NATIONAL UNIVERSITY OF SINGAPORE

CS2040C – Data Structure and Algorithms Quiz 1

(Semester 2: AY2022/23)

Time Allowed: 30 min

STUDENT NUMBER

A									
U ○	0	0	0	0	0	0	0	A	N
A ●	1	1	1	1	1	1	1	B	R
HT ○	2	2	2	2	2	2	2	E	U
NT ○	3	3	3	3	3	3	3	H	W
	4	4	4	4	4	4	4	J	X
	5	5	5	5	5	5	5	L	Y
	6	6	6	6	6	6	6	M	
	7	7	7	7	7	7	7		
	8	8	8	8	8	8	8		
	9	9	9	9	9	9	9		

INSTRUCTIONS

1. Write your **Student Number** on the right AND, using pen or pencil, shade the corresponding circle **completely** in the grid for each digit or letter. DO NOT WRITE YOUR NAME!
2. Zero mark will be given if you write/shade your Student Number incompletely or incorrectly.
3. All questions must be answered in the space provided; no extra sheets will be accepted as answers.
4. **Marks may be deducted** for (i) illegible handwriting, and/or (ii) excessively long explanations.

Part A: MCQs (6 x 3 marks)

What is the time complexity of the function `f()` in each of the following boxes in terms of n for n > 0? The function “`doOhOne()`” has a time complexity of O(1). Please select E if it’s “None of the given answers”.

		A:O(log n)	B:O(n)	C: O(n log n)	D: O(n^2)	E: None

1	void f(int n) {
	        for (int i = 0; i < n; i++)
	                for (int j = 0; j < n/2; j++)
	                        doOhOne();
	}
		○	○	○	●	○

2	void f(int n) {
	        for (int i = 0; i < n; i++)
	                doOhOne();
	        if (n<1) return;
	            else f(n-1);
	}
		○	○	○	●	○

3	void f(int n) {
	        for (int i = 1; i < 2*n; i*=2)
	                doOhOne();
	}
		●	○	○	○	○

4	void f(int n) {
	        if (n < 10) return;
	        for (int i = 0; i < n; i++)
	                doOhOne();
	        f(n/10);
	        f(9*n/10);
	}
		○	○	●	○	○

5	int f(int n) {
	        if (n < 10) return 0;
	        for (int i = 0; i < n; i++)
	                return f(n-1);
	}
		○	●	○	○	○

6	int f(int n) {
	        if (n < 10) return 0;
	        for (int i = 0; i < n; i++)
	                doOhOne();
	        f(n/2);
	}
		○	●	○	○	○

Part B: True or False (10 x 2 marks)

If it's a coding question, we refer to the C++ languages.

		True	False
6	A C++ class can have more than one constructor.	●	○
7	You do not need to give implementation details when you define an ADT.	●	○
8	A Queue ADT is a first-in-last-out structure.	○	●
9	In C++, inheritance is not compatible with template.	○	●
10	The best time complexity for Selection Sort can be O(n).	○	●
11	The time complexity for MergeSort is Θ (n log n).	●	○
12	For any binary tree, the pre-order traversal is always the reverse of ~~the reverse of~~ post-order traversal.	○	●
13	The in-order traversal of any binary tree is always the sorted order of the items in that tree.	○	●
14	The time complexity for in-order traversal of a binary tree is O(n log n).	○	●
15	The deletion of a node x in a tree with n items can be O(n) because the successor of x can have more child and it will cost another successor search.	○	●

Part C: Which type of sorting algorithm is the following code? (3 marks)

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```
// input: A is an array of
// integers with size n
void sort(int* A, int n) {
  for (int i=0;i<n-1;i++)
     for (int j=i+1;j<n;j++)
         if (A[i]>A[j]){
            int temp=A[i]; A[i]=A[j]; A[j]=temp;
}
```

○ : BubbleSort

● : SelectionSort

○ : InsertionSort

○ : MergeSort

○ : QuickSort

Part D: Fill in the blanks (3 x 3 marks)

Given the same C++ class of Trees in our lecture, fill in the blacks for the following code to complete the function to search for the minimum element in a tree.

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```
template <class T>
T BinarySearchTree<T>::searchMin() {
  TreeNode<T>* current = _root;
  while (current->_left)
    current = current->_left;
  return current->_item;
}
```

For examiners use only				
Questions	1-5	6-15	16	17
Marks				