IEMS 469 Project 1

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1 Problem Settings

1.1 Shuttle dispatching problem

K = The capacity of a shuttle. Assume $K = 15$.
c_f = The cost of dispatching a shuttle. Assume $c_f = 100$.
c_h = The cost per customer left waiting per time period. Assume $c_h = 2$.
A_t = Assume $A_t \sim \text{Unif}\{1, 2, 3, 4, 5\}$.
M = The maximum capacity of the station. Assume $M = 200$.

1.2 Construction of MDP

Discount factor $\gamma = 0.95$.
State s_t: the number of customers in the station at the beginning of time epoch t.
Action a_t: dispatch a bus or not.
Transition function: $s_{t+1} = \max\{[s_t - Ka_t]_+ + A_t, M\}$
Cost function: $c(s_t, a_t) = c_h s_t + c_f a_t$
Goal: to minimize the cumulative discounted cost function $\sum_{t=0}^{T} \gamma^t c(s_t, a_t)$

2 Algorithms

2.1 Enumeration

For enumeration algorithm, we have to choose a finite T to approximate the real value function. Let's assume that $T = 500$.

2.2 Value iteration

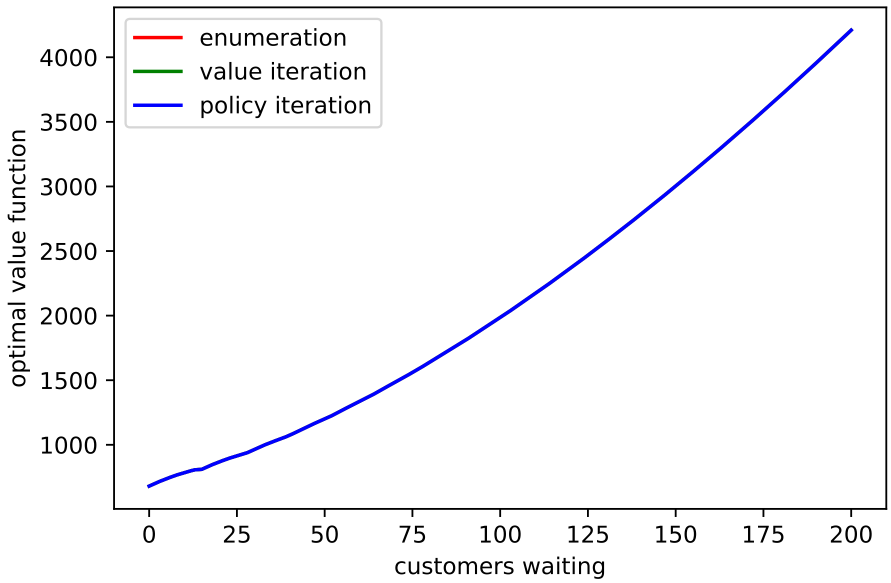
$T = \infty$. We choose to stop running the algorithm at step h when the L_∞ distance between value functions calculated at step $h-1$ and h is less than $\epsilon = 1e-5$, i.e. $\sup_s |v_h(s) - v_{h-1}(s)| < \epsilon$. Then take v_h as the approximate value function.

2.3 Policy iteration

$T = \infty$. We choose to stop running the algorithm at step h when the L_∞ distance between value functions calculated at step $h-1$ and h is less than $\epsilon = 1e-5$, i.e. $\sup_s |v_h(s) - v_{h-1}(s)| < \epsilon$. Then take v_h as the approximate value function.

3 Consequences and plots

The optimal policy calculated by three algorithms are all to dispatch the shuttle when the number of customers waiting is not less than 13. I draw the plots for three algorithms, and they almost coincide.



4 Problem 2

For more complex problem 2, I fail to run the same experiments as in problem 1. The main reason is: we have to decide how many people of each class should enter into this shuttle, so the action space is way too large.