ELL729: Stochastic Control & Reinforcement Learning
Coding Assignment II

Maximum Marks: 7

November 27, 2020

Investing in a Forward

Suppose you are an investment banker with some money < 100\$, reserved for the purpose of investing in a particular forward contract. At the beginning of each week, you have to decide how much money you wish to invest in the forward contract for that week. The forward contract matures at the end of every week such that it either returns double the investment value with probability p or results in a total loss of the investment. Your aim is to accumulate a total of 100\$.

To Do List

- For $p = 0.4$, use value iteration to plot a) Optimal Value Estimate vs State and b) Optimal Investment vs State. Note that the later is essentially the estimate of the optimal policy. Assume no discounting.
- Repeat the same for $p = 0.25$ and $p = 0.55$.
- Now assume that with increasing time, you start loosing interest in the forward. Plot the same graphs for a discount factor of 0.9
- Formulate the problem as an average cost problem and plot the two graphs. Try to give intuitions behind all the graphs.

Technical Subtleties

- Take the state space to be discrete i.e. $\{0, 1, \ldots, 100\}$.
- You get a reward of 1 for reaching 100\$. Zero reward for all other transitions.
- Assume the states 0\$ and 100\$ to be absorbing.
- At some state s, you can decide to invest $a \in \{0, \ldots, \min(s, 100 - s)\}$.
- Use some tolerance value such as 10^{-3} for declaring convergence.

Evaluation Criteria

- Correctness of code: 3 marks
- Report: 3 marks
- Intuition behind the graphs: 1 mark
- Code without comments and proper indentation may not be evaluated.

Logistics

- **Deadline** is 15^{th} December midnight
- **Only** MATLAB or Python will be accepted
- Any plagiarism detected will lead to a zero in the entire programming assignments section i.e. a zero on twenty.
- Switching to project will not be allowed if plagiarism is detected.
- Libraries for Value Iteration are not allowed. Numpy is allowed and encouraged for python.
- Try to ensure that all of your code is contained in one .py or .m file only.
- All discussions pertaining to the assignment to be done on Piazza.
- Make one single zip file containing all the files and name it as 2017MTabcde_2.zip