

UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

SUPPLEMENTARY EXAMINATION 2009

Title of paper: NETWORKS AND CODING THEORY – II

Course number: CS438

Time allowed: 3 hours

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.

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

QUESTION 1

- a) What are the major services provided by the network layer? [4]
- b) Explain briefly the concept of a virtual circuit. [4]
- c) Why is routing necessary in the network? What are the major properties of routing algorithms? Is the shortest –path routing algorithm a static routing algorithm? [8]
- d) What algorithm is OSPF routing protocol based on? How does the algorithm work in routing? How does operation of BGP and OSPF differ from each other? [5]
- e) Routing tables, routing protocols and packet forwarding are part of routing. What are they and how are they connected to each other. [4]

QUESTION 2

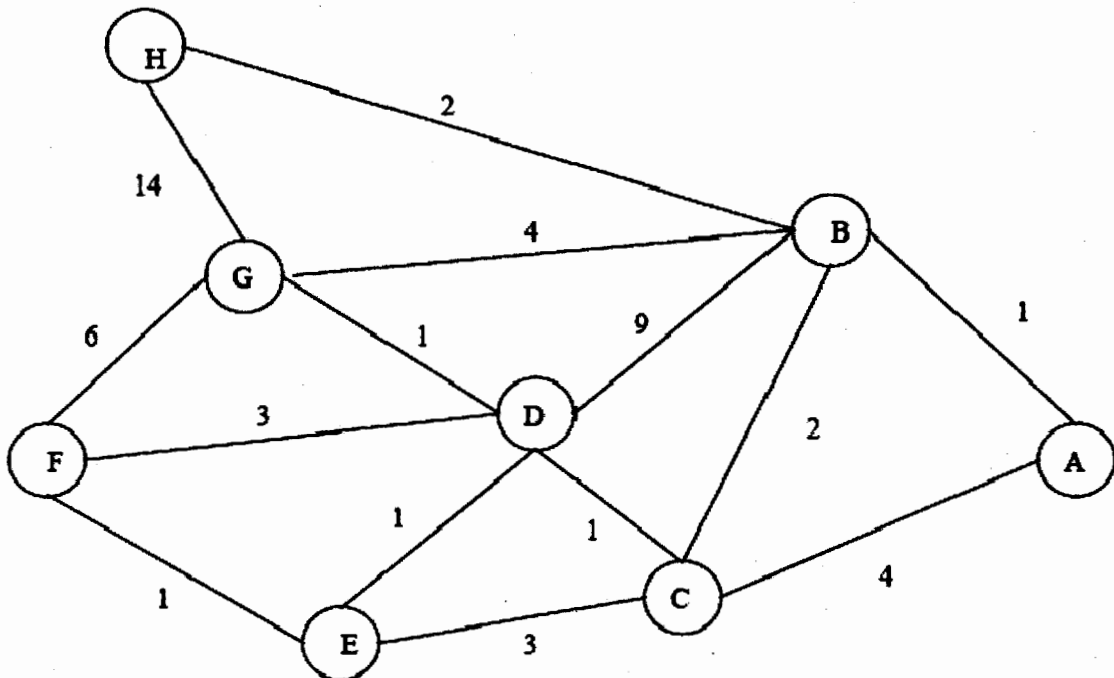
- a) Consider the following shortest path algorithm as used for finding a shortest path route from S (source node) to D (destination node). Define N as the set of nodes in the connected graph, define M as the set of nodes in the selected path.
 - i) Start at a source node S, initialize set M to empty
 - ii) Find a neighbour node not in set M with lowest link cost, add this node to set M
 - iii) Repeat step (2) until D is in set M

Will this algorithm correctly find least-cost routes? If this is not a good algorithm, give an example where it fails. [8]

- b) What are the four causes of delay in a packet switched network? What can be done to reduce the delays? [5]
- c) Briefly explain the concept of source routing. [2]

- d) Given the following directed graph, Fig 1.
- Use Dijkstra's algorithm to construct the spanning tree and hence the routing table for node F. [5]
 - Use the distance vector algorithm to compute the distance and routing tables, for node F. [5]

Show all your working.



QUESTION 3

- The IPv4 address space is considered to be too small to accommodate future Internet growth. Explain how the structure of IPv4 addresses has led to the wasting of substantial portions of the IPv4 address space. [6]
- What is a class B IP address? How many class B subnets can there be? How many hosts per class B subnet? [8]
- The IPv4 address space is considered to be too small to accommodate future Internet growth. Explain how the structure of IPv4 addresses has led to the wasting of substantial portions of the IPv4 address space. [5]
- Explain the concepts of tunneling and VPNs. [6]

QUESTION 4

- a) What causes congestion in a network? Explain the concept of a deadlock in relation to network congestion? State and explain the types of deadlocks. [10]
- b) Give a detailed account of the following congestion control techniques for virtual circuit and datagram networks:
i) Choke packets
ii) Jitter control
iii) Load shedding [3 marks each]
- c) Explain the services provided by the transport layer. Describe the two army problem and explain its relevance to the releasing of connections. [6]

QUESTION 5

- a) What are the two key components of an IP address? List the three main address classes initially used on the Internet. [5]
- b) "TCP works well for long-lived connections but not so well for short-lived connections." Discuss. [4]
- c) How does TCP ensure reliable delivery of packets? How does it also ensure ordered delivery of packets? [6]
- d) Distinguish between TCP and UDP, explaining the kinds of applications to which each is suited. [10]

QUESTION 6

- a) i) Who or what parties have the authority to govern or decide the usage policy of the Internet? Who or what parties can, for example, allow a person or an organization to use the Internet and/or limit the use? [3]
- ii) In your opinion, who or what parties should have the authority to decide on the protection of privacy on the Internet? Who or what parties should, for example, regulate the use of strong cryptography on the Internet? Why? What kind of issues should these decisions be based on? [4]
- b) In the Internet world servers are said to reside on "well-known ports". What does this mean? Outline how ports are used (both in the initial and in subsequent packets) as a document is retrieved from a WWW server. [8]
- c) End-to-end encryption is an OSI Presentation layer function; however, even when secure end-to-end encryption is employed, what forms of security attacks can be employed using information from the lower OSI layers? How can these be solved? [7]
- d) Proxy servers are widely used in client-server based applications, for example HTTP. List three functions implemented by a web proxy server, and briefly describe the benefits of implementing a web proxy server. [6]