

Student Number _____

THE UNIVERSITY OF MELBOURNE
DEPARTMENT OF COMPUTING AND INFORMATION SYSTEMS

Mid Semester test – Semester 2, 2018

COMP90007 Internet Technologies

Test Duration: 40 minutes
Reading Time: 5 minutes

Total marks in this Test: 20
(Worth 5% of the final mark for the subject)

This exam has 9 pages.

Authorized materials:

The following items are authorized: writing materials (e.g. pens, pencils).
Calculators and all other books are *not* allowed.

Instructions to Invigilators:

Supply students with standard script book.

The test paper must remain in the exam room and be returned to the subject coordinator.

Instructions to Students:

- This paper contains 3 questions. Attempt all questions.
- Write your answers directly on this question paper as instructed by each question.
- Bullet points are acceptable in answering descriptive questions.
- *Any unreadable answers will be considered wrong.*

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Q1 [10 marks] Multiple Choice Questions. Note: only one answer is correct.

Indicate your answer by circling the appropriate choice for each question. [1 mark for each question]

1. When encapsulating data using the OSI model as a reference, the MAC address of the sending and receiving hosts is identified at which layer?

- (a) Layer 7
- (b) Layer 2
- (c) Layer 4
- (d) Layer 3
- (e) All of the above
- (f) None of the above

2. Complete the following sentence: As the data moves down through the layers of the OSI reference model, before passing it down to a lower layer, each OSI layer

_____.

- (a) adds a header and (if applicable) a trailer
- (b) adds a header after stripping the header added by the previous layer
- (c) adds both a header and a trailer
- (d) adds only a header
- (e) All of the above
- (f) None of the above

3. Which of the following options are layer(s) of the TCP/IP model?

- (a) Presentation
- (b) Transport
- (c) Session
- (d) Data link
- (e) All of the above
- (f) None of the above

4. What types of ICMP messages are used by the PING command?

- (a) Whois Request
- (b) Destination unreachable
- (c) Echo request
- (d) Echo reply

(e) Both (c) and (d)

(f) None of the above

5. To capture traffic that is not destined for the local machine, in which mode must the network card must be placed?

(a) Promiscuous

(b) Transparent

(c) Not attached

(d) Managed

(e) All of the above

(f) None of the above

6. Which of the following statements is correct?

(a) A protocol used by a lower layer is decided by the upper layer

(b) Interface is used to provide services by the upper layer to the lower layer

(c) The number and type of primitives are fixed for different services provided by a layer

(d) Layer 4 protocol is used to set up physical connection between the peers in two different hosts

(e) All of the above

(f) None of the above

7. Which of the following statements is correct?

(a) In Physical layer, we use Nyquist's theorem to determine the maximum data rate of a noisy channel

(b) Network layer can provide connectionless service only

(c) MAC-sublayer is normally used to solve transmission problem in point-to-point network links

(d) In the OSI model, the transport layer supports connection-oriented communication only

(e) All of the above

(f) None of the above

8. Comparing wireless and wired/wireline technology, which of the following statements is correct?

(a) Wireless transmission technology supports mobility

(b) Wired/wireline transmission technology can support short to very long distance

- (c) Wired/wireline transmission can be cheap or expensive depending on the technology
- (d) Both wireless and wired/wireline technologies can have full-duplex and half-duplex links
- (e) All the above**
- (f) None of the above

9. In Data Link layer, which of the following statements is correct?

- (a) Framing is used because networks have a maximum size for packet
- (b) In bit stuffing, Start and End flags can be used to indicate the start and end of a frame**
- (c) Physical media may be subject to errors so error correction is the only method to provide reliability to a transmission link
- (d) Hamming distance is the maximum bit flips to turn one valid codeword into any other valid one
- (e) All the above
- (f) None of the above

10. In Network layer, which of the following statements is correct?

- (a) Services provided by a Network layer protocol depend on the router technology
- (b) 20-bit label in Multi-protocol label switching (MPLS) network is used to determine where in the datagram the current fragment belongs to
- (c) Subnetting is used to assign local private IP addresses to hosts
- (d) Network Address Translation (NAT) is a process used to join multiple IP prefixes into a single larger prefix to reduce the size of routing table
- (e) All the above
- (f) None of the above**

Q2 [5 marks] A high-definition (HD) video with resolutions of 1920×1080 (pixels) and 24 bits are used to indicate the colour of each pixel. The refresh frequency is 24 frames/second and the video length is 10 minutes. (Note: $1920 \times 1080 \approx 2,000,000$)

a. Determine the raw size (uncompressed) of the HD video in bytes. [2 marks]

Ans: $(1920 \times 1080 \times 24 \times 24 \times 10 \times 60) / 8 = 89.58$ Gbytes

