The network administrator want Router 0 to permit the entire sales network and just the 172.16.50.2 from the engineering network, while also denying all other traffic from entering the administration network. Write the access-list instructions to be configured. [4]

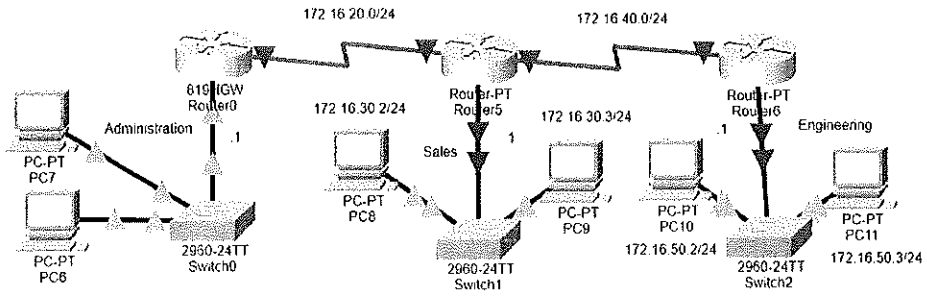

Fig. 2: Network plan.

(e) State the functions of the Bluetooth layers. [6]

QUESTION 4

(a) Explain the exposed station problem using illustrations? [5]

(b) What does it mean for a signed document to be verifiable, nonforgeable, and nonrepudiable? Use Bob and Alice as examples. [4]

(c) Discuss the similarities and differences between circuit-switched and virtual-circuit networks? [5]

(d) A network administrator wants to add a line to an access list that will block only Telnet access by the hosts on subnet 192.168.1.128/28 to the server at 192.168.1.5. What command should be issued to accomplish this task? [3]

(e) Use the additive cipher with key = 15 to dencrypt the message "WTAAD" when the plaintext and ciphertext are in modulo 26. [4]

(f) Differentiate between backpressure and choke packet methods? [4]

QUESTION 5

(a) Describe how flow control is handled in the transport layer? [2]

(b) Describe the piggybacking process and its benefit? [2]

(c) Draw the FSM for the Go-Back-N protocol. [10]

(d) Given the dataword 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender site (using binary division). [5]

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

(f) The ISDN standard define three (3) basic types of channels. Discuss one of them. [2]