A2

Receding Horizon Method

Please read through this document and complete the coursework as required. The coursework submitted (including the relevant program source files) should be all your own work and reference to, quotation from, and discussion of other work should be correctly acknowledged.

Note: This coursework accounts for 20% of your final mark for this module. Please spend no more than 20 hours on this assignment.

Inventory Management Using Receding Horizon Method

In this assignment, we will consider a different version of the inventory management problem studied in Assignment 1.

Background: In the year 2100, human beings live on over 100 planets including Mars and the Moon, with a new United Nations (UN) headquarters situated on Earth. Although these planets can provide most of the goods for human beings' consumption by themselves, there is a special product, called 'Super Apple', that can only be produced on Earth.

The Mission: Authorised by the UN, you will be sent to Mars to open a new flagship store for 'Super Apple' for a duration of 52 weeks. You will be offered a very competitive basic salary, plus a performance related bonus.

The Market: The 'Super Apple' is an expensive nutritional product. Its weekly demand on Mars is a random number with the following probability distribution

Table 1 probability distribution of the demand on Mars

Demand (D)	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Probability (p)	**0.04**	**0.08**	**0.28**	**0.4**	**0.16**	**0.02**	**0.02**

Inventory Management: You are responsible for managing the store and your key job is to control the inventory, including paying for warehouse costs, ordering from the earth etc. You will order policy order number y units of 'Super Apple' from Earth once your stock is less than or equal to a fixed level of r units (set to be the best level found in Assignment 1).

Note: only integer number units of 'Super Apple' can be ordered.

Assumptions: (1) You will check your stock level at the end of each week (i.e. Friday at 17:00) and place an order if necessary; (2) The order number y can be **different** for different weeks (**note this KEY difference with Assignment 1**); (3) If you place an order, the 'Super Apple' will be delivered to you before 9:00 the next Monday; (4) You start your job on the Friday before the 1st week with 0 initial stock.

Your Performance: The UN has decided to measure your performance based on your operational cost, including:

1. Warehouse Cost: if at the end of a week you have any stock left, you will have to store them in a special warehouse during the weekend due to the chemical property of the 'Super Apple'. The cost is 5 gold coins per unit per weekend.

2. Short of Stock Penalty: if you cannot meet your customers' demands for any week, i.e. your stock is less than your demand, you will be charged by the UN a fixed penalty of 20 gold coins for that week.

3. Return Cost: on the last day of the 52th week, if you still have any stock left, you will need to return them to the earth with a cost of 10 gold coins per unit.

Your key job is to minimise the cost over the whole 52 week period.

In this coursework, you are required to complete the following tasks:

Task 1: Without using simulation, how would you choose the order number y for these 52 weeks? Please explain your reason(s).

Task 2: Use receding horizon method to formulate and solve the problem. Clearly state any assumptions you might have made during the process. How is this solution different from the one you obtained in Assignment 1? Is there any benefit using a variable order number y? Evidence this.

Task 3: Using receding horizon method requires the choosing of control and prediction horizons. How do these parameters affect your design? Evidence this.

Task 4: Critically evaluate your work. Have you achieved the objectives? What problems did you find during this work? What conclusions can you draw from your design? How would you improve your estimate/design? From the experience of this work, what do you need to consider when solving a practical problem?

Assessment of Your Work: The project accounts for **20%** of your final mark for this module. You will be asked to upload a report and relevant program source files (with clear instructions on how to run the program) before the deadline (16:00 15/05/2020) using the ECS handin system.

Template of the Report: The project report should be written in the form of a **TWO page** length conference paper. A template is available on the IEEE Control System paper management website

http://css.paperplaza.net/conferences/support/support.php