Or

$$(2,000,000 \times 24 \times 24 \times 10 \times 60) / 8 = 86.4 \text{ Gbytes}$$

b. Assuming that compression technique is used to reduce the size of the above video to 5 Gbytes. This video file is then transmitted over a 10,000 kilometres optical transmission link with a bandwidth of 100 Gbps. Determine the total latency for transmitting the video file. (Assuming speed of the signal = 3×10^8 metres per second). [3 marks]

Ans:

$$\text{T-delay} = 5 \times 8 / 100 = 0.4 \text{ seconds}$$

$$\text{P-delay} = 10,000,000 / (3 \times 10^8) = 0.03333 \text{ seconds}$$

$$\text{Total latency} = 0.43333 \text{ or } 433.33 \text{ ms}$$

Q3 [5 marks] We discussed the implementation of virtual circuit network in the class. Consider the virtual circuit network example shown in the figure below connecting hosts H1 and H3 to H2. The routing tables in the example correspond to circuits established between processes in H1 and H3 to H2. The routing table at different routers is given below:

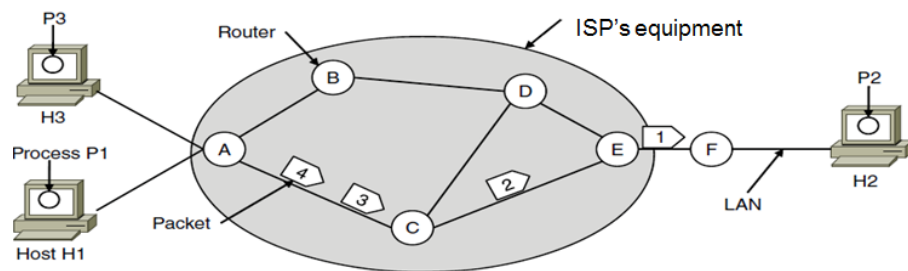


Figure Q3

A's Table

In		Out	
H1	1	C	1
H3	1	C	6
H1	2	B	7
H3	2	B	9

B's table

In		Out	
A	7	D	13
A	9	D	17

C's Table

In		Out	
A	1	E	21
A	6	E	23

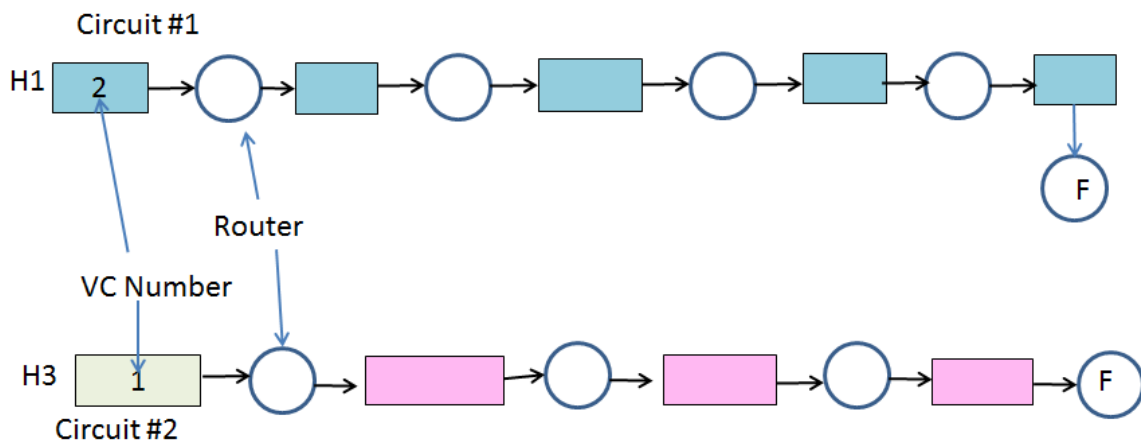
D's table

In		Out	
B	13	E	10
B	17	E	11

E's Table

In		Out	
C	21	F	1
C	23	F	3
D	10	F	4
D	11	F	5

The following figure shows the paths taken by the packets from H1 and H3 via different routers to H2 on two different virtual circuits, where some information about the routers and the VC numbers of the packets is missing.



- a. Now complete the missing routers and VC numbers for the Circuit #1 and Circuit #2 given in the figure. [2 marks]

H1: 2 -> A -> 7 -> B -> 13 -> D -> 10 -> E -> 4 -> F

H3: 1 -> A -> 6 -> C -> 23 -> E -> 3 -> F

- b. What is the total number of different VCs running in Figure Q3? [1 mark]

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- c. What is the main difference between virtual circuit and datagram networks? [2 marks]

In virtual circuits, a connection needs to be established prior to the actual communication (connection-oriented). All of the packets hence take the same path to the destination.

In datagram circuits, there exists no such prior connection. The packets can take whichever path they wish to take, to reach the destination. It is connectionless.

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End of test