The University of Melbourne
School of Computing & Information Systems

COMP90083 Computational Modelling & Simulation

Assignment 2

Released: Thursday 10 September, 2020
Proposal due: 23:59, Sunday 27 September, 2020
Report due: 23:59, Sunday 1 November, 2020

Overview

In this assignment, you will use NetLogo or a general purpose language to create an agent-based model (ABM) of a complex phenomenon. You will conduct this work as part of a group (of three people). This assignment is intended to give you greater freedom to apply the knowledge and skills you are acquiring in this subject to a domain of interest to you.

The objectives of this assignment are to gain experience in:

- identifying a research question of scientific or policy interest;
- designing an appropriate ABM and experiments to address a specific question;
- communicating the design of your model, and the results of your investigation;
- collaborating over an extended period of time to execute a substantial piece of work.

Background

Agent-based models can be used to model a broad range of systems in the real world. You are free to choose a topic of interest to you for this assignment. While the work you submit (proposal, report and model code) must be that of your group, I am happy for topics and questions to be discussed with me, with each other, in class, in tutorials, and on the Discussion Board.

To get you started, a list of possible topics are provided at the end of this specification. Note that any of these example topics could each be used as the basis for *many* possible questions, and could potentially lead to very complex models. However, bear in mind the time constraint on this project: You should start by aiming for a *single* question that can be addressed using a relatively *simple* model. It is far more important to address a simple question *well* than to address a complex question *poorly*. If your initial question and model go well, you can always elaborate your question and extend your model.

In terms of model complexity: as a baseline, your model should involve some form of non-trivial agent behaviour and interaction between agents, such that you can identify and measure some interesting emergent behaviour of the system.

Your tasks

1. Identify a question and review relevant literature and existing models;
2. Write a proposal describing your question and proposed approach (first deadline);
3. Design and implement your model (in NetLogo or a general purpose language);
4. Design and execute a series of experiments using your model;
5. Write a report describing your model and findings (second deadline).

Procedure and assessment

- This assignment is to be completed *in groups of three*.
- There are two deadlines for this project, listed above: a proposal, and a final report (plus model code). The suggested structure for each submission is outlined below.
- Late submissions will incur a penalty of 2 marks for every day (or part thereof) after the deadline. If there is a valid reason that you require an extension, email Nic well before the due date to discuss this.
- You should submit you both your proposal and your report via Canvas LMS. All files should contain the names and student numbers of all group members.
- We encourage use of the Piazza Discussion Board to discuss and ask questions about this project; however, all submitted work must be your group's own work.
- This project counts for 40% of your total marks in this subject. Marks will be awarded according to the criteria described below.

Proposal

Your proposal should be 2 pages outlining: (a) your research question; (b) a brief summary of previous research relevant to this question; (c) your proposed approach to addressing this question, in the form of a draft ODD description. Your proposal counts for 5% of your total marks in this subject.

Report

Your report should be 8–12 pages, incorporating the following components:

- *Introduction:* Motivate and describe your question and summarise relevant research on this topic.
- *Model design:* Describe your model using the ODD framework; this should be sufficiently detailed to enable someone else to implement your model.
- *Methods:* Describe the experiments used to analyse your model's behaviour and address your question; this should be sufficiently detailed to enable someone else to recreate your analysis.
- *Results:* Provide a qualitative and quantitative summary of your model's behaviour, including tables or figures as appropriate.
- *Discussion:* Interpret your results: how do they answer the question that motivated your project. Put your results in a broader context: what are the implications of your findings. Describe the strengths, limitations and potential future directions of this work. This is also the place to reflect on things that may have gone well, or less well, in carrying out the assignment, and briefly summarise what you have learned from the experience.

Your report counts for 35% of your total marks in this subject. Note that you are free to reuse any content from your proposal in your report.

