Student Number: **PLEASE PUT NO HERE**

THE UNIVERSITY OF MELBOURNE
SCHOOL OF COMPUTING AND INFORMATION SYSTEMS

Sample Mid Semester Test – Semester 1, 2019

COMP90007 Internet Technologies

Test Duration: 40 minutes   Total marks in this Test: ABC
Reading Time: 5 minutes   (Worth IJK% of the mark for the subject)

This exam XYZ number of pages.

Authorized materials:
No materials/items are authorized: writing materials (e.g. pens, pencils) needed. Calculators etc are *not* allowed or needed.

Instructions to Invigilators:
Supply students with standard exam paper, one per student.

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

Instructions to Students:

- This paper contains KLM no of questions. Attempt all questions.
- Write your answers directly on this question paper as instructed by each question.
- Bullet points are acceptable in answering some questions.
- *Any unreadable answers will be considered wrong*.

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Q1 [X marks per sub-question] Multiple Choice Questions:

Indicate your answer by circling the appropriate choice for each question.

1. 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 number of services for all services provided by all layers

(d) Layer 5 OSI model protocol is used to set up physical connection between two different hosts

(e) All of the above

(f) None of the above

2. 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) All OSI layers can provide connectionless service only

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

(d) All OSI layers can provide connection-oriented service only

(e) All of the above

(f) None of the above

3. In Physical layer, which of the following statements is correct?

(a) Multiplexing techniques are used to convert digital bits to analogue electrical signals

(b) Amplitude modulation can be used when multiple sources want to access the transmission medium

(c) Shannon's theorem is used to determine the maximum data rate of a noiseless channel

(d) Transmission delay is the only factor in choosing the appropriate transmission medium

(e) All the above

(f) None of the above

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

(a) Wireless transmission technology supports mobility

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

(c) Wired transmission can be cheap or expensive depending on the technology

(d) Both wireless and wired technologies can have full-duplex and half-duplex links

(e) All the above

(f) None of the above

5. 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 average bit flips to turn one valid codeword into any other valid one

(e) All the above

(f) None of the above

6. Given the following 4 codewords of 6 bits (n=2, k=4),

        000000;

        000111;

        111000;

        111111;

Which of the following answers is correct?

(a) 3 errors can be detected

(b) 3 errors can be corrected

(c) 2 errors can be detected

(d) 2 errors can be corrected

(e) All the above

(f) None of the above

7. In MAC-sublayer, which of the following statements is correct?

(a) MAC-sublayer locates between Data Link and Network layers

(b) Ethernet uses minimum frame size for reliable and efficient detection of collisions

(c) Bit map protocol has lesser overhead than binary countdown protocol

(d) Contention protocols work better than collision free protocols under all traffic loads and types

(e) All the above

(f) None of the above

Q2 [Y marks] A high-definition (HD) video with resolutions of 1920×1080 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: you can assume $1920 \times 1080 \approx 2,000,000$)

a. Determine the raw size (uncompressed) of the HD video in full Gigabytes. [A marks]

Ans: $(2,000,000 \times 24 \times 24 \times 10 \times 60) / 8 = 86$ 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 $= 3 \times 10^8$ metres per second). [B marks]

Ans:

T-delay $= 5 \times 8$ Gbits $/ 100 = 0.4$ seconds

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

Total latency $= 0.43333$ sec

Q3 [Z marks] A communication system transmits a digital signal using 16-level modulation scheme, corresponding to 0, 1, 2, ... ,15 volts. The transmitter has a bandwidth of 3.5kHz. Calculate the bit-rate of the channel.

Ans:

A 16 level modulation scheme encodes log $_2$ 16 = 4 bits/symbol.

Hence the bit-rate of the channel is 4 bits/symbol $\times$ 2 x 3500 = 28,000 bits/s

Q4 [W marks] A stop-and-wait protocol is used on a 100 Mbits/s link. The round-trip propagation time on the link is 300 microseconds. What is the minimum frame size required (in bits) in order to guarantee that the maximum utilization of the link is at least 40%? Assume that transmission is error free, and the length of an acknowledgement frame is negligible.

Ans:

Max Utilisation = L/(L + b Roundtrip)

L/(L + b Roundtrip) > 0.4

L > 0.4L + 0.4b Roundtrip

0.6L > 0.4 b Roundtrip

L > (b Roundtrip $\times$ 0.4) / 0.6 = 100 $\times$ 10^6 $\times$ 300 $\times$ 10^-6 $\times$ 0.4 / 0.6

L > 20 kbits

End of Test