LIMERICK INSTITUTE OF TECHNOLOGY

SUMMER EXAMINATIONS 2018/2019

MODULE: COMP08064-Concurrent & Distributed Systems

PROGRAMME(S):
  LC_KGDVM_KTH   Bachelor of Science (Honours) Games Design and Development

YEAR OF STUDY: 4

EXAMINER(S):

Eugene Kenny	(Internal)
Mr. Damien Costello	(External)

TIME ALLOWED: **2 HOURS**

INSTRUCTIONS: **Answer 4 questions. All questions carry equal marks.**

PLEASE DO NOT TURN OVER THIS PAGE UNTIL YOU ARE INSTRUCTED TO DO SO.
The use of programmable or text storing calculators is expressly forbidden.
Please note that where a candidate answers more than the required number of questions, the examiner will mark all questions attempted and then select the highest scoring ones.

Requirements for this paper:
1. Calculators

QUESTION 1 **[25 Marks]**

(a) What are atomic actions in the context of concurrent programs? **[10 marks]** Distinguish between *fine-grained* and *course-grained* atomic actions.

(b) What type of actions are atomic and what problems arise when we **[15 marks]** rely on them to achieve mutual exclusion?

QUESTION 2 **[25 Marks]**

(a) What are *semaphores* and show how they can be used to implement **[10 marks]** critical sections.

(b) Describe the *Dining Philosophers* problem. Using semaphores, **[15 marks]** implement a solution to the Dining Philosophers problem.

QUESTION 3 **[25 Marks]**

(a) What are *monitors* and what are the benefits of using monitors rather **[10 marks]** than semaphores for solving mutual exclusion and condition synchronization problems.

(b) Outline a monitor based solution to the single producer – single **[15 marks]** consumer problem using a bounded buffer.

QUESTION 4 **[25 Marks]**

(a) Discuss the goals of a distributed system. **[15 marks]**

(b) Virtualization is becoming increasingly important. Explain why this is **[10 marks]** the case and outline how it is supported by servers.

QUESTION 5 **[25 Marks]**

(a) Outline how a Remote Procedure Call (RPC) operates. **[15 marks]**

(b) Describe how Lamport's logical clocks work. **[10 marks]**