A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
-

COMP2054 2023-24 ADE Coursework THREE (12.5%)
Mon. 13-MAY-2024

Time: 30 minutes.

Do not turn over page until instructed.
Answer ALL questions for a potential total of 25 marks.

Calculators are not permitted.

Write your answers on these sheets within the spaces provided.

PLEASE TRY TO WRITE CLEARLY

Write your name & ID in the box below CLEARLY AND IN UPPER CASE LETTERS.

<u>Circle the first initial of your family name in the column on the left side of this page</u>

FAMILY NAME:	
FIRST NAME(S):	
Student ID number:	
Signature:	

(Standard policy) If you think something in a question is incorrect, then please just answer the question as it is – but write a short note about anything you think is wrong. The test is distributed over multiple rooms and times and so it is not possible to do corrections "live". If there an error, then this will be taken account of during the marking.

For completion by markers:

Total mark (out of 25):

Q1: Q2: Q3:

Question 1. Hashmaps using linear probing [9 marks]

a) Consider a hash table of size N= 7, with the (very simple) hash function

h(k) = (k+4) mod 7

and using **linear probing.**

Starting from an empty hash table give the results after each stage of the following sequence of 3 insertions.

You can use that: **h(2)=6**, **h(3)=0**, and **h(9)=6**

Show the result after doing insert(2), after starting from an empty table:

Index	0	1	2	3	4	5	6
Entry							

.. and then, insert(3) gives

Index	0	1	2	3	4	5	6
Entry							

.. and then, insert(9) gives

Index	0	1	2	3	4	5	6
Entry							

Note that you do not need to write justifications, just add entries to the tables.

Question 1. (cont)

b) Using the same hash table and function as in Q1a, and again using linear probing a sequence of operations resulted in the following state of the table:

Index	0	1	2	3	4	5	6
Entry	5					8	2

You can use that: **h(8)=5**, **h(2)=6**, and **h(1)=5**

The task is then to do remove(8).

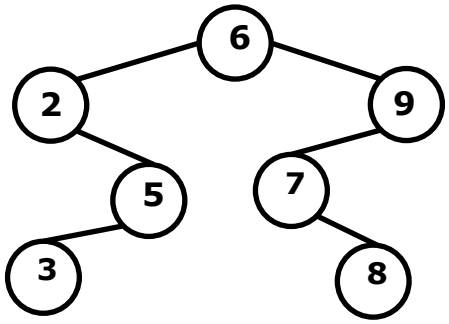
State the problem that will arise if the entry for 8 is simply set to be blank (empty):

Briefly describe ONE scheme for handling removals when using linear probing:

Show the final result of the table after using the scheme you suggested,

Index	0	1	2	3	4	5	6
Entry							

Question 2. Binary Search Trees (BSTs) [9 marks]



Consider the BST above: You are to **delete(6)** (i.e. remove 6 from the set of keys) using the method as given in the lectures.

Show and **briefly explain** the process to delete(6), and give the final BST that results after the deletion:

TURN OVER FOR Q3 !

Question 3. Change giving [7 marks]

Consider a **set of coins {2,5,4} and a target of change of 6.**
Only ONE of each coin in the set is available.
Consider the algorithm of the lectures based on an array A, with meaning:

A[i]=T iff a change of i is possible using the coins considered so far

Complete the following tables to show the state of the array after every iteration. In the arrays, leave the entry as blank to signify "F" for false, and just add the "T" for true – meaning that the sum given by the index (given in the top row) is achievable using the coins so far.

Using the starting array:

0	1	2	3	4	5	6
T						

Complete the array after adding coin '2':

0	1	2	3	4	5	6

Complete the array after also adding coin '5':

0	1	2	3	4	5	6

Complete the array after also adding coin '4':

0	1	2	3	4	5	6

From your final array:

Is it possible to give a change of 6? Yes / No (circle one)

Is it possible to give a change of 3? Yes / No (circle one)