TECHNOLOGICAL UNIVERSITY DUBLIN

# Sharks and Fishes Problem in a Parallel Computing Environment Proposal

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# *Abstract*

School of Computing
Department of Informatics and Engineering

Bachelor of Science in Computer Information

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The project proposal describes; Simulating the Sharks and Fishes problem; in a Parallel Computing Environment. The proposal will explain the methods and the technologies we intend to use to carry out this task. This proposal will include the aim and objectives, scope, and a Gantt chart...

# Contents

# Chapter 1

# Introduction

The goal of this project is to create a model using the 'Cellular Automation' framework that will simulate the 'Sharks and Fishes' problem. We will be using several tools to carry out this project, such as: Pthreads, the C programming language, and Java programming language.

## 1.1 Sharks and Fish problem

The 'Sharks and Fishes' problem; is an example of a Cellular Automata, utilizing the 'Predator-Prey Model; which is based on the work of Bill Madden, Nancy Ricca, and Jonathan Rizzo, whilst at Montclair State University. This is achieved by placing each cell in a state. Each cell is then affected by their neighboring cells, according to the rules that have been set by the developer, meaning either a cell can either: breed a fish/shark, that fish/shark could die, or the fish/shark already living within the cell could age up. Each cell is affected simultaneously in a generation corresponding with the rules; set by the developer. These rules are then repeated over several generations, changing the states of cells each generation.

## 1.2 C Programming

C is a general-purpose programming language developed for operating systems such as Unix. C was first developed in the early 1970s by Ken Thompson and Dennis Ritchie at bell labs[2].

C programming is a compiled language that is extremely popular and widely used in the world.

C is a basic language to write everything from the operating systems such as 'Windows' and many more complex programs [1]. It is a powerful language and can be used for a multitude of applications.

## 1.3 Parallel Computing

Parallel computing is when a program is broken up into separate sections each section is then broken up into several instructions. In parallel computing, multiple of the section's instructions can be executed at the same time on multiple processors [3].

The primary goal of parallel computing is to increase the available computation power so that the application processing and problem-solving is faster [4].

## 1.4 Serial Computing

Serial computing is when a computer program is broken up into several different instructions. These instructions are then processed and executed one at a time, by a single processor, 'singular fashion' [3] until all the instructions have been executed.

Serial programming is much slower and less cost-effective than parallel programming. Therefore serial programs can not reasonably compete with parallel programs for solving large and complex problems [3].

# Chapter 2

# Aims and Objectives

## 2.1 Aims

• Show the differences between using serial program and the parallel program.

• Show parallel computing can speed up intensive calculations.

• Show that executing multiply computations at the same is faster than executing one at a time.

## 2.2 Objectives

• Write a serial C program to mimic the changing population of the sharks and fishes.

• Write a parallel C program to mimic the changing population of the sharks and fishes.

• Create a visualisation for serial and parallel c programming.

• Test all programs to make sure there are no bugs, and they are operating correctly.

• Make predictions about the change of populations using the results from the programs.

• Compare the difference between the computational performance of the serial program and the parallel program.

# Chapter 3

# Scope

## 3.1 Research Questions

1. How efficient is parallel computing compared to serial computing?

2. Why is parallel computing more efficient?

## 3.2 Tasks to Determine Success

The finished C programs should be able to simulate the 'Sharks and Fishes' problem. The difference between serial computing and parallel computing should be outlined. The visualisation tool should demonstrate the Sharks and Fishes problem.

# Chapter 4

# Methodology

## 4.1 C Programming

We plan to use the C programming language, on a 64-bit version of a Linux (Mageia) virtual machine, to write both: the serial (single processor) program, and on the parallel program with Pthreads (POSIX Threads).

## 4.2 POSIX Threads

POSIX Threads are commonly abbreviated as 'Pthreads'. We will use Pthreads to assist with the implementation of the parallel programs. Pthreads is an implementation and execution model that exists independently from a language, as well as a parallel execution model.

## 4.3 Java

We also plan to use the Java programming language to write a program to visualise the results of the evolution of sharks and fishes across the geographical area of study; over several generations.

# Chapter 5

# Conclusions

We are ready to start this project however, there are some parts we may still have to change; the next stage of this project is to start writing pseudo-code for the serial program. The project is scheduled to be delivered on the 14th of December.

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# Appendix A

# Project Gantt Chart