Computation Economics II
Spring 2019
Capital Investment Environment Details

February 5, 2019

- General Aspects
  1. There will be N periods in a horizon.
  2. There is only one type of plant.
  3. Each period, the player will earn some amount of profit determined by the number of plants owned.
  4. Once a plant is built, it will remain built for the remainder of the horizon.
- Functions
  1. The net profit in a period is given by
  $$\Pi_t = \text{Revenue - Production Costs - Fixed Costs - Build Costs}$$
  2. Production costs are the amount it costs to actually produce the units demanded. (cost of staff, inputs, etc.). This is given by
  $$PC_n(q) = \alpha q + \beta \frac{q^2}{2n}$$
  where n is the number of plants built, q is the quantity produced, and α and β are parameters. When $n = 0$ production costs are 0.
  3. Fixed costs are an amount you have to pay every period for any plant you own. The equation is therefore just $F_t = fn$, where f is a constant.
  4. Build costs are only incurred the same period as when a plant is built.
  5. All units are sold at the same price, so $R_t = pq$, where p is the price price units are sold at, and quantity is the amount sold. Price is determined by plugging into the demand equation:
  $$D(q) = \frac{A_t - q}{B}$$
  where A_t is given and increasing with each period, and B is a constant.
  6. There are two possible equilibrium quantities. You will need to implement them both.
     - Competitive quantity:
     $$q^* = \frac{n(A_t - \alpha B)}{n + \beta B}$$
     - Monopoly quantity:
     $$q^* = \frac{n(A_t - \alpha B)}{2n + \beta B}$$

     Additionally, each plant has a maximum capacity, c. The maximum quantity is therefore constrained to $c * n$, so:
     $$q_{\text{Final}} = \min{(q^*, cn)}$$
- Note: You can set a reasonable constraint on the number of plants built over the horizon (10 would likely suffice). You can also place a reasonable constraint on the number built per period if you prefer.