Imperial College London - Department of Computing

Module 429 PARALLEL ALGORITHMS
"Classified Assignment" (Assessed CBC)

Issued: 7 November 2013 **Due:** 28 November 2013

For Your Eyes Only

Dear Mr/Ms Bond and team,

We need your help. Our agents recently discovered a top secret computer system in an underground bunker in the rogue nation of Nukehavistan. Our agents took some photographs, and these are shown overleaf. They also reported that one of the cabinet doors opens to reveal a slot into which a pluggable circuit board may be inserted. While the precise purpose of the computer is unknown, it is believed to perform some kind of intensive computation using the circuit board, the result of which is shown on the CRT display.

Unfortunately the computer was too large for our agents to extract but they did manage to retrieve the circuit board that was in the machine, as shown in the lower left of the photograph overleaf. An analysis of the board has revealed two input pins labelled X (Re) and Y (Im), and one output pin labelled L(X,Y). Fortunately our cybersecurity team has recreated the board in software for you (by reverse engineering the circuitry) and has supplied you with the corresponding object code (in `mystery.o`); the necessary function prototype is:

```
std::complex<double> L(double X, double Y);
```

Your mission, should you choose to accept it, is to:

- Establish the general purpose of this machine, speculate on the symbols, writing and display on the machine, and investigate the specific purpose of the circuit board.
- Using the results of your research, implement in C++ what you believe to be the most likely serial software implementation of the machine.
- Parallelise your implementation using MPI, and, optionally, OpenMP.
- Compute the speedup and efficiency of your parallel implementation(s) when running on up to 16 lab machines (use `matrix01` through `matrix23`).
- Write a report addressed to the Director of Secret Services summarising your findings using diagrams, graphs, tables and figures as appropriate.

With best wishes,
Sir Robert Hinchcliffe-Smythers-Smythe the 3rd (Director of Secret Services)

P.S. Dialling the number given on the machine for technical enquiries has to date only resulted in a very large premium-rate phone bill and is not to be advised.

Submission and Marking

- You may execute your assignment in groups of up to 4 students. Please submit a tar file of your code called `mystery.tar` electronically via CATE, and a hard-copy of your report (with CATE coversheet) to the Student Administration Office.
- Your solutions will be marked according to the correctness and style of the program submitted, as well as the results and interpretation presented in your written report.

Classified Photographs of Computer System and Circuit Board