CS 747 Assignment-2

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1 Question - 1

1.1 Value Iteration

The algorithm stops when the norm of difference between value function and it's previous value is less than **0.00000001**

1.2 Linear Programming

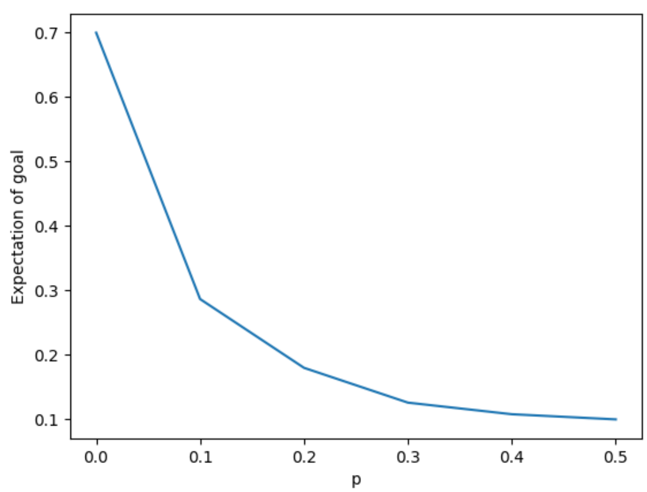
used **'PULP_CBC_CMD'** as the solver for linear programming with PuLP

2 Question - 2

2.1 Graphs and Observations

2.1.1 Varying p from 0 to 0.5

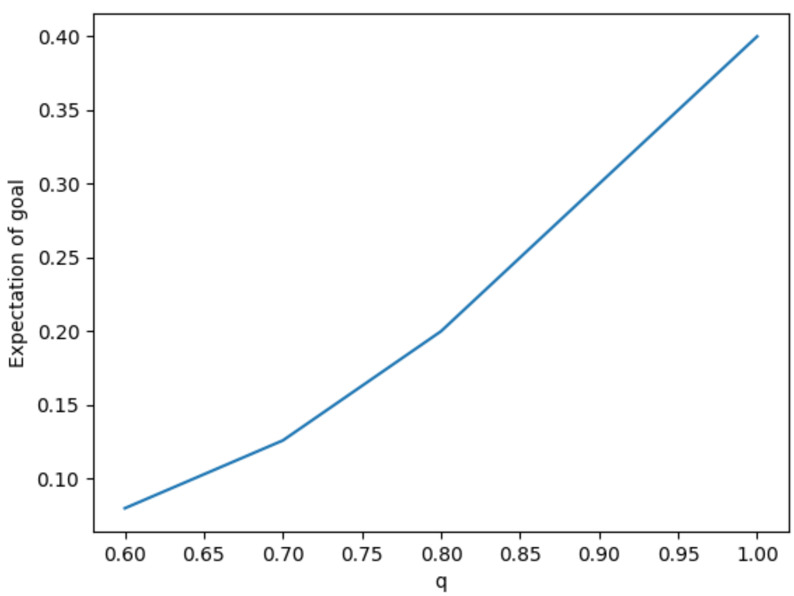
Plot for values p = [0, 0.1, 0.2, 0.3, 0.4, 0.5] and q = 0.7.



Observations:
Consider the case when $\mathbf{p = 0}$. In this scenario, the probability of successfully moving in any direction for B1 or B2(except when tackling) is 1. As R always follows B1, it can try to find a route from its current position to near the goal, where the probability of scoring a goal becomes its maximum, which is 0.7. If it directly attempts to score a goal from its current position, the probability is only 0.1.
Consider the case when $\mathbf{p = 0.5}$. In this scenario, the probability of successfully moving in any direction for B1 or B2 is 0, meaning they can aim for the target or pass the ball between them. The best possible action is to score directly, resulting in a probability of 0.1.
Between $\mathbf{p = 0}$ **and** $\mathbf{p = 0.5}$, it attempts to find the best possible situation for scoring a goal or moving closer to the goal.
As p increases, the expectation of scoring a goal gradually decreases. This is partly because of above explanation and also as p increases, the probability of ending the game on moving(2*p) and tackling (0.5+p) also increases, which in turn contributes to the decreasing expectation of scoring a goal.
The graph, as depicted in the data visualization, aligns closely with my intuition and expectations.

2.1.2 Varying q from 0.6 to 1

Plot for values q = [0.6, 0.7, 0.8, 0.9, 1] and p = 0.3



Observations:
Consider the case when $\mathbf{q = 1}$. The probability of scoring a goal from this position is 1 - 0.2*3 = 0.4, and the probability of moving in any direction with B1 is 0.4. Therefore, the maximum expectation it can achieve by moving from the current position is 0.4, rather it can simply choose the scoring the goal, so the expectation of goal is 0.4.
Consider the case when $\mathbf{q = 0.6}$. The probability of scoring a goal from this position = 0.6 - 0.6 = 0, and the probability of moving in any direction with B1 is 0.4. Therefore it has to move in a direction and goal from that position. So B1 move to right with success probability 0.4 and goal from that position with probability 0.2, overall probability of 0.08.
Between **q = 0.6 to q = 1**. It attempts to find the best possible situation to score a goal or move towards the goal.
As q increases, the expectation of scoring a goal gradually increases. This is partly because of above explanation and also as q increases, the probability of scoring a goal(q - 0.2*(3-x1)) increases, which in turn contributes to the increasing expectation of scoring a goal.
The graph, as depicted in the data visualization, aligns closely with my intuition and expectations.