



# **School of Computing final year project**

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**PJE40**

## **Project Initiation Document**

### **Parallel Barnes-Hut Simulation**

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##### **1. Basic details**

Student name:

Draft project title:	Parallel Barnes-Hut Simulation
Course:	BSc (Hons) Computing
Client organisation:	
Client contact name:	
Project supervisor:	Dr. Jiacheng Tan

## Project outline, aims and objectives.

The aim of the project is to parallelize the Barnes-Hut galaxy simulation.

## Deliverables

The project will have the following deliverables; requirements, design, test strategy, testing results, program code, and report.

The requirements documentation will state the changes to be made in order to parallelize the code. The requirements are likely to change throughout the project so I expect this will be updated multiple times.

The initial design of how the program should work; the different classes and functions involved. This is also likely to change during the programming stage.

There will be a test plan detailing all the tests that need to be carried out and the expected result of each test; this can be compared with documentation demonstrating the result of each test, confirming whether the tests results were as expected or if issues were found and whether they were resolved or not.

The code will be documented, explaining how different functions contribute to a speedup.

## Constraints

The main projects constraints are time and my own ability.

Another constraint is my own ability; if I struggle with any part of the project I am likely to fall behind schedule and this could have a sizeable impact on the final deliverables.

## Approach

The first stage of approaching this project is deciding upon the hardware and software to be used. It has already been decided that the hardware will be university computers, in order to get a fair comparison when benchmarking over multiple machines. The decision on the software I use will be made after the research stage.

During the programming stage I will need to decide on the different approaches to parallelizing the code. Approaches which offer an improved speedup may be more difficult to implement, and therefore not time effective to attempt.

## **Facilities and resources**

I will use java for coding, I have previous experience with java but not related to parallelization so will need to learn some new programming techniques in order to complete the project.

There should be an abundance of resources online, so as long as I understand them I should be able to overcome most problems.

## **Risks**

One risk is bugs in my programming, bugs will lead to slowdowns depending on the difficulty to solve them. Vigorous testing should identify and resolve most bugs.

Running out of time is another risk; I should know in advance if this is likely to happen and can make the necessary adjustments to compensate. Some adjustments that could be made include cutting back the project to its minimum requirements, which should give me the time needed to complete the project but will result in a reduced speedup, so should be avoided if possible.

## **Starting point for research**

The first thing to look at is existing technology and projects carried out by other people. This is to get an idea of what direction my project could take.

Once I get to the programming part of the project, I will need to research solutions to any parts I get stuck on.

## **Tasks**

### **Research**

- Look into existing approaches
- Decide upon frameworks to be used

### **Hardware**

- Same computers used for benchmarking throughout, or results unreliable

### **Programming**

- Start coding different functions

### **Testing**

- Testing should be carried out throughout the programming stage to identify bugs and performance improvements/losses as soon as possible.

### **Documentation**

- I will document the development process for use in my report.

### **Report**

- The final submission will be worked on throughout the project, updated regularly as tasks are completed and an evaluation will be written at the end.

## **Legal, ethical, professional, social issues**

No legal issues should arise during the project; I shouldn't be breaking any laws during this project. For professional issues there should not be breaking any code of conducts. There are no ethical or social issues.

## **Project plan**

Start by modifying the sequential code so it can be benchmarked, this will be achieved by adding a timer. As parallel code is developed record times to determine what approaches offer the best speedup. Once sequential and parallelized code benchmarked use MPJ framework to run code over multiple machines, then as before benchmark and analyse time improvements.