OLLSCOIL NA hÉIREANN, CORCAIGH
THE NATIONAL UNIVERSITY OF IRELAND, CORK

COLAISTE NA hOLLSCOILE, CORCAIGH
UNIVERSITY COLLEGE, CORK

SUMMER EXAMINATION SESSION 2014

BSC COMPUTER SCIENCE

CS 4402 – PARALLEL AND GRID COMPUTING

Prof IAN GENT
Prof BARRY O'SULLIVAN
Dr SABIN TABIRCA

DURATION OF PAPER – 1.5 HOURS

ANSWER ALL QUESTIONS

PLEASE DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO
THEN ENSURE THAT YOU HAVE THE CORRECT EXAM PAPER

Question 1. Parallel Computing Models

(a) Explain briefly the following terms: Shared Memory Machine, Distributed Memory Machine, SPMD and Load Balancing. **(10 marks)**

(b) State the Gustafson law and provide a proof for it. **(10 marks)**

(c) Give and explain briefly four consequences of this law. **(10 marks)**

Question 2. MPI Programming and Parallel Algorithms

(a) Explain briefly and give the full prototype for the following MPI functions: MPI_Bcast(), MPI_Gather(), MPI_Gatherv(), MPI_Comm_size(). **(10 marks)**

(b) Give an explanation of how the parallel bucket sort works and write an MPI function for it. The prototype of this function may be:

*int MPI_Sort(int n, int *a, int root, MPI_Comm comm)*

(20 marks)

(c) Evaluate the speedup of the *MPI_Sort* function assuming that all buckets are similarly sized. For simplicity consider that the complexity of the sequential sort is quadratic and $T_{startup}=0$. **(10 marks)**

(d) Provide and briefly discuss two negative and two positive facts about the *MPI_Sort* function. **(10 marks)**