GRIFFITH COLLEGE DUBLIN

QUALITY AND QUALIFICATIONS IRELAND

EXAMINATION

MASTER OF SCIENCE IN COMPUTING

PARALLEL AND DISTRIBUTED PROGRAMMING
Module Code: MSCC-PDP

MASTER OF SCIENCE IN BIG DATA MANAGEMENT AND ANALYTICS

PARALLEL AND DISTRIBUTED PROGRAMMING
Module Code: MSCBD-PDP

POSTGRADUATE DIPLOMA IN SCIENCE IN BIG DATA MANAGEMENT AND ANALYTICS

PARALLEL AND DISTRIBUTED PROGRAMMING
Module Code: PGDBD-PDP

POSTGRADUATE DIPLOMA IN SCIENCE IN COMPUTING

PARALLEL AND DISTRIBUTED PROGRAMMING
Module Code: PGDC-PDP

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External Examiner(s): **Dr Omar Portillo /**
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Date: 8th January 2025 **Time: 2.15-5.15pm**

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

QUESTION 1

(a) For each of the following thread state transitions, say whether the transition is legal and how the transition occurs or why it cannot.

(i) Change from thread state BLOCKED to thread state RUNNING

(ii) Change from thread state RUNNING to thread state BLOCKED

(iii) Change from thread state RUNNABLE to thread state BLOCKED

(9 marks)

(b) Explain two reasons why lightweight processes (Threads) are better than heavyweight Ones (Processes).

(9 marks)

(c) Implement a lock free structure thread safe counter.

(7 marks)

Total (25 marks)

QUESTION 2

(a) Three processes share four resource units that can be reserved and released only one at a time. Each process needs a maximum of two units. Show that a deadlock cannot occur.

(10 marks)

(b) Write a java class that implement a semaphore **release** and **acquire** methods using ReentrantLock with a condition?

(15 marks)

Total (25 marks)

QUESTION 3

(a) Write Implement a Java class using **Callable objects** to count number of zeros in an Integer array of size 10,000,000, write only the main class

(15 marks)

(b) What are the key characteristics of fair locks? list four

(10 marks)

Total (25 marks)

QUESTION 4

(a) Using 4 computer machines with each computer having 8 core CPU, write a hybrid **OpenMP/MPI C program** to find the integral of $\int_0^1 \frac{dx}{1+\sin(x)}$ from x=1 to x=2 , with 10000 segments between x=1 and x=2, how would you compile and run the Code

(15 marks)

(b) Explain what is the difference between Sections and Tasks in OpenMP

(10 marks)

Total (25 marks)

QUESTION 5

(a) Explain the meaning of mutual exclusion.

(5 marks)

(b) Discuss different scheduling options in OpenMP. Explain how each one works and identify a situation where each performs well.

(20 marks)

Total (25 marks)