Student Number:

THE UNIVERSITY OF MELBOURNE
Department of Electrical and Electronic Engineering

ELEN90061 Communication Networks

Progress Test 1

2024

Time allowed: 45 minutes
This paper has 11 pages

Authorised materials:

Approved electronic calculators (Casio FX82 and FX100) are permitted.

Only *two sheets of A4 handwritten notes* (both sides) allowed!

This is a closed book test!

Instructions to students:

Please write your answers clearly and legibly in the provided boxes. *Show all your work to receive full credit!* You can use the empty spaces for derivations and explanations.

The marks for each question are indicated in brackets after the question.

The total marks for this test are **40**. It makes up 10% of your final mark in the subject.

Question 1 [15 marks]:

Select whether the following statements are true or false. Explain your answer with a single sentence and/or calculation. (NO credit if NO explanation is provided!)

1.1 If two terminals communicate using a half-duplex link, then only one of the terminals can send messages to the other one. **[2 marks]**

TRUE/FALSE

1.2 According to Metcalfe's Law on the value of a network, large networks are much more valuable than small networks. **[2 marks]**

TRUE/FALSE

1.3 Routing and forwarding are two key functions of the physical layer. **[2 marks]**

TRUE/FALSE

1.4 Compared to circuit switching, packet switching allows more users to use the network. **[2 marks]**

TRUE/FALSE

1.5 Transmission delay depends on the distance between the nodes communicating over a link. **[2 marks]**

TRUE/FALSE

1.6 Compared to a connectionless communication service, connection-oriented service is lightweight, cheap but provides no guarantees. [**2 marks**]

TRUE/FALSE

1.7 Which of the following statements are correct about layers and protocols in each layer. If incorrect, explain which layer the protocol belongs to. **[3 marks]**

a) Ethernet is a data link layer protocol

b) HTTP is a transport layer protocol

c) UDP is a network layer protocol

Question 2 [10 marks]:

2.1 Mention one advantage and one disadvantage of fibre optics over copper wires for communication networks? [**2 marks**]

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2.2 Name four propagation environment effects that impact wireless transmission. [**4 marks**]

2.3 Consider a Code Division Multiple Access scheme used by four stations A, B, C and D. They are assigned the following code sequences.

A = (+1 -1 -1 +1)

B = (+1 -1 +1 -1)

C = (+1 +1 -1 -1)

Assume that stations A, B and C send signals to receivers A', B' and C', respectively.

What is the recovery at station C' when A and B transmit bit 1. You must show all your steps for full marks. [**4 marks**]

Question 3 [10 marks]:

3.1 Calculate the single bit parity for the bit stream 101010111101 using even-parity. How many bit errors can this scheme detect? How many bit errors can this scheme correct? Please explain.

[**3 marks**]

3.2 Find the Cyclic Redundancy Check (CRC) for 10110011 with the divisor 10011. You must show all the steps for full marks. [**5 marks**]

3.3 What is the code rate of the error detection code considered in question 3.2 above.
[2 marks]

Question 4 [5 marks]:

4.1 Comparing slotted ALOHA and pure (unslotted) ALOHA give one advantage and one disadvantage of pure (unslotted) ALOHA? [**2 marks**]

4.2 Four active communication nodes A, B, C, D attempt to transmit to using a CSMS/CD system. Assume that all four stations have constant load to send and are always ready to transmit. If each station transmits during contention slot with probability **p,** find the probability that some station acquires the channel in a slot. [**3 marks**]