THE HONG KONG POLYTECHNIC UNIVERSITY
HONG KONG COMMUNITY COLLEGE

Subject Title	: Computer Networking	**Subject Code**	: SEHH2238
Session	: Semester Two, 2020/21	**Time**	: 20:30 – 21:30
Date	: 26 March 2021	**Time Allowed**	: 1 Hour
Subject Examiner(s)	: Dr Hon-sun CHIU Dr Candies LAM		

Mid-term Test

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

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.

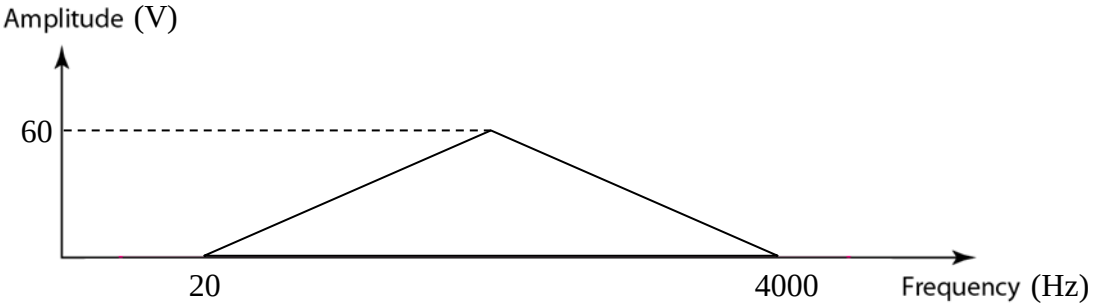
Authorised Materials:

	YES	NO
CALCULATOR	[✓]	[ ]
SPECIFICALLY PERMITTED ITEMS	[ ]	[✓]

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

Question 1 (25%)

Consider an *n*-minute speech is recorded and has the following spectrum, where *n* is the **3rd digit** of your student ID number, set *n*=10 if the 3rd digit is 0. The audio recording is saved as a digital file using PCM with 256 levels.



(a) What is the minimum sampling rate required? What will happen if the rate is not reached? (10 marks)

(b) By using the sampling rate in (a), calculate the size of the digital file produced. (10 marks)

(c) Suppose all 256 levels represent positive amplitude. Quantization is done by rounding to the nearest level. A sample has amplitude 25V. State the bits of this sample. (5 marks)

Question 2 (25%)

Consider that Alice and Bob are 1000 km apart. They are transmitting data using stop-and-wait ARQ protocol, with ACK piggybacked to data packet as a field of the header.

- Data rate: 500 Kbps
- Propagation speed: 2 x 10^8 m/s
- Maximum size of data packet: 1500 bits, including a 24-bit long header
- Size of ACK packet: 24 bits (i.e. header only)

(a) Briefly explain how stop-and-wait ARQ protocol achieves flow control and error control in data transmission. (5 marks)

(b) Calculate the transmission delay and propagation delay of a max-size packet. (5 marks)

(c) Alice starts sending a file to Bob first. After Bob has received the first packet, he also sends a file of same size back to Alice, with ACK piggybacked. Calculate the time for the file exchange to complete.

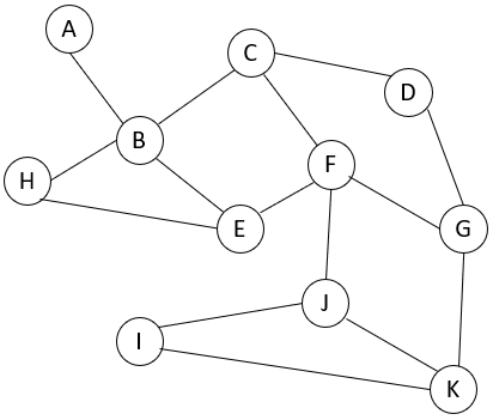
4th digit of your student ID	File size
odd	5000 bits
even	6000 bits

(15 marks)

Question 3 (25%)

In the following network, assume: shortest path, no other data traffic, Stop-and-Wait like operation. Station A is the source station and station K is the destination station.

- For circuit switching, the setup time is 10 seconds.
- For packet switching using datagram service, the packet size is 4 seconds and the nodal processing time is 1 second. There is no waiting time.
- Time for teardown can be ignored.
- All packets follow the same path and the size of the packet header could be ignored.



Use the following parameters in your calculation:

5th digit of your student ID number	Message length	Propagation delay per link
odd	40 s	0.5 s
even	80 s	0.2 s

(a) Find a shortest path from the source to the destination. (5 marks)

(b) What is the end-to-end delay of transmitting the message from station A to station K for circuit switching? (5 marks)

(c) What is the end-to-end delay of transmitting the message from station A to station K for packing switching using datagram service? (15 marks)

Question 4 (25%)

(a) In a block of addresses, we know the IP address of one host is 192.168.172.134/*n*, where $n = (20 + x)$ and x is the **6th digit** of your student ID number. Find the followings:

i. the network mask, in BOTH dotted binary AND dotted decimal notations.
ii. the network address.
iii. the broadcast address.
iv. the number of addresses in the block. (10 marks)

(b) There are three stations A, B and C in a bus network with the following data packets to be transmitted:

Station	Packet ID	Packet Length	Ready time (at)	Backoff Time
A	1	6 minutes	3:00 pm	3 minutes
B	2	7 minutes	3:05 pm	5 minutes
C	3	8 minutes	3:10 pm	8 minutes
A	4	9 minutes	3:15 pm	3 minutes

Assume the propagation delay is negligible and the source station can receive the acknowledgement from the destination station immediately after the packet transmission.

Using non-persistent CSMA protocol, find out at what times will the packets successfully finish their transmissions. You should write down individual finish time for each packet, demonstrating your answer with a timing diagram. (15 marks)

- End of Paper -