Team Brogram: Stackelberg Plan

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0.1 Design

0.1.1 Overview

1. On game initialisation, parse *CSV* and perform batch regression to find follower's reaction function, $R_F(x)$.
2. For the first day, find global maxima of $J_L[]$ to obtain price to submit.
3. On proceeding to a new day, take previous follower's price and perform recursive regression to efficiently update approximation of $R(x)$.
4. Again, find maxima of updated $R(x)$ and submit price. Repeat for each new day.

0.2 Schedule

This section describes each task in more detail.

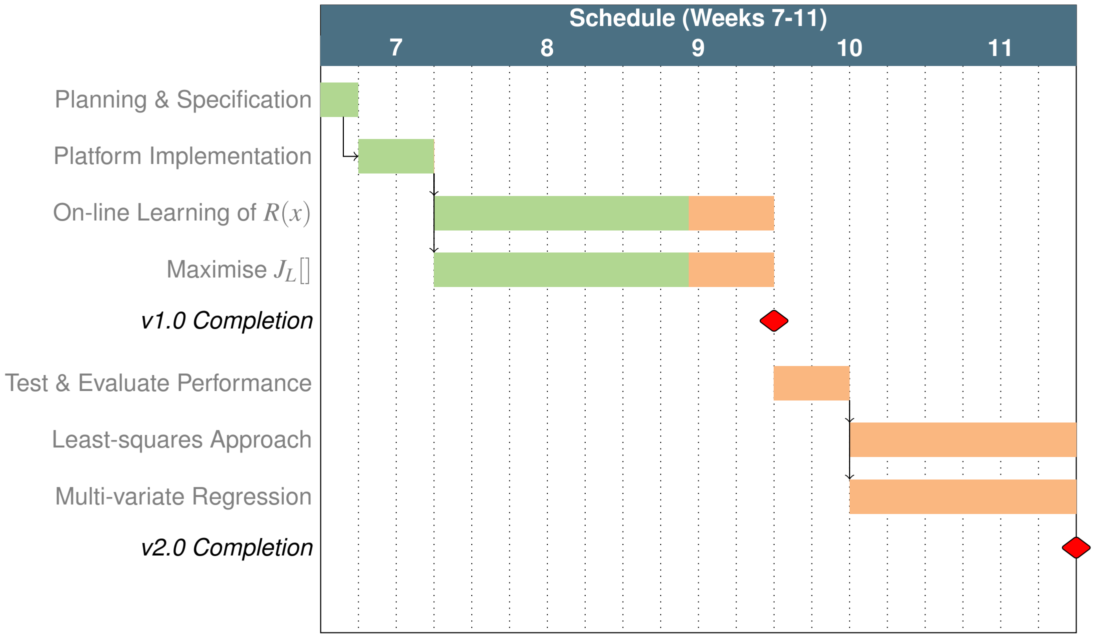
0.2.1 Tasks

We have broken development down into the following key deliverables:

1. Learning the reaction function (*Sam* & *Danyal*)
    - Currently assuming the follower's reaction function is linear, so simply representing the function as two variables, a and b, from $R(x) = a + bx$.
    - We then parse CSV data files to obtain historical data on follower responses
    - After, we perform linear regression via least-squares on this data to to find values for a and b.
    - Regression performed using formula from Xiao-Jun's fourth lecture, slide 20.
    - Our next task is to find the global maxima of the function.
2. Online Learning (*Sam* & *Danyal*)
    - Weight least square w/ a forgetting factor to produce an updated estimator.
    - Use recursive least square approach to find coefficients.
3. Finding the global maxima (*Freddy*)
    - Having estimated the follower's reaction function, $R(x)$, we will then calculate our optimal strategy by maximising the (leader's) payoff function, $J_L[]$.

0.2.2 Gantt Chart

The Gantt chart below shows how the development will progress over the coming weeks.



Milestones/deliverables are marked by a **red** diamond.

0.3 Regression Equations

$$\hat{a}^* = \frac{\sum_{t=1}^{T} x^2(t) \sum_{t=1}^{T} y(t) - \sum_{t=1}^{T} x(t) \sum_{t=1}^{T} x(t)y(t)}{T \sum_{t=1}^{T} x^2(t) - \left(\sum_{t=1}^{T} x(t) \right)^2}$$

$$\hat{b}^* = \frac{T \sum_{t=1}^{T} x(t)y(t) - \sum_{t=1}^{T} x(t) \sum_{t=1}^{T} y(t)}{T \sum_{t=1}^{T} x^2(t) - \left(\sum_{t=1}^{T} x(t) \right)^2}$$