ATHLONE INSTITUTE OF TECHNOLOGY

SCHOOL OF ENGINEERING

SEMESTER 1 EXAMINATIONS 2014

December Session

BACHELOR OF SCIENCE IN SOFTWARE DESIGN (WEB/GAME DEVELOPMENT)

YEAR 3

OPERATING SYSTEMS & CONCURRENCY

External Examiner(s):   Dr Chris Exton
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Internal Examiner(s):   Dr Sheila Fallon

Instructions to candidates:
Read all questions carefully.
All questions carry equal marks.
Answer **Three** out of **Four** questions.

Time Allowed: 2 Hrs

No. of pages including cover sheet: 3

Q.1. (a) Explain the Fetch-Execute cycle. Your answer should include explanations of the following terms: PC and CIR

(6 marks)

(b) In Process Management what is a context switch? Explain how an Operating System can implement a context switch. Your answer should include a description of the run and blocked queues.

(7 marks)

(c) "It is advantageous to give I/O bound processes a higher priority than CPU bound processes, as they use the CPU for short periods of time". Explain how Dynamic Priority Scheduling can achieve this.

(7 marks)

[20 marks]

Q.2.
(a) Briefly describe the difference between a process and a thread. Explain **three** reasons why developers use threads and concurrency.

(6 marks)

(b) Using short sections of java code compare and contrast the **two** ways of creating and starting threads in Java. Briefly explain why a programmer may choose one way of creating threads over the other.

(7 marks)

(c) State and explain Amdahl's law. Using Amdahl's law, calculate the max speedup with ten processors, for a program with 10% serialization. Would it be efficient to use 100 processors for this program? Explain your answer.

(7 marks)

[20 marks]

Q.3
(a) Briefly explain the terms Critical Section and Mutual Exclusion. The monitor is a key mechanism in Java for ensuring mutual exclusion. Explain how it works

(5 marks)

(b) Explain the Producer Consumer design pattern. Describe **four** benefits of this design pattern

(5 marks)

(c)   Using short sections of java code illustrate
        (i) how a producer thread creates items and inserts them into an instance of java.util.concurrent.BlockingQueue.
        (ii) how a consumer thread removes items from the BlockingQueue
        (iii) a main() method that creates and starts a producer thread **and** a consumer thread.

(10 marks)

[20 marks]

Q.4.   (a)   Explain the function of a Cache Coherence algorithm. Describe the MESI protocol explaining the four states of data

(8 marks)

(b)   What are the advantages and disadvantages of the following implementations of a Web Server?

        (i)   Singly Threaded Web Server
        (ii)   Multi-Threaded Web Server with thread for every request.
        (ii)   Thread Pool based Web Server

(6 marks)

(c)   Explain how the java.util.concurrent separates task submission and task execution. In particular what are the relevances of the interfaces Executor and ExecutorService?

(6 marks)

[20 marks]