COURSEWORK ASSESSMENT SPECIFICATION

Module Title:	Program design and development
Module Number:	KF5008
Module Tutor Name(s):	Ossama Alshabrawy
Academic Year:	2020-2021– Semester One
% Weighting (to overall module):	60%
Coursework Title:	Assignment A – Code
Average Study Time Required by Student:	

Dates and Mechanisms for Assessment Submission and Feedback

Date of Handout to Students: 23th October 2019
Mechanism for Handout to Students: eLP
Date and Time of Submission by Student: 21 st December 2019 1:30 PM (lunch time)
Mechanism for Submission of Work by Student: Electronic submission via Blackboard/Demonstration in workshop class.
Date by which Work, Feedback and Marks will be returned to Students: Feb 3rd 2018 (20 working days)   Date by which corrections/queries should be sent back Feb 14th : 13:30
Mechanism for return of assignment work, feedback and marks to students: feedback and marks on ELP.

Learning Outcomes tested in this assessment (from the Module Descriptor):

Knowledge & Understanding:

- Understanding of Algorithms & Data structures
- Use of development tools to measure code performance.

Intellectual / Professional skills & abilities:

- Decompose simple designs into a series of steps executable by a machine

Personal Values Attributes (Global / Cultural awareness, Ethics, Curiosity) (PVA):

- To be able to look critically at technology and how it effects wider society.

Assessment Criteria/Mark Scheme: After the assessment.
Nature of the submission required:

All the work for this assessment should be produced as a single PDF document. This document will be submitted to turn-it-in. IT should identify student by name and ID. Supporting code should be attached. All files should be submitted in a zip file with the students name. Only .zip files will be accepted.

Instructions to students:
This is an individual piece of work and you must not work with others to construct your work. During the semester there are numerous opportunities to seek and get advice and support on your work, from tutors and peers but you must ensure you do not do work for others or copy work from others.

Academic Conduct:
You must adhere to the university regulations on academic conduct. Formal inquiry proceedings will be instigated if there is any suspicion of misconduct or plagiarism in your work. Refer to the University's regulations on assessment if you are unclear as to the meaning of these terms. The latest copy is available on the university website.

If you need an extension:
Contact ask4Help. Tutors and Module tutors cannot change deadlines.

Disabled students
Contact the module tutor about reasonable adjustments. For example dyslexic students might submit question 1 as a power point with an audio recording of material.

Errors
If any errors are found in this document, changes will be posted to the eLP (blackboard). Versions will be clearly stated. All versions will be accepted.

Assignment Brief

Introduction

You have been hired to work for a company called NetHoc, which has been developing a program that simulates what is known as **ad hoc information transmission**. That is information transmission without a central network. Here mobile phones relay messages from one machine to another. Communications happen from phone to phone. If two people want to speak, they need to have enough people with enough range. For example, if A wants to talk to B. if they are within range, they can do so directly. If they are not, A looks for all the people in range (C). C then look for all the people who are in range of them. If that includes B, then the connection is established. If not, the process is repeated until either a connection is established through several relays or no connection is established. Even if there is no direct connection information can still be transmitted because a message can be passed on the phone. Strictly speaking, this information isn't vital for you to understand what you need to do.
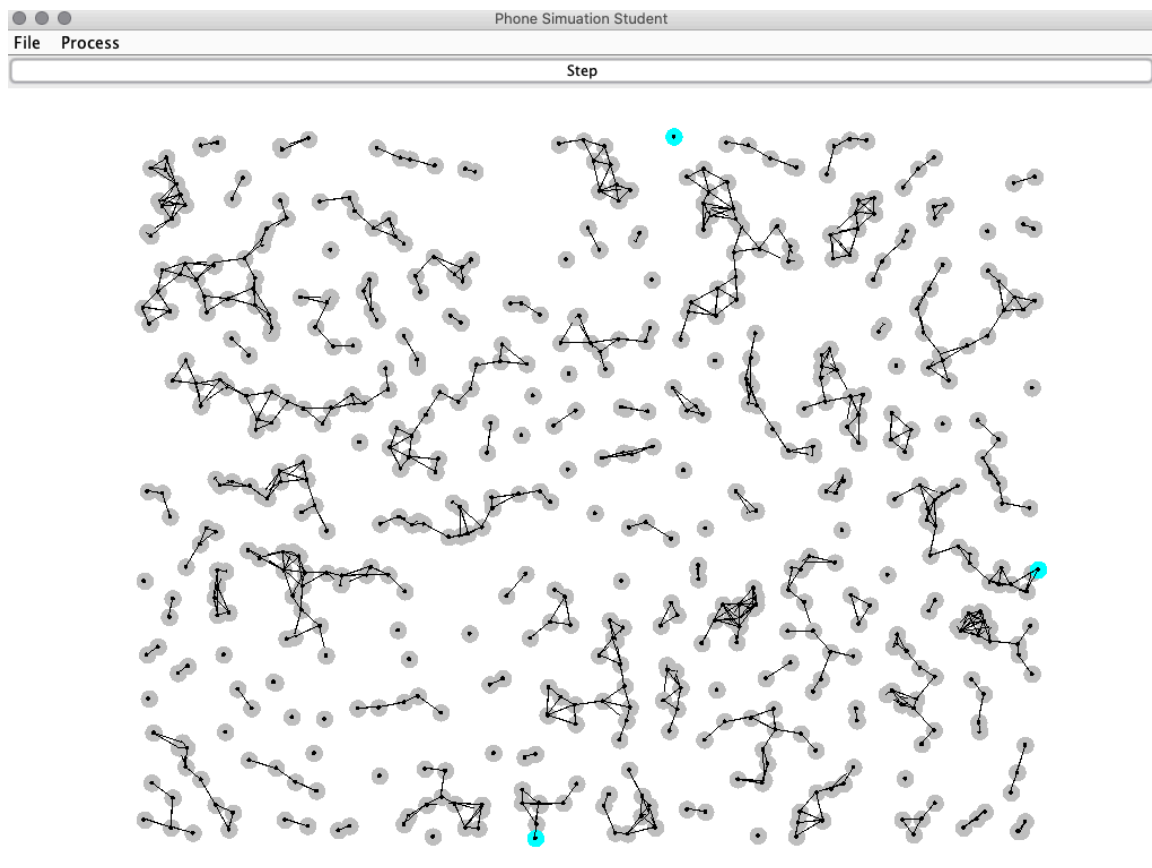
To assess this, the company NetHoc – have built a simulation. This is a Java swing app which simulates people moving around. The problem is, while the app works in real-time for a few hundred people, the investors want a demonstration showing what would happen over a real city (Millions). When the networking program is run the simulation, it runs too slowly on the machine the client possesses. You have been brought in to speed up the code to work in real-time on the investors machine.

