THE UNIVERSITY OF WAIKATO
Department of Computer Science

COMP312-07A Communications and Networks
Mid Semester Test – 26th April 2007

Worth 10% — Marked out of 90

Time allowed: 1 Hour 30 Min

Answer ALL Questions.

Hand in exam question paper with your answers.

---

1. Protocol Models

   Figure 1 represents a typical protocol stack.

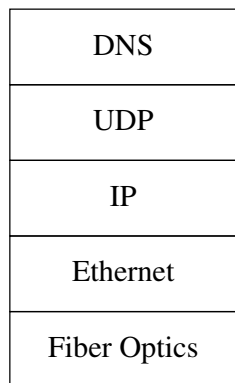 | DNS |
   |:---:|
   | UDP |
   | IP |
   | Ethernet |
   | Fiber Optics |

   Figure 1: Protocol Stack

   (a) Give the generic name for each layer of the protocol stack.

   (b) Application layer protocols are commonly referred to as *Layer 7* protocols. Why is this?

   (c) Draw a diagram showing the data traversing the stack between two end nodes connected through an intermediate router. Carefully identify which protocol layers are involved at each node.

   (10 marks)

2. Networks

   (a) What are the three purposes of an address in a network such as the Internet?

   (b) What advantage does a circuit-switched network have over a packet-switched network?

   (c) What advantages does a packet-switched network have over a circuit-switched network?

   (10 marks)

3. Applications

   (a) How are applications multiplexed by the Internet protocols?

   (b) What is the main difference between HyperText Transfer Protocol (HTTP) 1.0 and HTTP 1.1?

   (c) How is the Domain Name System (DNS) database distributed?

   (d) Describe the role of a DNS root server.

(10 marks)

4. User Datagram Protocol (UDP)

   (a) What are the four fields in a UDP header, and what are they used for?

   (b) List three properties of UDP that make it suited to being the transport protocol used by the DNS protocol.

   (c) Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP? If so, how?

(10 marks)

5. Transmission Control Protocol (TCP)

   (a) List three properties of TCP that make it suited to being the transport protocol used by the HTTP protocol.

   (b) Explain the difference between a TCP active open and a passive open.

   (c) Draw a time-sequence diagram that illustrates the TCP three packet handshake. Your diagram must provide example TCP port numbers, TCP flags, and TCP sequence and acknowledgement numbers.

   (d) Why does a TCP header contain both a sequence number and an acknowledgement number?

(10 marks)

6. TCP dynamics

   (a) When may a TCP sender transmit more data? Describe any exceptions.

   (b) Draw a time-sequence diagram that illustrates TCP slow start.

   (c) Four TCP round-trip-time samples in the order they are collected are 12.4ms, 13.5ms, 15.0ms, and 14.3ms. If the weighting is 0.125, what is TCP's current estimate of the round trip time? You must show all working.

(10 marks)

7. Internet Protocol (IP)

   (a) What is the primary purpose of the Time To Live (TTL) field in the IP header?

   (b) Describe how an IP packet of 1500 bytes is fragmented when it encounters a link with a Maximum Transmission Unit (MTU) of 576 bytes, in terms of how the following IP header fields are used:

       i. Total Packet Length
       ii. Identification
       iii. Flags
       iv. Fragment Offset

   (c) Assuming class-based routing, for each of the following addresses, identify the class, the net ID, the host ID, the network address and the broadcast address:

       i. 130.217.248.42
       ii. 210.86.20.108
       iii. 64.28.67.35

(10 marks)

8. Routing

   (a) What is a static route? When would a static route be used?

   (b) What is a dynamic routing protocol? When would a dynamic routing protocol be used?

   (c) Describe, using an example, how Classless Interdomain Routing (CIDR) may be used to reduce routing table size.

(10 marks)

9. IP routing

   (a) What is the difference between a *stub* AS, a *multi-homed* AS, and a *transit* AS?

   (b) For 130.216.1.234/28, identify the net ID, the host ID, the subnet mask, and the broadcast address.

   (c) Produce a routing table typical of an end host on the Internet that consists of the destination, gateway, netmask, flags, and interface columns. You may assume a host 130.217.251.39 that operates on a class B network with gateway 130.217.64.2, with two interfaces eth0 and lo.

(10 marks)