

Student Number:

SCHOOL OF COMPUTING AND INFORMATION SYSTEMS

COMP30023 Computer Systems

Mid-Semester Sample Test

Time Allowed: 30 minutes.

Authorized Materials: None.

Instructions to Students:

- This paper counts for 10% of your final grade.
- There are two parts to the test:
 - Part A - 10×1 mark multiple choice questions;
 - Part B - 5 short answer questions with $1 + 1 + 2 + 2 + 4 = 10$ marks.
- Attempt all questions.
- Please write your answers to the multiple choice questions in the labelled boxes on page 2.
- Please write your answer to each of the short-answer questions in the ruled boxes.

Part A (10 marks).

Each of the following questions has one and exactly one answer. Pick the most appropriate answer to each of them and write it in the answer box below.

Question	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Answer										

1. The Internet community (“TCP/IP model”) consider layers 5 and 6 to be “empty”; they do not add any processing, headers or messages. Is it possible for the network layer of a communication system to be empty?
 - (a) No, the network layer is the only layer of the stack that cannot be empty.
 - (b) Yes, a single point-to-point link like a USB cable can be seen as a communication system with no network layer
 - (c) Yes, the “network layer” refers to the actual network equipment (wires, routers), not a protocol
 - (d) No, without a network layer, data cannot go from one place to another
2. What layer is DNS?
 - (a) Network; DNS concerns the naming of nodes, which is a network layer function
 - (b) Transport; DNS uses the network to provides service to the application layer, and so is a transport layer protocol
 - (c) Application; DNS is concerned with allowing the final application to use simple names
 - (d) Link; DNS provides a link between domain names and IP addresses
3. Which of the following is NOT a role of sockets in network programming?
 - (a) They are the interface between the transport layer and the application layer.
 - (b) A pair of sockets provides a connection between two peers at the application layer
 - (c) A socket can bypass the physical layer to allow an application to continue working when a cable gets cut.
 - (d) A socket can listen for attempts to connect to a particular TCP port.
4. What is multiplexing/demultiplexing, and how does it relate to the transport layer?
 - (a) Multiplexing/demultiplexing refers to sharing one resource between multiple uses; the transport demultiplexes a single network attachment (IP address) between multiple logical data flows
 - (b) Multiplexing/demultiplexing refers to being able to do more than one thing at once; the transport layer can send and receive data at the same time, which is a form of multiplexing
 - (c) Multiplexing/demultiplexing refers to requiring multiple numbers to identify something; a TCP connection is identified by (source address, source port, destination address, destination port)

- (d) Multiplexing/demultiplexing refers to indexing things by sequence numbers; TCP uses multiplexing/demultiplexing to know which packets to retransmit when loss occurs
5. In SMTP, how does the receiver know when the header is finished?
- (a) The header starts with a “Length” field saying how many bytes are in the header
 - (b) The header starts with a “Length” field saying how many lines are in the header
 - (c) The header ends with a “Bcc” field; after that is the message body
 - (d) The line after the header is the first blank line after the start of the message.
6. If an authoritative DNS server becomes unavailable, what happens?
- (a) DNS will no longer work because no other DNS servers are authorized
 - (b) The hosts for which that server is authoritative will become unreachable, and all connections to them will be broken
 - (c) Most things will keep working because the information in the authoritative server is probably cached in other DNS servers, and an ongoing TCP connection does not need DNS
 - (d) DNS will stop working for the hosts for which this server is authoritative, but existing connections will continue.
7. Why are protocol “stacks” made of layers?
- (a) Early designers wanted to break the coding tasks between teams, and the functionality assigned to each team is called a “layer”
 - (b) Layering is the only way to implement a network stack, because each module can only interact with two other modules
 - (c) Layering allows each protocol to hide some complexity from the higher layers to provide a simpler view of the network, but sometimes layers need to interact with layers they are not adjacent to
 - (d) A “layer” is any protocol that lays headers in front of packets; these headers are needed to tell other network entities what to do with the packet
8. TCP is a “reliable” protocol. That means
- (a) It delivers to the receiver all of the packets that are sent by the sender
 - (b) TCP is not vulnerable to network devices that maliciously alter the contents of the data stream
 - (c) It doesn’t accidentally disconnect often; some implementations automatically reconnect if needed
 - (d) If packets are lost by the lower layers, it will keep retransmitting them until either they get through or the connection is broken
9. The URL `foo://123.45.6.7/abc/def.jpg`
- (a) is not a valid URL
 - (b) is a valid URL telling a browser to contact host 123.45.6.7 with protocol “foo”

- (c) says that there is a JPEG image file called def.jpg in folder abc at host 123.45.6.7
 - (d) tells the browser to contact host 123.45.5.6 and try to access file abc/def.jpg
10. HTTP can use persistent or non-persistent TCP connections.
- (a) A non-persistent connection is a different type of TCP connection that doesn't persist in retransmitting lost packets; these are better for streaming applications
 - (b) A persistent TCP connection is a type of TCP connection that reconnects if the connection is interrupted, such as by closing and reopening a laptop
 - (c) Using persistent connections is always faster than non-persistent connections, because there is less overhead
 - (d) Using non-persistent connections can be faster because they allow more parallelism than persistent connections

Turn Over the Page for Part B

Part B (10 marks).

1. What are three advantages of UDP over TCP? (1 mark)

2. What are three advantages of TCP over UDP? (1 mark)

3. What are the differences between SMTP and HTTP? (2 marks)

4. TCP allows the use of “delayed ACKs”. That halves the number of ACK packets sent by sending an ACK only every second packet (or after a short timeout). What impact will delayed ACKs have on slow start? (2 marks)

5. Suppose Host A sends three TCP segments back to back to Host B over a TCP connection. The sequence numbers of these three segments are 13, 73 and 123, respectively. Host B also sends three segments to Host A with sequence numbers of 20, 60 and 80, respectively.

- (a) How many bytes are there in the data field of the second segment sent by A? (1 mark)
- (b) Suppose that when A’s first segment arrives to B, and B then sends its first segment to A. What are the values of *seq* and *ack* in B’s first segment? (1 mark)
- (c) Suppose that A’s second segment is lost and A’s third segment arrives to B, and B then sends its second segment to A. What are the values of *seq* and *ack* in B’s second segment? (1 mark)
- (d) Upon the arrival of B’s second segment, Host A retransmits its second segment. What are the values of *seq* and *ack* in this retransmission? (1 mark)