The code simulates a crowd moving through space. If a virtual person wants to transmit information to another person it does so tying looking through the network which is formed. The code is not 'production' code. It's badly documented, badly structured, with dead-end methods and really poor choices of data structures written by a physicist.   There are some restrictions on what you can do.

1. When you run the system it must produce exactly the same result as the old version.
2. You are <u>not</u> expected to tidy the program up or make any unnecessary changes, add new functionality etc. This would confuse the original author and your not getting paid for that.

3. There is a timing test data set - this is run by the test in SimulationModelTest.java This is the time the whole program takes to run.

So the program must work exactly as it did before just faster. Your program should be general – that is it should not depend on the exact test data used. The test data currently takes about three minutes to run. The real file is a lot bigger.

Your tasks are as follows.

1. Down load the template WORD solution document (SolutionDocument) from blackboard. This is there to help you get through the exercise and make sure you have done everything.
   - When your done upload this to blackboard via the web form (see below).
   - Change the name to YourLASTNAMESolution.docx
2. Put your name and ID at the top of the document
3.
   - In box 1 put the URL for Oracle's documentation for TreeMap in Java? [**2 Marks**]
   - In box 2
       i. In 200 words or less describe what a TreeMap does.
       ii. What interfaces does TreeMap implement?
       iii. Put a list of the names of the unique (not inherited) methods of **NavigableMap?**
       iv. Pick one method from the unique methods NavigableMap and explain what does.
       v. What is your estimate for the O notation for that method?
                                                                                    b.   **[5 Marks]**
4. Based on **the last DIGIT** of your STUDENT ID name pick one of the following pairs
   - 2,6,0,
       i. Look at ArrayList , LinkedList
   - 3,7,1
       i. Look at TreeMap and HashMap
   - 4,8
       i. Look at TreeSet and HashSet
   - 9,5,
       i. Look at HashMap and ArrayList
   - IN A MINIMUM OF **400** YOUR OWN WORDS (400 each 800 total) – Pick a method from each class which is faster than the other. Say which method that is and explain why it is faster (you might need to refer to how to the class works internally).
   - If you have problems writing use
       i. Diagrams you can assume 1 diagram = 30 words.
       ii. One code example = 30 words
   - For each data method write 100 words on what real world circumstances might be faster for which purposed. You can make the real world example up but it must be plausible.
   - Going over 800 and 200 is permissible.
   - IF YOU HAVE PROBLEMS GETTING STARTED GOT TO THE LIBRARY AND GET ONE OF THE ALGORITHUM BOOKS OUT.
   - This section will be checked for plagiarism
                                                                              - **[20 MARKS]**
5. Download the NetBeans project from the blackboard site assignments. (SimulationApp.zip)
6. Investigate the current classes.
   - You might want to make your own UML chart to help but this is optional and up to you. This is for your development only and no marks are available.
   - THE KEY CLASS TO LOOK AT is StudentSimulation.java , MobilePhone.java
       i. This is the main class of the project and should be the one which runs in the main when you run it.
       ii. What does it produce?
             iii. [**NO MARKS** JUST TO HELP YOU WORK OUT WHAT TO DO]
7. Run PhoneSimApplication.

