

THE HONG KONG POLYTECHNIC UNIVERSITY  
HONG KONG COMMUNITY COLLEGE

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<b>Subject Title</b>	: Computer Networking	<b>Subject Code</b>	: SEHH2238
<b>Session</b>	: Semester Two, 2020/21	<b>Time</b>	: 19:30 – 20:30
<b>Date</b>	: 31 March 2022	<b>Time Allowed</b>	: 1 Hour
<b>Subject Examiner(s)</b>	: Dr Hon-sun CHIU	Dr Candies LAM	Dr Louis LAM

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### Mid-term Test

This question paper has a total of **THREE** pages (including this covering page).

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#### Instructions to Candidates:

1. There are **FOUR** questions in this paper.
  2. Answer **ALL** questions in the answer sheet provided.
  3. Use **1K=1000, 1M=1000K and 1G=1000M**. Correct your answer to **4 decimal places**.
  4. Show your steps clearly. Marks will be deducted for untidy work.
  5. After 1 hour of the test, there is **15-minute** grace period for submission.
  6. Submit your work in **PDF** via Moodle.
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#### Authorised Materials:

	YES	NO
CALCULATOR	<input checked="" type="checkbox"/>	<input type="checkbox"/>
SPECIFICALLY PERMITTED ITEMS	<input type="checkbox"/>	<input checked="" type="checkbox"/>

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**DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO**

### **Question 1 (25%)**

- (a) Suppose a cable has power loss is  $-0.6 \text{ dB/km}$ . If the signal at the end of a  $16 \text{ km}$  cable has a power of  $0.5644 \text{ mW}$ , what is the power of the signal at the beginning? (5 marks)
- (b) Continued from (a), the cable has bandwidth of  $13 \text{ kHz}$  and maximum data rate of  $24 \text{ Kbps}$ . What is the noise at seen at the beginning of the cable? (5 marks)
- (c) Apart from energy loss and noise, explain the third factor that may alter the signal during transmission. (5 marks)
- (d) Consider a data word 'W4' is encoded and transmitted with CRC.
- (i) Suppose the data word is encoded using 7-bit ASCII. Given the 7-bit ASCII table decimal value of '0' and 'A' are 48 and 65 respectively. What is the code word? Show your steps. (2 marks)
- (ii) Calculate the CRC for the code word in (d)(i) using the polynomial  $x^4 + x^2$ . Show your steps. (8 marks)

### **Question 2 (25%)**

Consider a system that uses the Stop-and-Wait ARQ Protocol. There are 1.6 million bits of data to be sent over a distance of  $2000 \text{ km}$ , with other parameters below:

- Data rate:  $1.2 \text{ Mbps}$
- Propagation speed:  $1.3 \times 10^8 \text{ ms}^{-1}$
- Frame size:  $900 \text{ bits}$
- Ignore processing delays, ACK transmission time and the overhead due to the header and trailer.

- (a) Briefly explain the operation of Stop-and-Wait ARQ. (6 marks)
- (b) Calculate the round-trip delay of sending a frame. (5 marks)
- (c) Hence, or otherwise, what is the total time of sending 1.6 million bits of data? (4 marks)
- (d) Suppose there is a data frame lost in every 10 data frames sent. Sender retransmits the lost frame after a timeout of  $130 \text{ ms}$ . How long does it take to send 1.6 million bits of data? (10 marks)

### Question 3 (25%)

There are four stations A, B, C and D in a bus network with the following data packets to be transmitted. The packets and back-off information are given in the table below.

Station	Packet ID	Packet Length	Ready Time (at)	Back-off Time
A	A1	13 minutes	6:00 pm	8 minutes
B	B1	12 minutes	6:03 pm	9 minutes
C	C1	7 minutes	6:12 pm	5 minutes
D	D1	1 minute	6:17 pm	7 minutes

Assume the propagation delay is negligible and the source station can receive the acknowledgement from the destination station immediately after the packet transmission. Further assume that there is no other data in the network.

- (a) Compare the non-persistent and 1-persistent approaches in CSMA protocol. (5 marks)
- (b) By using a timing diagram, with collision(s) indicated by “X”, determine the individual finish time for EACH packet if the following protocols are used.
- (i) The network adopts non-persistent CSMA protocol. (10 marks)
- (ii) The network adopts 1-persistent CSMA protocol. (10 marks)

### Question 4 (25%)

- (a) In a network, one of the hosts has an IP address 10.121.151.11/18. Determine the items below:
- (i) the network mask in both binary and dotted decimal format. (2 marks)
- (ii) the network address in both binary and dotted decimal format. (3 marks)
- (iii) the broadcast address in both binary and dotted decimal format. (3 marks)
- (iv) The range of usable addresses in dotted decimal format ONLY. (2 marks)
- (b) In a digital circuit-switched network, the data rate is 2 Mbps and the propagation speed is  $2 \times 10^8$  m/s. A path is setup by exchanging 500 bits during the setup and teardown phases. Suppose the setup phase is a two-way communication and the teardown phase is a three-way communication, calculate the total delay for transmitting 90000 bits of data over a path of 4000 km long. (15 marks)

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