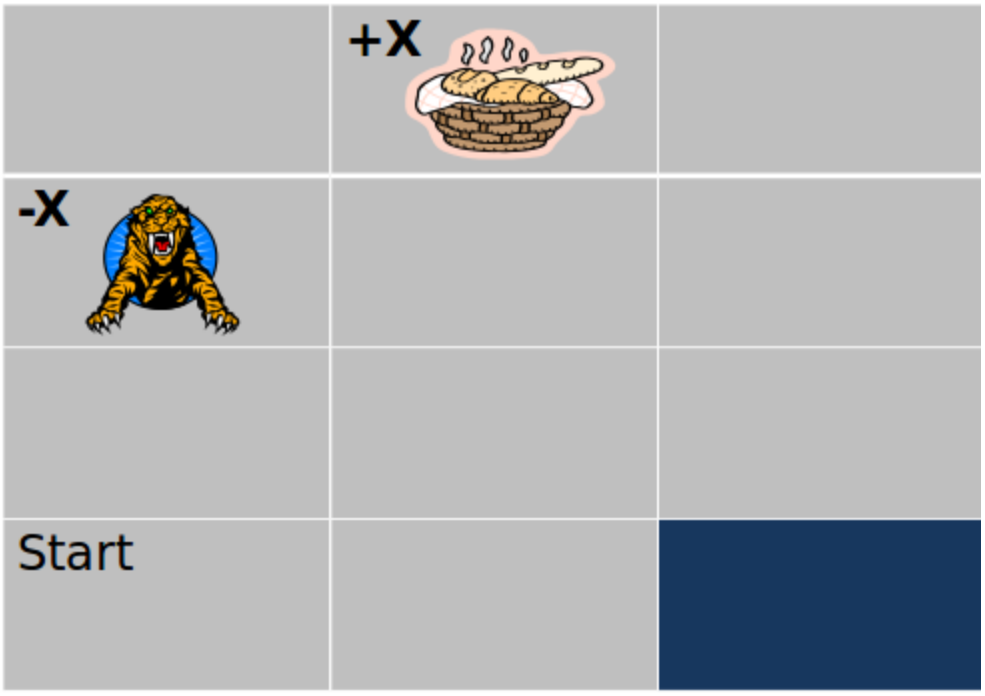
ASSIGNMENT 2

Deadline : 14.3.2015 11:59pm

This assignment consists of two parts :
a) Working out Value Iteration Algorithm on a MDP
b) Conversion into a Linear Programming problem and solving it.

The following figure is the grid world(MDP) you must consider while doing the assignment.



Problem Details :

1) Take X as your team number. If your team number is 10, your X value will be 10.
2) Consider Gamma = 1, Delta = 1/20 * X
3) Agent can go North, South, East or West
4) Action from state results in
    - Intended direction with .8 probability and
    - Each of the perpendicular directions with .1 probability
5) R(s,a) = -1/20 * X in non-terminal states
6) No action to be performed at terminal states.

Problem Statement :

Part A : Perform the Value Iteration algorithm manually on the above MDP to calculate the reward achieved for the given start state. The cell (0,1) is the positive sink whereas cell (1,0) is the negative sink. The dark colored cell is blocked(assume it is a wall). All the four corner sides of the matrix are also considered to be walls. Replace X with your respective reward value. The parameters gamma and delta are as mentioned above.

Part B : Modelling the above problem using LP show below.

$$\max(\mathbf{rx}) \mid \mathbf{Ax} = \boldsymbol{\alpha},\ \mathbf{x} \geq 0,$$

Q1: Model the parameters r, A and α
Q2: Use the excel LP solver to compute the x values and the expected reward for this MDP
Q3: Please verify that the expected reward obtained is equivalent to the one obtained using the VI algorithm. The VI value and LP value can differ at max by Delta*1.2.

Deliverables :

You are supposed to submit :

1. A pdf consisting of
    - Matrix for each iteration until convergence.
    - The final expected reward and the optimal path from Start to terminal.
    - Values of x and the expected reward derived from solving LP.
    - A brief description of why you think the expected rewards matched or did not.
2. Excel file or .ods(LibreOffice) file, showing the LP solved

You are supposed to upload the above files in a zipped folder with the name Assignment2_<TeamNo>.zip

A hardcopy of your rough work (detailed steps). Make sure you write down the steps in detail and neatly. All your calculations in the hard copy must be reflected in the matrix values submitted as pdf.

Additional Resources:

LP using Excel :

1. Load the solver add-in in Excel if not already installed. (It comes loaded with LibreOffice packages by default)
2. You can refer to the video to understand how to solve simple linear equations. https://www.youtube.com/watch?v=RicajFzoenk