GRIFFITH COLLEGE DUBLIN

QUALITY AND QUALIFICATIONS IRELAND EXAMINATION

MASTER OF SCIENCE IN BIG DATA MANAGEMENT AND ANALYTICS

CONCURRENT AND PARALLEL PROGRAMMING
Module code: MSCBD-CPP

ONLINE EXAMINATION

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Date: 17th August 2020   **Time: 9.45-12.45**

THIS PAPER CONSISTS OF FOUR QUESTIONS
ALL QUESTIONS TO BE ATTEMPTED
ALL QUESTIONS CARRY EQUAL MARKS

HONOUR CODE

By submitting my exam script via Moodle, I certify that my answers contained in this Examination Script document are entirely composed of my own original work.

During the exam period, which began when I received the exam paper document, I did not work with anyone else on the exam or discuss the examination with anyone else.

I did not copy and hold out as my own any material belonging to or produced by another person.

I understand that failure to adhere to these instructions shall be an Honour Code violation.

Violation of the Honour Code will result in being charged with academic misconduct.

QUESTION 1

(a)   Using Java ForkJoin Framework, write code to solve the following problem, given an array of random integers, it is required to reverse the order of elements into a new array.

(15 marks)

We have provided some of the code for you.

```
import java.util.concurrent.ForkJoinPool;
import java.util.concurrent.RecursiveAction;
public class Main {
static final ForkJoinPool fjPool = new ForkJoinPool();
static int[] reverse(int[] array) {
// ADD A LINE HERE
fjPool.invoke(new Reverse(answer,array,0,array.length)); // DO NOT CHANGE
// ADD A LINE HERE
}
}
// DEFINE A CLASS HERE
```

(b)   Discuss a thread safe coding design consideration when two elements in a 2-Dimensional array need to be swapped, this of the 2-Dimensional array as a matrix. Implement a java code method called swap to be thread safe and deadlock free

(10 marks)

Total (25 marks)

QUESTION 2

(a)   The code of a simple server is shown below. It offers the trivial service of accepting an integer value from a client and returning twice the value received. Explain the weakness in the design of the server and re-write it in light of your critique.

(15 marks)

(b)   Write a Parallel stream program to count all negative integers in an array of integers A[N]

(10 marks)

Total (25 marks)

QUESTION 3

(a)   A developer has a problem whose size can increase with an increasing number of processors. He needs to execute the program and determines that in a parallel execution on 100 processors. 5% of the time is spent in the sequential part of the program. What is the scaled speedup of the program on 100 processors?

(5 marks)

(b)   A platform has space for at most 100 people at any one time. People are only admitted when the platform is open and the number of persons does not exceed the prescribed limit. Using condition variables write a class that could be used to control access to the platform.

(15 marks)

(c)   A resource is shared between N threads such that access to the resource is on a *first-come-first-served* basis. Explain how you would implement a policy of *first-come-first-served*.

(5 marks)

Total (25 marks)

QUESTION 4

(a)   Explain what factors lead to Big data and NoSQL databases.

(8 marks)

(b)   Explain the concurrency in MapReduce and how it works.

(7 marks)

(c)   Explain the difference between thread starvation and race conditions with code sample of both.

(10 marks)

Total (25 marks)