Artificial Intelligence : Lab Exercise 1

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1 Motivation

Knowing the *right* decision is key. In this session, we will look at how *curse-of-dimensionality* makes decision making diffcult. To understand the difficulty, we will make *random* decisions, and study its effect as dimensions increase. Let us create the following three environments (in below S stands for state-space and A for action-space)

- *Line* environment whose state space is given by $S_{1-d} = \{0, 1, \ldots, L-1, L\}$, the agent starts at $s_0 = \lceil \frac{L}{2} \rceil$. There are 2 actions namely move left by one step and move right by one step.
- 2-*d Grid* environment has state space given by $S_{2-d} = S_{1-d} \times S_{1-d}$, the agent starts at $s_0 = (\lceil \frac{L}{2} \rceil, \lceil \frac{L}{2} \rceil)$. There are 4 actions namely move up, down, right, left by one step.
- Generalize the above to a 3-*d Grid* environment. The agent again starts at the center, and the agent has 8 actions (why?).
- Implement a random agent which performs a random action at any given state. Use *numpy.rand.randint* to generate random actions.
- The agent never leaves the grid, for illegal moves the agent stays in the same position.
- In all the evnironment the reward is 0 for all the states except for the goal state $s = (s(1), s(2), s(3))$, such that $\sum_{i=1}^{d} s(i) = dL$, where d is the dimension of the problem (this is the goal state). The reward at the goal state sis 1.
- The aim of the random agent is to reach the goal state.
- Measure the time it takes reach the goal in each of the cases. Try for cases $L = 2, 3, 4$. Is there any realtion to $|A|^{|S|}$?

2 Simple Traffic Simulator

It turns out that this can achieved by *Priority Queues* in a simple and neat manner. Please try that as well.

Deadline for submitting all the previous experiments is this weekend. As mentioned before, you can work in groups of 2-3. Please send the code to Rekha Raj C T (111804102@smail.iitpkd.ac.in)