

 	<p>Student's full name: .....</p> <p>Students' code: .....</p> <p>Student's class: .....</p>	
<p><b>[NAME OF SUBJECT]</b></p> <p><b>Date: 16 Mar, 2021</b></p> <p><b>Duration: 60 minutes</b></p>	<p><b>MID-TERM EXAMINATION</b></p>	
	<p><b><u>Invigilator 1</u></b></p>	<p><b><u>Invigilator 2</u></b></p>

- Writing test consists of **5 PAGES** (*Answer Sheet included*).
- Students are required to use provided **blue-color** pens to write responses.
- Learning materials, dictionaries and any kinds of electronic devices are **NOT** allowed during the test time.



**Student Full Name:** .....

**HCMUS Student ID:** .....

**Student's class:** .....

**MID-TERM EXAMINATION  
ANSWER SHEET**

Result	Examiners

**Question 1. LINKED LIST**

Consider a singly linked list for managing all students of a class. Each student has the following basic information: student id, student name, mathematics grades, physics grades, chemistry grades.

- a. Declare all necessary data structures to manage all students using a singly linked list.

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- b. Write a function that counts the number of students whose GPA is greater than or equal to 5.0

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- c. Write a function that prints out the names of the students whose GPA are greater than or equal to 5.0 and having no subject's grade less than or equal to 2.0

## Question 2. STACK – QUEUE

Given an in-order expression as below:

$$P = (A-B)*C+((D+E)/F-G*H)^I$$

- a. Convert the above expression to a post-order expression using stack and queue

Notice: Write only the post-order expression result.

- b. Calculate the result of the post-order expression using stack only.

$$A = 10; B = 2; C = 4; D = 5; E = 9; F = 2; G = 5; H = 2; I = 2;$$

Notice: demonstrate step by step the calculating process.

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## Question 3. BINARY SEARCH TREE

Consider a balanced binary search tree AVL.

- a. Draw the AVL tree step by step with the following keys in the exact order:

45, 36, 15, 29, 57, 78, 60, 83, 79, 96, 20, 99


- b. Demonstrate the pre-order traversal (NLR) and post-order traversal (LRN) results of the tree in question 3a.

NLR:

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LRN:

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- c. From the tree in question 3a, delete the following key in the exact order: 78.

Notice: if you delete a two-child node, the replaced node is the minimum node of the subtree to the right.

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- d. Write a function that counts the number of nodes that contain an odd value and have only 1 child node.

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**-The end-**