Code

You may implement your model in NetLogo or a general purpose language (eg, Python, Java or C++). If you choose to use a general purpose language to implement your model, you are welcome to use an agent-based modelling library / framework such as Mesa, Repast or MASON (though note that the teaching team may not be able to provide support for these libraries).

Your model code will not contribute to your mark for this assignment, but it is a hurdle requirement, in that it must be submitted (in well structured and clearly documented from) in order to obtain a passing mark for the assignment.

Marking criteria

Criterion	Description	Marks
Proposal	The question proposed is clearly articulated. Relevant background information is well summarised. The draft model description clearly outlines a model suitable for addressing the proposed question	5 marks
Introduction	The introduction clearly motivates the study, reviewing appropriate literature and outlining the gap in knowledge and question you will address	7 marks
Model design	The model is comprehensively described, making appropriate use of the ODD protocol. The design of the model is well matched to the research question. The model incorporates non-trivial agent behaviour and interaction, and reflects an understanding of the concepts covered throughout the subject.	7 marks
Methods	The experiments are appropriate to the question and well justified, and all relevant information is provided.	7 marks
Results	The results are clearly summarised and communicated, including appropriate use of figures and tables, and sensitivity or uncertainty analysis as appropriate to the question.	7 marks
Discussion	The results are clearly interpreted, an answer to the question is provided. The implications of the research, and strengths and limitations of the approach taken, are discussed. The discussion and reflection demonstrates an understanding of concepts covered throughout the subject.	7 marks
Model implementation	The code is well structured, readable, and is well commented and explained. Note: your code will not marked, but must be provided as part of your submission in order to obtain a passing mark for this assessment item.	(hurdle)
Total		40 marks

Academic misconduct

The University misconduct policy [1] applies. Students are encouraged to discuss the assignment, but all submitted work must represent the group's understanding, implementation and writing. You may make use of short sections of code from existing models where appropriate, but these should be clearly commented as such and include a reference to the original source of the code. Turnitin will be used on submitted reports to detect high levels of similarity with other material. While you will need to refer to existing material in your background review, the words used should be your own and original sources must be acknowledged. See the policy link for guidelines about good scholarship.

[1] https://academicintegrity.unimelb.edu.au/

Example topics

- Managing student flow on campus post-COVID-19: once back on campus, students will need to move to and from lectures, tutorials and other locations; typically this involves areas becoming congested at particular times, which may create transmission risk. How could a model be used to explore strategies to reduce congestion? (this could also be investigated at the scale of, for example, people embarking / disembarking from a tram or train)
- While demonstrations (public gatherings of people to protest for or against a particular idea or action) are typically peaceful, they can result in violent behaviour. How could a model be used to explore the situations in which an otherwise peaceful protest may become violent and strategies to avoid this occurring?
- Natural attractions are geographical or biological features of broad tourist appeal. However, such attractions can become victims of their own success as increasing popularity can lead to overcrowding and degradation of the tourist experience. How could a model be used to explore this phenomena and identify solutions that would benefit tourists, service providers the attraction itself?
- You have seen how a ABMs can be used to model response to a natural disaster such as a bushfire. How could a similar approach be adapted to model the response to another type of natural disaster, such as a flood, volcano, tsunami, or earthquake?
- In the Business Investor model, “space” was virtual; however, certain businesses such as retail shops in a mall do have spatial relationship, or stall in a market, do have spatial structure. How could a model be used to explore the dynamics of which type of structure might emerge if investors are choosing which types of retail business to operate and where?
- Zombie movies and books have considered various strategies for averting the zombie apocalypse. How could the model discussed in class be extended to address some question of vital importance to the survival of humanity? (NB: a project like this would require a clear statement of “facts” about the “world” that the model simulates.)
- Historically, the discovery of new regions of the globe, or of new economic resources in known regions, has prompted a rush to exploit these resources, often to the detriment of the environment and local populations. How could a model be used to explore this phenomena and suggest sustainable approaches to usage of future resources?

Nic Geard
9 September 2020
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