EE5311 Assignment 1 (AY23/24 Semester 2)

This assignment counts toward 25% assessment for the course. This assignment is due for submission by **18 March 2024**.

The assignment problems below are open-ended and may admit many possible solutions. Bearing in mind that the assignment provides you an opportunity to practice what you learn in this course, it is recommended that you think about how physics-guided machine learning techniques might help you solve the problems.

You **may** discuss both assignment problems and the solution methodologies with other students and the instructor, but you are **not allowed** to share code or project report with other students. The Canvas discussion forum is a great place for discussions and/or clarification regarding this assignment.

> Caution
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> **Any copying or plagiarism will hamper your own learning, and may also result in disciplinary action against you**.

Part A

You work for a government organization that regulates fishing in coastal waters to ensure long term sustainability. The allowed fish harvest per year is reviewed every 5 years, and a stock (fish population) assessment is undertaken before the next review.

Based on historical data, the Salmon harvest and stock estimates are as shown in Table 1.

If the Salmon stock drops below 100,000, experts have advised that there is a high chance of population collapse due to over-fishing. Based on the historical data, your task is to recommend the maximum allowable harvest for the next 5 year period, such that the Salmon stock at the end of the 5 years will not drop below 100,000.

Table 1: Historical Salmon harvest and stock data

Harvest	Stock at end of 5 years
20,000	241,725
50,000	228,076
80,000	212,319
110,000	193,015
140,000	165,744

> **Tip**
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> You may assume that the simple fisheries model presented in week 6 in class (see presentation slides for details) is consistent with Salmon population dynamics in your country. However, the maximum supportable population and reproduction rate for Salmon are not accurately known for your coastal waters.

Submission requirements for part A

(10 marks)

- Brief report (**page limit: 2 pages**) in `pdf` format, clearly outlining the method used for your recommendation, and your recommendation on allowable Salmon harvest.
- Well-commented runnable code yielding the results to support your recommendation.

Part B

You work at an investment house that invests in niche stocks on behalf of their clients. One of your colleagues, Bill, has, in the past, observed that the stock prices of two companies (`ATBG` and `BRDW`) show some kind of dependence and periodicity. Bill thinks that the current stock prices for both companies somehow drive future changes in stock price. This is not surprising, given that both companies provide products in the same domain and although can be seen as competitors, also benefit each other by developing the market together. The domain is quite niche and isolated and so sees little influence from other stocks or market forces in the short term.

For the past 4.5 months, Bill has been keeping records of the stock prices of the two companies and offers you that as data (file `assignment_1b-data.csv`). The data is visualized in Figure 1.

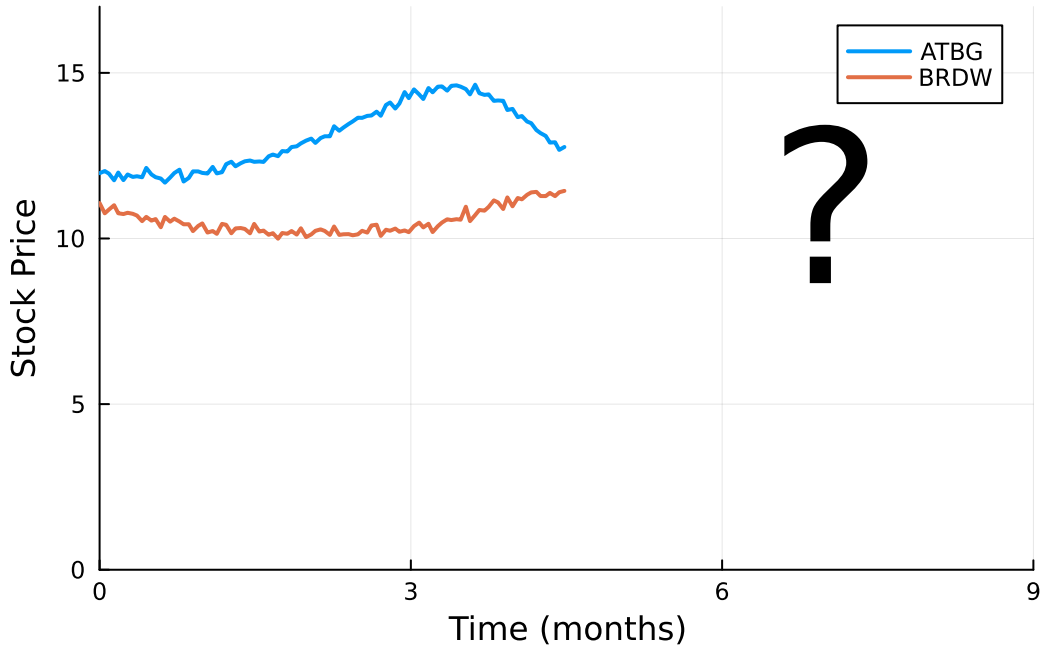

Figure 1: Record of stock price for ATBG and BRDW over 4.5 months. Your task is to fill in the right half of the figure, forecasting both stock prices over the subsequent 4.5 months.

Your task is to forecast the stock prices for the two companies over the next 4.5 months, to help guide Bill's investment decisions.

Submission requirements for part B

(15 marks)

- Brief report (**page limit: 2 pages**) in `pdf` format, clearly outlining the method used for forecasting stock prices.
- A `results.csv` file containing your results (forecasted stock prices). The file should have 3 columns, with the first column being `time`, and the next 2 columns being forecasted stock price for the 2 stocks `ATBG` and `BRDW`. The file should only contain forecasted data for time 4.5 to 9.0 months in steps of 0.1 months.
- Well-commented runnable code yielding your results. Running this code should create an identical `results.csv` file as your submission.