

UNIVERSITY OF SWAZILAND

Faculty of Science

Department of Computer Science

MAIN EXAMINATION 2009

Title of paper: NETWORKS AND CODING THEORY – II

Course number: CS438

Time allowed: 3 hours

Instructions to candidates:

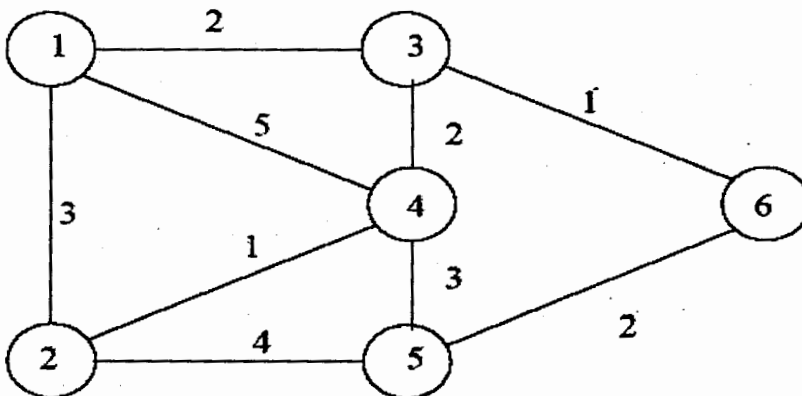
This question paper consists of **SIX (6)** Questions. Answer any **FOUR (4)** questions. Marks are indicated in the square brackets.

All questions carry equal marks.

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QUESTION 1

- a) What is the main difference between connectionless and connection-oriented protocols? Give an example for each protocol respectively. [4]
- b) State and explain 2 properties of a good routing algorithm. Hence distinguish between flooding and random routing. Under what circumstances would the use of each be appropriate? [6]
- c) What are the pros and cons of distance vector versus link state routing protocols? Give examples derived from protocols in use today. Where are hybrid schemes employed and why? 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. [9]
- d) Given the following graph, Fig.1, Use Dijkstra's algorithm to compute the shortest path from node 6 to all other nodes. Hence construct the routing/forwarding table for node 6. (Link costs are indicated on the links between the nodes). [4]



- i) Assume that the link between node 3 and 6 is now broken up. Explain what happens thereafter for the Distance Vector algorithm. [2]

QUESTION 2

- a) Define the term flow control. How does it differ from congestion control? When does congestion occur? Describe the problems encountered if in a network there is no traffic control. State any 2 goals of traffic control. [10]
- b) Flow control mechanisms in networks can be loosely categorized as open loop, and closed loop. The telephone network of today and the Resource Reservation Protocol (RSVP) and associated services proposed for the future Internet provide open loop control. Briefly explain the use of Negotiation, Admission control and Choke packets in congestion control. [6]
- c) Describe the operation of the leaky bucket algorithm? How is it used to police traffic? How can it be used to shape traffic? [5]
- d) It has been said that flow control and congestion control are equivalent. Is this true for the Internet's connection-oriented service? Are the objectives of flow control and congestion control the same? [4]

QUESTION 3

- a) What are the major differences between TCP and UDP? Why does DNS use UDP instead of TCP for its service? What is the size of a TCP header? What is the size of a UDP header? What fields exist in both TCP header and UDP header? [9]
- b) What's the difference between routing and forwarding? What is their relationship? [4]
- c) TCP employs a "three-way handshake at the start of a connection. With the aid a well labeled diagram explain what is meant by a "three way handshake" and why it is necessary. [6]
- d) What's the transport protocol employed by HTTP? What's the difference between non-persistent HTTP and persistent HTTP? [6]

QUESTION 4

- a) What is meant by DHCP? Why is dynamical allocation of IP addresses needed? Explain the process through which a device gets an IP address using DHCP. [5]
- b) Name two methods of making more efficient use of IP addresses. [2]
- c) A TCP entity transmits 10,000 bytes of data in 2,000 byte segments (thus, including the TCP header, there will be 2,020 bytes of IP data for each segment). The IP entity is operating with a Maximum Transmission Unit (MTU) of 1024 bytes. Calculate how many packets the IP entity will transmit and justify your answer. (You may ignore errors and assume that IP headers are 20 bytes). [3]
- d) State 2 applications that use DNS to resolve the name that users enter to real IP addresses. How do IP addresses get mapped onto Data link layer addresses? [5]
- e) Explain the concept of subnetting. State any 2 benefits of subnetting. [4]
- f) i) Is multiplexing at the Transport layer different from multiplexing at the physical layer? Explain your answer. [3]
- ii) Internet transport protocols have header formats which carry source and destination port numbers. Explain how these port numbers are used when a client makes a request to a server. [3]

QUESTION 5

- a) A system is designed which allows students access to a remote database containing personal records of students. Each student is allowed access only to his or her own information. Students identify themselves to the system by typing a username followed by a password. The remote system encrypts the password and compares the result with an encrypted copy stored in a database table. For ease of maintenance, the encrypted passwords are globally readable. Comment on the security of this system and its sensitivity to the way in which users choose passwords. [4]
- b) Describe how Public Key Cryptosystems work. You need not go into the mathematics of the RSA algorithm. [5]
- c) With the aid of appropriate examples explain how transposition and substitution ciphers work. [4]
- d) Use the RSA algorithm to encrypt the letter **g** assuming that $p = 3$ and $q = 7$. What will be the public key, private key and the encrypted message to be transmitted? Show all your working. [5]

- e) Explain briefly what a firewall is? What kind of operations or functions does a firewall typically perform? Name one (1) security threat that a firewall prevents and name three different security threats that a firewall is useless against. Name 2 different types of firewalls. [7]

QUESTION 6

- a) i) What are the most important DNS records? Explain the role of a DNS (Domain Name System) server. [6]
- iii) Suppose that everyone in the world was perfectly capable of remembering Internet addresses instead of just host names. Would DNS still serve a purpose in this world? Explain. [3]
- b) What is a URL? What is its structure? Also give two different examples of URLs. How does the abbreviation of domain names work? [5]
- c) Briefly describe the following :
- i. SMTP,
 - ii. POP3,
 - iii. ARP
 - iv. Cookie
 - v. Wiki [8]
- d) Distinguish between HTTP and HTTPS. [3]

<<End of Question Paper>>