- Do a performance analysis of the performance test in Netbeans.
- To do this right click on StudentSimulation.java and select 'Profile File'
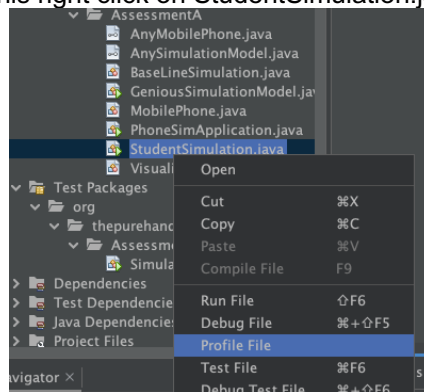
  - i.
- This is your time to be a detective.
  - i.   Ask yourself what is slowing this code down?
  - ii. Dig wide and deep. Use the profiler to look for clues.
- 5.1 In your solution document (the word document see template) paste in a screen dump of your performance analysis when running (it should look something like this figure but include the method names). Note profiling something other than StudentSimulation will get zero marks.
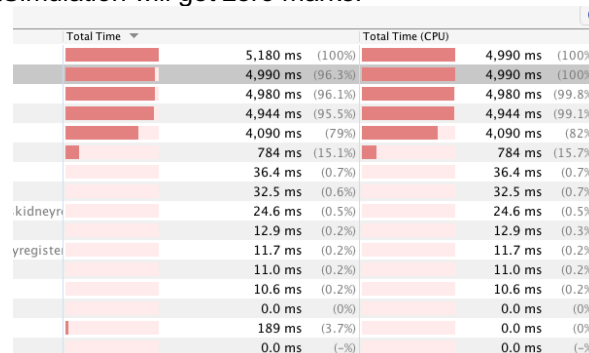
  - i.
    - ii.   [**5 Marks**]
- 5.2 In your solution document identify which top 4 methods from the project code are the most time consuming?   [**1 Mark each up to 4**]
  - i.
  - ii.
  - iii.
  - iv.

5

- 5.3 Now examine the code inside the project. Which methods should receive priority for your attention? Put down what and why you chose it. You don't have to pick the slow methods. You might pick another method for some reason. For example, one method might speed up two other methods which call it. Provided you have a good reason that's fine. **Put down your top 4 methods to change and why**
   - **[1 Mark each up to 4]**
  - i.
  - ii.
  - iii.
  - iv.
- 5.4 For each of your top 5 targets, enter in to your solution document what is your estimate of the O notation (e.g. O(n), O(n^2) O(log(n)) etc.) time of this method and/or any methods it calls
    1.   [**2.25 Marks each up to 10**]
  - ii.
  - iii.
  - iv.
  - v.

- 5.5 Estimate the overall 0 Notation for the project (that is what is the worst case for worst code) [**4 marks**]
- 5.6 What is O-Notation for
    - i. StudentSimuation.move( )
    - ii. StudentSimuation.generate( )
    - iii. StudentSimulation.testForInfection( )

8. You should now alter the code to improve the performance. There is a convenient UNIT TEST called 'which takes your improved class as an argument. It will print out what kind of speed increase you're getting. Use this to get an idea of how much you have achieved. Remember projects which fail to compile on the campus machines or don't pass the unit tests will score 0. Campus machines are running netbeans version 11.

