

UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

Main Examination May 2013

Title of paper: NETWORKS AND CODING THEORY – II

Course number: CS438

Time allowed: 3 hours

Instructions to candidates:

This question paper consists of **FIVE (5)** Questions. Answer any **FOUR (4)** questions. Marks are indicated in the square brackets.

All questions carry equal marks.

THIS EXAMINATION PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

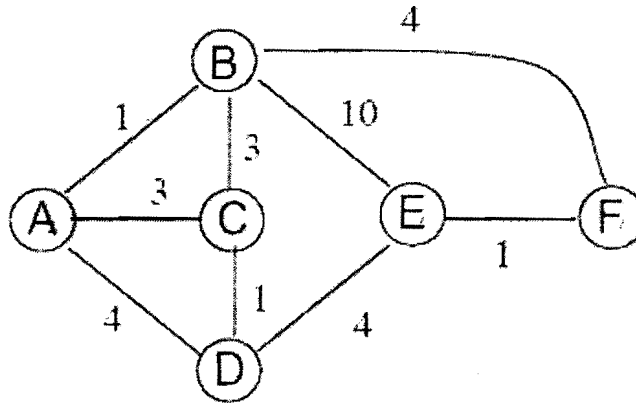
QUESTION 1

- a) State 4 functions of the network layer. What functions are performed by a router? Why is it important for routers to know about all of the possible routes through a network topology? [7]
- b) A packet traversing the Internet typically undergoes several types of delays, including nodal processing delay, transmission delay, propagation delay, and queuing delay. Define each of these four types of delays. How can each of these delays be reduced? [6]
- c) Illustrate the basic structure of an IP address. Given an IP address, how would you determine whether it is a class A, B or C address? [5]
- d) Given the IP network **192.168.17.0**, how many subnets would result if subnetting is done and the maximum number of hosts per subnet is **30**? What is the subnet mask? Why are some IP addresses not assigned to hosts in the subnet? [7]

QUESTION 2

- a) Distributed routing algorithms in communications systems are designed to provide a fault-tolerant computation of end-to-end paths in the event of link or router failure (or repair).
- i. Describe how this occurs, using as an example the distance-vector algorithm. [4]
 - ii. 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 are the pros and cons of distance vector versus link state routing protocols? [3]

- c) Consider the network represented by the directed graph below. Show the operation of Dijkstra's (Link State) algorithm for computing the least cost path from E to all destinations. Also, explicitly list the shortest path routes from E 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 in B.



[7]

- d) With the help of diagrams, describe the following routing strategies:
- i) Fixed routing.
 - ii) Random routing.

[6]

QUESTION 3

- a) Explain the term network jitter. How does jitter affect the performance of an audio streaming application? [3]
- b) In the context of networking, what is congestion? What is the difference between congestion and flow control? Describe the operation of the Token bucket algorithm. [6]
- c) The following terms are used when describing the Internet Protocol. Define what they mean
- (i) Internet Protocol Address.
 - (ii) Fragmentation.
 - (iii) Maximum Transmission Unit.
 - (iv) Time to Live.
- [8]
- d) How is the IPv4 header checksum calculated? [3]
- e) TCP employs a "three-way handshake at the start of a connection. With the aid of a well labelled diagram explain what is meant by a "three way handshake" and why it is necessary. What important control information is carried in the first TCP

segment (packet) of the three-way handshake, and why?

[5]

QUESTION 4

- a) Explain briefly what is meant by confidentiality, integrity and authentication. [6]
- b) With the aid of appropriate examples explain how transposition and substitution ciphers work. [5]
- c) Compare and contrast symmetric key cryptography (typified by the use of the DES algorithm), with public key cryptography (typified by the use of the RSA algorithm). In your answer you should list the major features of these approaches, but not discuss the details of DES or RSA. [6]
- d) Briefly explain how the Domain Name Service (DNS) is implemented and how DNS queries are resolved in the DNS system. Why does the DNS have zones? [5]
- e) What are the functions of ARP and DHCP? [3]

QUESTION 5

- a) What is the relationship between the Internet and WWW? [2]
- b) Proxy servers are widely used in client - server based applications, for example HTTP. Use a diagram to show how a web proxy server works. List three functions implemented by a web proxy server, and briefly describe the benefits of implementing a web proxy server. [5]
- c) With the aid of a diagram, describe a simple http session in which a user requests information that is stored in a database [7]
- d) Explain the difference between HTTP and HTTPS. [3]
- e) Describe how email works. In your description you should include how an end user gets to read the email using the appropriate client. [5]
- f) Briefly explain what a firewall is. [3]

<<<End of Question Paper>>>