# FIT3139 2024-S1: Final project

(Due by 11:55pm, Friday, 13 June 2025)

This final project has the purpose of assessing all learning outcomes in the unit. The learning outcomes are as follows:

1. Explain and apply the process of computational scientific model building, verification and interpretation;
2. Analyse the differences between core classes of modelling approaches (Numerical versus Analytical; Linear versus Non-linear; Continuous versus Discrete; Deterministic versus Stochastic);
3. Evaluate the implications of choosing different modelling approaches;
4. Rationalise the role of simulation and data visualisation in science;
5. Apply all of the above to solving idealisations of real-world problems across various scientific disciplines.

## What to submit

The final report will consist of two parts. A **video presentation** (worth 15% of the project mark) and a **final written report** worth (85% of the project mark). We also require all the source code, appropiately documented via comments as well as the slides used for the presentation. The weights on the different sections of the report are futher discussed below.

## Follow these procedures to submit this assignment

The assignment must be submitted *online* via Moodle, and should follow the following procedure:

- Accept the Electronic Plagiarism Statement for this Assignment. All your scripts/program will be scanned using MOSS (a plagiarism detection software). Read Monash Student Academic Integrity policy for consequences of plagiarism.
- All your scripts and reports **MUST** contain your name and student ID.
  - **You are free to program the assignment in either MATLAB or Python.**
  - Your submitted archive must extract to a directory named as your student ID.
  - This directory should contain all elements of the submission including
    - The report (in PDF format)
    - The source code for the model and analysis, appropriately documented with comments.
    - The video of your presentation in MP4 format
    - The slides used for your presentation in PDF format
    - An AI statement
- Submit your zipped file electronically via Moodle.

# Task description

To demonstrate all learning outcomes, you will develop an **extension of a model discussed in the classroom**. An extension addresses the same problem, but adds or relaxes specific assumptions about the model. For example, taking a deterministic model and introducing assumptions to do a stochastic analysis, or providing stochastic analysis for a simulation.

Your extension should address the same problem, but contain some different assumptions that may or may not lead to different conclusions — an analysis should be presented comparing the results of the original model and the extended model. The model extension should be explained, interpreted an analysed, and it should allow you to showcase **at least <u>two</u> of the following techniques**:

- Gillespie
- Markov chains
- Montecarlo simulation
- Heuristics
- Game theory

Your extension should address **two different modelling questions**, and use the algorithms, techniques and visualisations discussed in the clasroom to answer those questions.

# Submission structure

## Report structure

Excluding code your report should be no longer than 10 pages. Your report should contain the following sections:

### Section 1: Specification table

Fill the following table.

| | |
|---|---|
| **Base model** | One sentence description of the base model |
| **Extension assumptions** | One paragraph description on how assumptions are modified and the nature of the extension |
| **Techniques showcased** | Technique 1.<br><br>Technique 2. |
| **Modelling question 1** | Questions being addressed. |
| **Modelling question 2** | |

**Important**: This table should be briefly discussed and signed by your demonstrator on week 11 and week 12, during the lab session – not via email or forum post, please plan accordingly.

**Section 2: Introduction**

- *Learning outcomes 1, 5.* **10% of project final mark**

- Identify the problem you want to solve and its motivation, describe what the extension will be and identify questions your model will answer. In other words, this section takes the information in the specification table and develops it providing more detail and a motivation of your questions, and how your techniques are appropriate.
- Write clearly. Your mark is based on what we can understand so spend time crafting the text.

**Section 3: Model description**

- *Learning outcomes 1, 2, 5.* **35% of project final mark**

- Specify model extension details and list assumptions for both the original model and the extension model. Determine the class of model and analysis you are presenting (Numerical versus Analytical; Linear versus Non-linear; Continuous versus Discrete; Deterministic versus Stochastic). Be sure to describe in detail any algorithms or mathematical results or derivations you may use.
- Be clear and help the reader as much as you can.

**Section 4: Results**

- *Learning outcomes 2, 3, 4, 5.* **35% of project final mark**

- Interpret and analyse the results of your extended model, including visualisation of results. You should explain how you arrive at your results. All figures should be discussed, explained and interpreted and your report should include **at least 3 Figures**. The results and figures should support how you are answering the questions you have chosen to answer.
- Be clear and help the reader as much as you can.

**Section 5: List of algorithms and concepts**

- *Learning outcomes 2, 5.* **5% of project final mark**

- List of algorithms and concepts used in the unit that play a role in your model and interpretation.

## Video presentation

You should submit a presentation where you discuss your extended model. The presentation should be no longer that 6 minutes, and use slides to enhance the description of the model and the explanation of your results. It is suggested the presentation keep a similar structure to that of the report. The presentation is worth **15% of project final mark**.

A simple procedure to record the presentation using zoom can be found here: `https://www.youtube.com/watch?v=P6cTbnUPwfY`

### Source code

All code should be submitted and **appropriately commented**. It will be checked for correctness and be part of the marking in the model section (if the code is used to *produce* results, or in the results section if the code is used to *analyze* results). Clarity is in your best interest.

You can use any of the standard libraries we used in the class as long as you can explain what the library is doing.

## Feedback opportunities

- **Workshop 2 of week 9** will discuss the project task and provide examples. There will be no pre-workshop video, use the time to start thinking about what you want to do.
- **Week 10's applied**: You are welcome to have a very brief discussion of topic with lab demonstrator – they can provide simple advise con how to fine tune your question or idea.
- **Week 11's applied**: Present a draft of the specification table to your demonstrator and explain what you expect in terms of results.
- **Week 12's applied**: Discuss your progress with your demonstrator.

We will also have extra consultations before the due date, but they do not replace the activities above. Plan ahead and good luck.