1 Preamble

In practicals you have implemented and learned about simulations, object-orientation and (soon) how to automate the running of multiple simulations. In this assignment, you will be making use of these skills and knowledge to conduct three investigations. You will then report on the results generated by the simulation.

2 The Problem

There are three related investigations in this assignment: Power Usage, Power Modelling and Power Simulation. You can use Python programs, Bash scripts and/or Jupyter Notebooks for the analysis, modelling and simulation. The investigations can go in many directions, the prompts are given as ideas for possible things to investigate.

1. **Power Usage:** In this investigation, you will be collecting readings from a power meter you have access to. Readings will be recorded in a CSV file. You should read in this data and carry out some visualisation and analysis, which you will then report on. You should plot usage and the cumulative usage (at least).
    - **Prompts:** What understanding and insight can you get from your data? e.g. When is the highest/lowest usage rates? What patterns can you see? What might be the biggest factors in power use? Could you use external data to further understand the data? What is the baseline usage?
    - ***All input files should be unique for this investigation.***
2. **Power Modelling:** You will now be looking at the appliances and other factors that affect the power usage in "your" house. Record the type, power rating and usage of devices to work towards matching the Power Usage data from Investigation 1.
    - **Prompts**: Give an inventory of appliances and modelled factors. How have you determined a rating and usage for each? What assumptions have you made? What impact might solar energy have on the model?
    - **File format**: colon separated, multipliers are comma separated (internally):
        - *Residents:<number>*
          *<device name>:<power rating (W)>:<usage multiplier/hr*12>* e.g.
        - *TV:60:1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1*
3. **Power Simulation:** Create a street or suburb of houses/residences, implemented as **objects** in your program – based on the Power Modelling in Investigation 2. Imagine taking the view of the electricity provider and how they can service the needs of the

area. Your simulation should have the flexibility to be able to read in (or build) a range of scenarios.

- **Prompts**: How does varying the proportion of the different types of houses affect the load over time? What are the base and peak loads? How does solar energy impact this? What impact might feeding solar energy back into the grid have? Can you include some "seasonal" factors or weightings?
- **Data:** We will share house model files (format above) to give variation to your simulation. You can also create your own (documented).

Your code should include comments to explain what the developed code for each investigation does and how. It is useful to keep track of your changes in the comments at the top of the program, or use a version control system (e.g. git – but make sure your code is not viewable publicly!). Feel free to re-use the code and approaches from the lectures and practicals. However, remember to self-cite and cite your sources. If you submit work that you have already submitted for a previous assessment (in this unit or any other) you have to specifically state this.

Beyond the working program, you will submit two documents: **User Documentation** for your code and a **Power Investigation Report** on your experiments. There will be **bonus marks** for additional functionality and the use of more advanced programming techniques (e.g. interactivity, high quality visualisation, 3D space, parameter sweep etc.) but only if they're sensible and done well. Make sure to discuss the additional work in your User Documentation and Report, this will be easier if you make notes and keep old (incremental) versions of your code as you work.

Remember : Think before you code!

3 Submission

Submit electronically via Blackboard. Make sure to submit early. You can submit multiple times – we will only mark the last attempt. Take care not to submit your last version late though. Read the submission instructions very carefully.

You should submit a single file, which should be zipped (.zip). Check that you can decompress it on lab machines. These are also the computers that your work will be tested on, so make sure that your work runs there. The file must be named FOP_Assignment_<id> where the <id> is replaced by your student id. There should be no spaces in the file name; use underscores as shown.

The file must contain the following:

- Your **code**. This means all files needed to run your program. That includes input files used as part of the assignment if that is required to run your program.
- **README** file including short descriptions of all files and dependencies, and information on how to run the programs.
- **User Documentation** and **Power Investigation Report**, as described in Section 3.1.
- A signed and dated **cover sheet**. These are available on Blackboard. You can sign a hard copy and scan it in or you can fill in a soft copy and digitally sign it.

Make sure that your zip file contains what is required. Anything not included in your submission may not be marked, even if you attempt to provide it later. It is your responsibility to make sure that your submission is complete and correct.

3.1 User Guide and Report

You need to submit your User Documentation and Report in doc/docx, pdf or Jupyter Notebook format.

Your **User Documentation** will be minimum 4-6 pages, with a section for each investigation and should include the following:

- An **overview** of each of your program's purposes and features.
- A **guide** on how to use your programs/simulations.
- A **discussion** of your code, explaining how it works, any additional features and how you implemented them.

The **Power Investigation Report** will comprise of three parts, one for each of the investigations. Each part should be a mini-paper 2-3 pages long and follow the structure of a standard academic report. Required sections are:

- **Abstract:** Explain the purpose of the investigation and state the parameters you have investigated, and the outcomes/recommendations.
- **Background:** Discuss the purpose of the program/simulation and your choice of parameters.
- **Methodology:** Describe how you have chosen to set up and compare the simulations, and why. Include commands, input files, outputs – anything needed to reproduce your results.
- **Results:** Present the results of your simulations – include tables, plots and discussion.
- **Conclusion and Future Work:** Give conclusions and what further investigations could follow.
- **References**

3.2 Marking

Marks will be awarded to your submission as follows:

	Investigation 1	**Investigation 2**	**Investigation 3**
Tests and Functionality	10	15	15
Code Quality	5	5	5
Documentation	5	5	5
Report	10	10	10

- **Demonstration.** Students will demonstrate their code and respond to questions from the markers – marks go towards Tests and Functionality.

Marks will be deducted for not following specifications outlined in this document, which includes incorrect submission format and content. There will be a checklist of deliverables to ensure that you include everything required..