

UNIVERSITY OF SWAZILAND**Faculty of Science****Department of Computer Science****MAIN EXAMINATION May 2011****Title of paper: NETWORKS AND CODING THEORY – II****Course number: CS438****Time allowed: 3 hours****Total Marks: 100****Instructions to candidates:**

This question paper consists of **SIX (6)** Questions. Answer any **FOUR (4)** questions. Marks are indicated in the square brackets.

All questions carry equal marks.

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QUESTION 1

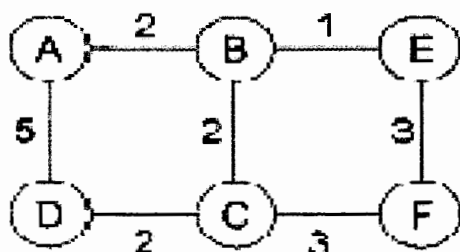
- a) The network level can establish either a connection oriented or a connectionless route between a source and a destination. What are the differences between these 2 types of connection? What advantages and disadvantages does each have? [8]
- b) Consider a system using flooding with a hop counter. Suppose that the hop counter is initially set to the "diameter" of the network. When the hop count reaches zero, the packet is discarded unless it is at its destination. Does this **always** ensure that a packet will reach its destination if there exists at least one functioning path (to the destination)? Why or why not? [Assume that a packet will not be dropped unless its hop count goes to zero] [5]
- c) The purpose of a routing algorithm is to find the least cost path from source to destination. What are some of the possible cost metrics? Which metrics could cause stability problems (i.e., oscillation or route flapping)? Why? [8]
- d) What are the possible causes of packet loss? [4]

QUESTION 2

- a) Distance-vector routing is said to be slow to react to changes. Explain why, and outline why link-state protocols are therefore preferred in today's Internet. [5]
- b) What is a tool/command that can be used to determine the number of hops to a destination and the round trip time (RTT) for each hop? [2]
- c) i) What are the important attributes for a good routing algorithm? [4]
- ii) What's the difference between routing and forwarding? What is their relationship? [4]
- iii) State the primary differences between Link-State and Distance Vector routing algorithms. [6]
- d) State two reasons for routers to drop data packets. [4]

QUESTION 3

- a) Students new to routing sometimes assume that bandwidth is a better metric than hop count. Why might this be a false assumption? [3]
- b) Consider the network represented by the directed graph in **Fig.1**. Show the operation of Dijkstra's (Link State) algorithm for computing the least cost path from **B** to all destinations. Also, derive the routing table for node **B** to all destinations that are the result of the algorithm's computation. Show the distance table that would be computed by the Distance Vector algorithm for node **E**. [10]

**Fig. 1**

- c) TCP uses a three-way handshake for reliable connection management, when establishing a logical end-to-end (process-to-process) connection.
- i) What important control information is carried in the first TCP segment (packet) of the three-way handshake, and why? [3]
- ii) State and explain the technique used by TCP in terminating a connection. How many TCP segments (packets) are required to close a TCP connection? [4]
- d) What is meant by the term Virtual Private Network (VPN), and explain how it can be used to provide secure communications over the Internet. [5]

QUESTION 4

- a) Which layer of the TCP/IP hierarchy (Application, Transport, Network, Link) does the following: [3]
- i) Deciding the direction in which message segments are transferred across the Internet.
- ii) Presenting incoming messages to the computer user
- iii) Deciding which application should receive an incoming message

- b) The diagram below illustrates the basic packet format for the Internet Protocol (IP).

Version	Type	Total Length
Identification		Fragment Offset
TTL	Protocol	Header Checksum
Source Address		
Destination Address		
Options		
DATA		

Use your knowledge of IP and the diagram to answer the following questions.

- i) IP uses 32-bit addresses that are usually written in a form like 128.233.128.46 for human users. What are the two different components present in an IP address that are part of IP's two-level hierarchical addressing scheme? [4]
- ii) What is the purpose of the Time to Live (TTL) field in an IP packet? How is it used? [4]
- iii) What is IP fragmentation? How is it handled? [3]
- e) In the context of networking, what is congestion? Describe the use of the Leaky bucket algorithm, Choke packets and Load shedding as applies to congestion control. [8]
- f) Explain the term network jitter. How does jitter affect the performance of an audio streaming application? [3]

QUESTION 5

- a) DNS uses a distributed approach as opposed to a single server. Why? If DNS were to "crash" or entirely go down, what would happen? Could the Internet still be "used" and, if so, how? [6]
- b) Why was IPv6 created? Describe 2 significant changes of IPv6 compared to IPv4. [5]
- c) With reference to IP addressing, what is the purpose of a subnet mask? [3]

- d) Your organization has been assigned the Class C address of 200.127.12.0 and your network Administrator intends to use the extended network prefix to be /29.
- i) How many sub-networks can you have on this network? Clearly show how you obtained your answer. [4]
 - ii) How many nodes can be supported on each of these sub-networks? Again, clearly show how you obtained your answer. [4]
- e) Can a host have more than one IP addresses? Why? [3]

QUESTION 6

- a) Name three email access protocols (that is, from user agent to SMTP server) for email download. [3]
- b) With the aid of appropriate examples explain the difference between Secret Key Cryptography and Public Key Cryptography. [6]
- c) When we discussed the Hyper-Text Transfer Protocol (HTTP/1.0) in class, we referred to it as "stateless". What is meant by a "stateless" protocol? [2]
- d) Briefly explain the overall approach to security embodied in using firewalls. Explain the idea behind packet filtering and give two examples of criteria that might be chosen as the basis of filtering datagrams. [6]
- e) There are a number of techniques that can be used to attack communicating entities during the authentication phase of a communication session. Using diagrams where appropriate, describe and discuss the following:
- i) A replay attack (also known as a playback attack). [3]
 - ii) A man in the middle attack. In your answer, discuss whether the use of public key cryptography would overcome the attack. [3]
 - iii) A reflection attack. [2]

<<End of Question Paper >>