ENCE463 Project 2 2013

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Project 2 is a team project. Each student is assigned to a team of 4. See Learn for the team you are in. The project is worth 35% and is due **October 11th, 5 p.m.**

Background

Your team works for a small R&D company that has been sub-contracted by Systec Dynamics who have the major contract to build a time machine. This machine is based on the prototype designed by Abe and Aaron and featured in the documentary "Primer". The time machine is based on Kurt Godel's time loop solutions of General Relativity. Access to the temporal field is achieved by confining neutralinos to a 2D plane, similar to the technique used in the Alcubierre Warp drive.

The time machine requires a bank of continuous 2D spatial auto-correlators. Systec have decided to implement the auto-correlators using Nvidia GPUs but require some performance analysis.

The Project

Part 1: Systec require the design and analysis of a 2D auto-correlator running on an Nvidea GPU. Your team will implement the algorithm; you may use any code or libraries that you find, but you will require an understanding of how the code works. You will develop a performance measure for the algorithm and determine its scalability and any limits to its operation. Your programming and testing is to be carried out using the CUDA framework and running under Linux.

Part 2: You will model-check the algorithm using the Labelled Transition System Analyser (LTSA). Distributed and concurrent processing has many pitfalls to be aware of, thus in addition to incorporating good concurrent programming practice in your algorithm development, you are required to create a Finite State Process (FSP) model of your algorithm. This model must prove that the algorithm will not run into problems such as deadlock, livelock, or race conditions which could expose users of the machine to unexpected temporal or spatial displacement, duplication, or annihilation. The model will be checked using LTSA.

The Method

You will be divided into teams of four. You may divide the work up in any way you choose, but each team member must have an overall understanding of the project. The team will carry out the programming, testing, and model checking, and then write a combined report describing what you did, why you did it, and showing performance data for your performance measure. Finally each team member will submit a short one-page report (see below).

Sources of information:

***CUDA*:**

A good place to start is: **`http://www.nvidia.com/object/cuda_home_new.html`**

***LTSA*:**

Magee, J. and Kramer, J. *Concurrency: State Models and Java Programs*. 2nd Edition, Wiley, 2006. [The book will be available for 3-hr loan in the PSE Library during Term 4]

Information is also freely available from : **`http://www.doc.ic.ac.uk/ltsa/`**

Marking Scheme

Group report is marked out of 15 (one member of each team is to submit the report)
GPU code is marked out of 10
LTSA modeling is marked out of 10

Each student will submit a one-page report answering the following:

> Consider that the customer is paying a bonus of $1000 to be distributed among your group for the group's work on Project 2. Indicate how you personally think that bonus should be distributed between the members of your group, taking into consideration the contribution each person has made. Briefly explain your reasoning.

Once a group mark has been determined, the allocations of the "bonus" submitted will be used to determine how to alter the mark awarded to each individual in the group, with the individual mark awarded being limited to the range: 0.8 x group mark to 1.2 x group mark.

Project Submission

Project submission will be via subversion for the GPU and FSP code, and via Learn for both the group and individual reports. The code version in the SVN repository at the deadline time is the version that will be assessed. Reports must be submitted in PDF format.

It is possible that this project specification will be altered. Make sure that you are working from the latest version.