-
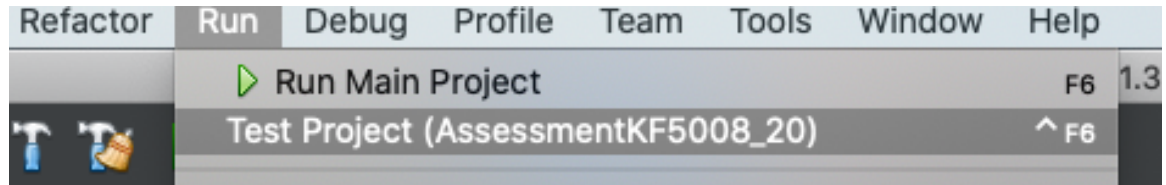
- **NOTE: the unit test takes about 2-5 minutes to run be patient.**
  ORIGINAL TRIAL TIME 77761383458 nano seconds (ns) = 77.761383458seconds
  WARPFACTOR (TIMES FASTER) = 0.905437
  APPROXIMATE MARK 1 - comment: no noticable change
  Try the text books?
  COMPLETE. Have you put your name and id in the @Author header file
-
- Note the mark for this question is approximate – We may raise the score if we feel your code shows you know what you're doing, but you don't get the speed you expect. The top result is against the gold-standard version. You might be able to better than the sample. If so an optional up to 5 marks may be added if you exceed the gold standard in a genuine performance improving way. These additional marks won't be added if you go beyond 100 marks for this assessment.
- **Warning** - if you're submitted code fails to compile against Netbeans 11.3 or 12.1 on a Northumbria cluster machine, it fails(zero marks) .
- **If** your code breaks unit tests, you lose ALL your marks for this question (zero marks).
- Again the marks for this section will are scaled against your performance increase. That is, the faster you make the code, the more marks you get.
- **Warning.** Don't change the unit tests.
- **Warning. For your** convenience**, Try to** confine your changes to StudentSimulation.java– this is the only file that **needs** to be changed for maximum marks. Other changes are not forbidden but thought unnecessary.
- SUBMIT YOUR JAVA CODE **WITH** THE SOLUTION DOCUMENT
    - i. (**Just the java file is fine**).

- [**20 Marks**]

9. What did you change and why ? **Code not working? see I can't compile note below**. Each row in this table will have three columns
    - FOR EACH CHANGE YOU MAKE
        - i. Each row will have the original code before
        - ii. Each row will have an after (your change) code copied from your source.
        - iii. The final column should contain your reasons from making that change. This can be short as long as it is clear. For example, 'Changed TreeSet to HashSet because HashSet has log(1) on deletion.
            1. [**4 marks for each row up to 16 Marks**]
10. In your solution document (the word document - see template) paste in a screen dump of your performance analysis AFTER YOUR NEW CODE (it should look something like this figure but include the method names). Make sure you are using SMALL_PUNY.txt as the input file.

i. [**5 Marks**]

Submission of materials

- **Your solution (word document**) should be <u>submitted to blackboard</u> via the link attached to the assessment area.
    - o You can submit more than once but if you do check your mark reflects the last version when published.
- All code you modify should contain
    - o Your name
    - o Your student ID. In the comments.
- **The Zipped file** of your java project should be <u>submitted to blackboar</u>d.
    - o If the file **is not in zip format** you will score 0 for all the code portions of the exercise.
    - o Your zip file <u>should contain your last name and first initial and id code</u> i.e.
        - ▪ DaltonNW124030202022.zip
    - o IF the file is not in this format you may score 0.
    - o The file should not contain any .class files.
    - o Any submissions which **only** contain .class files will score 0
    - o The zip file SHOULD ONLY include the files you have altered.
        - ▪ E.g. StudentSolution.java ✅

Assessment

- This assessment accounts for 60% of the marks for this module.
- There is a form to help you get all of the elements in the right place and allow for efficient marking and feedback.
- The unit test will <u>indicate</u> your mark for the speed test. This is a <u>rough guide only</u>. After all work is submitted this mark may be changed reflecting our views of your understanding of what you did.
- Feedback
    - o After the last submission (including late submissions) a 'Sample' version of the code will be released to compare against your own document.
    - o Feedback will be against your submission document on the VLE.

FAQ
Help my code will not compile for some reason.
You can still get Marks for section 9. Simply put on which code you would fix. Feel free to put down some pseudocode to explain what you would do to fix it. If your reasoning is clear it should be quite possible to get a passing mark for this part of the assessment.
Remember you can also download the original version again. This is why program is invented version control.

Marking criteria Question 2

Grade	Criteria

15-20	Both explanations are consistent with the class. There is a reference to external sources to support the explanation. Both diagrams, code and text are used to support each other. More than one method is explained and the time implications for each method given. Real world examples given to support the explanation.
11-15	The overall work is good but is not outstanding. There are some flaws in the charts and reasoning, or there is a in fault logic. No real world examples given.
6-10	Work contains a number of problems, and there may be some good elements however there are sufficient problems. One, but not both explanations are incorrect.
0 - 5	Work in incomplete or contains significant flaws.

For Question 5.4

Grade	Criteria
2	The O notation correctly reflects the code in question and any method the code calls.
1	O notation is wrong by 1 (so N^3 when it should have been N^4)
1	The O notation is correct but the code has no impact on the performance. Unit test code, system code like println relates to irrelevant N values such as length of player names.
0	Missing or incorrect. Code would not compile like this.