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| **University of Chester -** Postgraduate Programmes Assignment Specification  **Faculty of Science, Business & Enterprise**  **Department of Computer Science** | | | |
| **Module No**  CO7315 | **Module Title**  Bio Inspired Computing | **Assessment No**  1 | **Weighting**  75% |
| **Submission Date**  8th July at 17:30 | | | **Feedback due by**  5th August |
| **Assignment Title**  Simulation | | | |
| **Learning Outcomes Assessed**   1. Master the use of complex software for bio-inspired computing development, such as swarms, neural networks and evolution. 2. Systematically deploy knowledge of techniques that allow simulation and modelling of bio-inspired computing. 3. Critically evaluate current research and development in the field. | | | |
| **Submission Information**  For projects that include programming code:  The TurnItIn submission box will have multiple parts. You must submit to the appropriate part   * A PDF containing your report as well as an appendix with all programming code from your project (in a monospace font), followed by a reference list in APA format. * A ZIP file containing the project. * Both files must be named with your assessment (J number), e.g. J123456.pdf and J123456.zip. The name for each entry on TurnItIn must also be your assessment number.   Files submitted in an incorrect format will usually be marked as zero.  All components must be submitted to avoid receiving a mark of zero.  Any late work penalties for assignments will be calculated using the latest submission date/time. | | | |
| **Extensions**  Extensions should be requested through the online system available on the Registry services pages on [Portal](https://v3apps.chester.ac.uk/oed/#!start). Late work is penalised at the rate of 5 marks per day or part thereof.  **Academic Conduct** The material you submit must be your own work. Please avoid colluding with peers on your work. The penalties for breaching the academic conduct policy are severe. The minimum penalty is usually zero for that piece of work. Further information is available at Portal > Support Departments > Academic Services > Academic Standards > Academic Conduct > Information for Students > [Academic Conduct](https://portal1.chester.ac.uk/aqs/Pages/aqss-academic-conduct-information-students.aspx) | | | |
| **Generative AI The use of generative AI tools where not permitted will be treated as a breach of the academic integrity policy.**  **This assignment does not permit the use of any generative AI tools, including but not limited to ChatGPT, Gemini, Copilot, Midjourney, and others.** | | | |
| **Referencing code**  Code adapted from third parties must be clearly referenced using comments to denote the start and end of the adapted code. You must also include an APA format reference in the PDF file.  **Example of referenced code**  *//code adapted from Thomson, 2012* **if** (someCharacter == **'z'** || someCharacter == **'Z'**) {  someCharacter -= 25;  } **else** {  someCharacter += 1; } //end of adapted code  **Example of reference entry in PDF file** Thomson, C. (2012). Rot-13 function in Java?. Stackoverflow. Retrieved October 25, 2021, from <http://stackoverflow.com/questions/8981296/rot-13-function-in-java> | | | |

**Assignment Brief**

You are provided with a Netlogo simulation based on the life cycle of fungus gnats such as *Bradysia Ocellaris*. The simulation, called ‘Gnots’ (Gnat-bots), proceeds through the four stages of gnat growth: egg, larva, pupa and adult. Once a gnot has reached adulthood it has a chance of laying eggs roughly once a week if it is female. Male gnots do not lay eggs. The expected quantity and spread of egg positions are adjustable using sliders.

The model tracks the descendants of each member of the initial population of gnots and counts how many still have descendants left in the model. This number can be seen in the ‘families remaining’ monitor. The model counts larval and pupal deaths as well as the overall gnot count for the simulation.

The simulation can be found here: [Gnots Simulation](https://drive.google.com/file/d/1hlfOhG9liMLaIpRsK6GCu5hsPn2CVmDq/view?usp=drive_link)

**Task 1 (20 marks):**

Read the code and perform simulations before filling in the documentation section of the Netlogo file. This should include all required sections. Include this documentation in your report PDF.

**Task 2 (20 marks):**

Modify the code so that a gnot’s children have the same mean *initial* strength as their parent gnot and standard deviation set by ‘stddev-strength’ parameter. Create a checkbox to toggle this feature on or off so that the user may decide whether strength is inherited or random.

Create a plot which graphs the mean initial gnot strength over time. Update the documentation for task 1 accordingly, including any new emergent phenomena observed.

**Task 3 (40 marks):**

Perform behaviour searches on the model using the genetic algorithm provided, to establish the initial conditions which:

* Maximise the chances of family survival
* Minimise the death rate prior to adulthood (larvae + pupae)
* Maximise the mean initial gnot strength

In all cases you must prevent behaviour search from exploring initial conditions which cause the gnot population to die out completely. You should take reasonable steps to make your searches run efficiently and the results are stable (multiple runs yield similar results). All three .bsearch files must be included in your submission.

**Task 4 (20 marks):**

Propose a method by which a gnot-inspired approach might be adapted for the Travelling Salesperson Problem (TSP). You are not required to code the solution (and neither is there any additional credit on offer if you do).

**Assessment Criteria**

Detailed mark breakdown:

Task 1:

What is it? 2 marks

How it works 3 marks

How to use it 2 marks

Things to notice 5 marks

Things to try 3 marks

Extending the model 3 marks

Remaining sections 2 marks

Task 2:

Inheritance 5 marks

User inputs 5 marks

Plot 5 marks

Documentation update 5 marks

Task 3:

For **each** behaviour search:

Measure 3 marks

Objective 3 marks

Efficiency 2 marks

Stability of results 2 marks

Exclusion of dead populations: 10 marks

Task 4:

Mapping of simulation parameters to TSP solutions 5 marks

Exploration and exploitation 5 marks

Evaluation of solutions 5 marks

Overall feasibility 5 marks