S228/101

**DUBLIN INSTITUTE OF TECHNOLOGY**

**KEVIN STREET DUBLIN 8**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

#### BSc. (Honours) Degree in Computer Science

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**Year 1**

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## SEMESTER 2 EXAMINATIONS 2012

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##### ALGORITHM DESIGN & PROBLEM SOLVING

A. Curley

Dr. D. Lillis

Duration: 2 hours

Wednesday-23-May

9.30 - 11.30

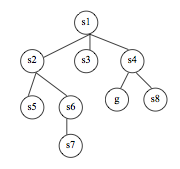
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Answer question (1) and ***any two*** of questions (2), (3), (4)

Question (1) is worth **40** marks.

Questions (2), (3), (4) are worth **30** marks each

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| **1.** | **(a)** | Write an algorithm, in pseudo code, to decide whether a number is prime or not.  (8 marks) | | (5 marks) |
|  | **(b)** | **(i)**    **(ii)** | Describe briefly how the bubble sort algorithm works.  (6 marks)  Illustrate how the bubble sort algorithm works on the list: [3, 1, 4, 7, 5, 9, 6, 2]  (6 marks) | |
|  | **(c)** | In the following state space graph, show how both depth-first and breadth-first search traverse it to get from state s1 to the goal state g. Also, show the contents of the stack and queue data structures involved.  (6 marks) | |

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| **(d)** | | The following algorithm calculates the *factorial* of a number.  Factorial (n)  if n=1 or n=0  return 1  else  return n\*Factorial(n-1) | | |
|  | **(i)**    **(ii)** | | Discuss how this algorithm maps to Scratch, C and Haskell.  (9 marks)  Write an **iterative** version of this algorithm in pseudo code.  (5 marks) |

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| **2.** | **(a)**  **(b)**  **(c)**  **(d)** | The pseudo code below shows a solution to the *Tower of Hanoi* problem. What type of approach does the Tower of Hanoi solution use? Describe this approach using examples.  (9 marks)  moveTower (disks, source, dest, spare)  if disk = 0  Move disk from source to dest  else  moveTower (disk-1, source, spare, dest)  move disk from source to dest  moveTower (disk-1, source, spare, dest)  What are the problems or issues with this algorithm?  (5 marks)  In pseudo code, rewrite the Tower of Hanoi algorithm to correct the problems or issues discussed in 2(b).  (8 marks)  Draw a flow chart of the corrected algorithm given in 2(c).  (8 marks) | | (5 marks) |
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| **3.** | **(a)**  **(b)**  **(c)**  **(d)** | Write an algorithm, in pseudo code, to describe the *merge sort* process.  (10 marks)  Discuss the suitability of the use of **recursion** for this algorithm.  (6 marks)  Illustrate how the following list of numbers are sorted using the merge sort algorithm – [5,4,8,6,2,1,7,3].  (8 marks)  Discuss the merge sort algorithms with regards to the worst-case scenario. Give a rough outline of how this is arrived at.  (6 marks) | (5 marks) |

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| **4.** | **(a)**  **(b)**  **(c)**  **(d)** | Write an algorithm, in pseudo code, which finds the *minimum number* in a list.  (10 marks)  What is a linear search and when should it be used?  (6 marks)  What is the worst case scenario for a linear search algorithm? Give a rough outline how this is arrived at.  (4 marks)  Draw a flow chart describing a binary search algorithm.  (10 marks) | (5 marks) |