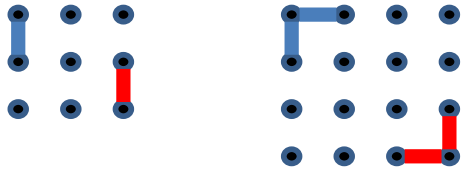
MARYLAND ROBOTICS CENTER
THE INSTITUTE FOR SYSTEMS RESEARCH

Homework #4

Due Apr. 29th, 6pm, (50 points)

(1) Program a game of Dots and Boxes:



Players take turns drawing lines to complete boxes. A player is allowed to take another turn after completing a box. The game concludes when no more lines can be drawn and all boxes are claimed.

Begin with a 2x2 grid. Assign a reward of +1 for completion of a box, +5 for a win, and 0 otherwise. Have it train itself to play through self-play and Q-learning. Use a table to store the Q-values. Compare performance against an automated player making random (legal) moves. Train for 100, 1000, and 10,000 games. Document improvement in performance against the random player as a function of the number of games of self-play.

(2) Change the grid size to 3x3 and repeat training. Evaluate the potential of using the Q-value table from (1) to seed learning (to initialize the Q-table).

(3) Replace the Q-value table from (1) with a functional approximation, such as a neural network. Use Q-learning to self-train (refine the Q-value functional mapping), and document the improvement in performance (against the random player) as a function of the number of games of self-play. Compare results obtained with performance from (1).

(4) Using a 3x3 grid and a functional approximation to represent the Q-values, train the system for 100, 1000, and 10,000 games. Document performance against a random player as a function of the number of games played. Compare with results from (2) and determine which Q-value representation is more effective: table or functional approximation.

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Deliverables:
A link to GitHub repository, named – (Homework title)

The repository should follow the following File tree and naming:
Repository
|- src (Containing All the source Codes)
|- Results (Containing output images/videos/other files)
|-Any other folder you want to include
|- Report.pdf
|- ReadMe.md
ReadMe should be well documented and contain all instructions