

**DUBLIN INSTITUTE OF TECHNOLOGY  
KEVIN STREET, DUBLIN 8.**

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# **BSc Computer Science (HIT)**

**Year 4**

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**WINTER EXAMINATIONS 2008/2009**

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**DISTRIBUTED SYSTEMS**

**MR. C. O'LEARY**

**2 HOURS**

**ATTEMPT 3 QUESTIONS**

**ALL QUESTIONS CARRY EQUAL MARKS**

1. (a) Clearly define the term *distributed system*. **(8 marks)**
- (b) Identify and describe all the states that it is possible for a thread in a Java program to occupy. Clearly show, using sample code and examples where necessary, how a thread enters and exits each of the states. **(10 marks)**
- (c) Provide the code for the following Java program:
- The program takes an unlimited number of integer values as command line arguments.
  - For each command line argument, it starts a thread, which calculates the factorial of the number (the product of the number and all numbers less than it and greater than 0).
  - The main thread waits until all worker threads have finished their calculation, and then prints out the result.
- Note: The main thread must go into a waiting state. **(15 marks)**
2. (a) Discuss the role of XML in distributed systems, identifying clearly the importance of well-formedness and validity for communicating processes. **(8 marks)**
- (b) Using an example of your choice, demonstrate the important differences between XML schema and DTD. You must provide a DTD and a Schema for the same XML language as part of your answer. **(10 marks)**
- (c) Provide the code for the following Java program:
- The program takes an XML document as an argument.
  - The program parses the XML document and prints out the number of elements in the document.
- (15 marks)**
3. (a) Describe, using examples, what is meant by *serialisation* and *externalisation* in Java applications. **(8 marks)**
- (b) Demonstrate, using examples, the difference between passing primitive types, objects and remote objects as arguments in distributed object systems. **(10 marks)**

- (c) Provide the code for the following Java game:
- Players have a client application which they use to guess a number between 1 and 100, chosen randomly by the server.
  - Any number of clients can participate in the game.
  - When a player makes a guess, the guess is sent to the server and the server returns true if the guess is correct or false if the guess is incorrect.
  - If the correct number is guessed, the server informs all clients that the game is over.
- (15 marks)**

4. (a) Describe the important differences between TCP, UDP and Multicast IP as transport layer protocols.
- (8 marks)**
- (b) A coordination protocol is required such that a set of processes can establish which has the highest priority, where the highest priority process is elected as the coordinator. Describe such a protocol, and comment on its ability to tolerate failure and dynamic priority, such as a priority based on load.
- (10 marks)**
- (c) Provide the code for your application from part (b) above.
- (15 marks)**