Question 1

In Section 6.11 (Exercises), solve Problem (3).

(U, R), (D, L) are the Nash equilibriums in the game because both of them are pair of best responses to one others.

Question 2

In Section 6.11 (Exercises), solve Problem (4). In part (b), you must show the precise steps to arrive at your answers. Each part carries 2 points.

(a) Player A has no dominant strategy. If Player B chooses different strategy then Player A responses different strategy. But Player B has a dominant strategy. No matter what strategies Player A chooses, Player B chooses strategy L because it has the best payoff.

(b) Because strategy L is the dominant strategy for Player B, we only need to consider (t, L), (m, L), and (b, L). Since player A has the best payoff of 5 when choosing strategy b, (b, L) is the only Nash equilibrium in the payoff matrix.

Question 3

In Section 6.11 (Exercises), solve Problem (6). You must show precise steps on how you arrive at your answer for each part. Each part carries 3 points.

(a) (D, R) is the only Nash equilibrium in the payoff matrix because if Player A chooses D then R is Player B's best response, and if Player B chooses R then D is also Player A's best response.

(b) (U, L) is the only Nash equilibrium in the payoff matrix because if Player A chooses U then L is Player B's best response, and if Player B chooses L then U is also Player A's best response.

(c) For pure strategy, (U, R) and (D, L) are the Nash equilibriums because both of them are pair of best responses to one others. To find mixed strategy equilibrium, let the probability that player A uses strategy U be p and the probability that player B uses strategy L be q. The strategies must have equal expected payoffs. Let's start from q,

$$q + 4(1-q) = 3q + 2(1-q) \tag{1}$$
$$4 - 3q = q + 2 \tag{2}$$
$$q = \frac{1}{2} \tag{3}$$

And for p,

$$p + 3(1 - p) = 2p + 2(1 - p) \tag{4}$$
$$3 - 2p = 2 \tag{5}$$
$$p = \frac{1}{2} \tag{6}$$

Programming Question

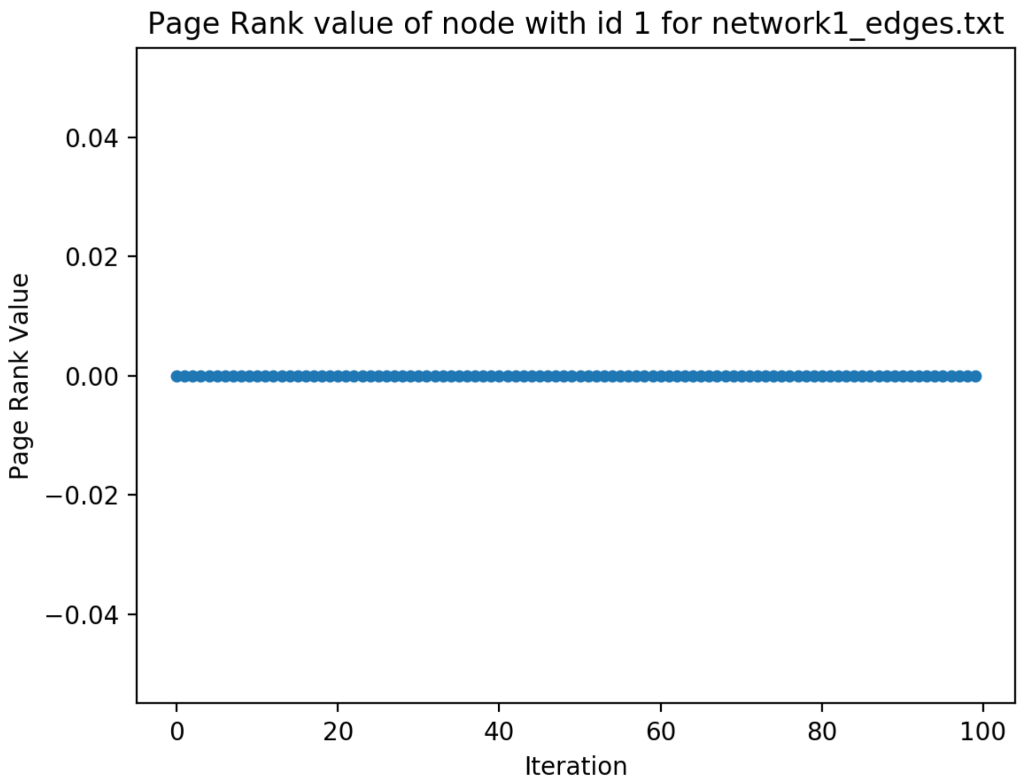
1. For a search query on category Sports, list out the top-10 nodes in decreasing order of pagerank for network1.

No.	Node	Value
1	22	0.07337147814497139
2	10	0.07336692613970157
3	3	0.05674003392784882
4	7	0.0481100988197505
5	2	0.035637325246298875
6	0	0.03134989001865639
7	17	0.012485129298648881
8	26	0.012482762945723975
9	16	0.007267142437929469
10	13	0.007266736188418042

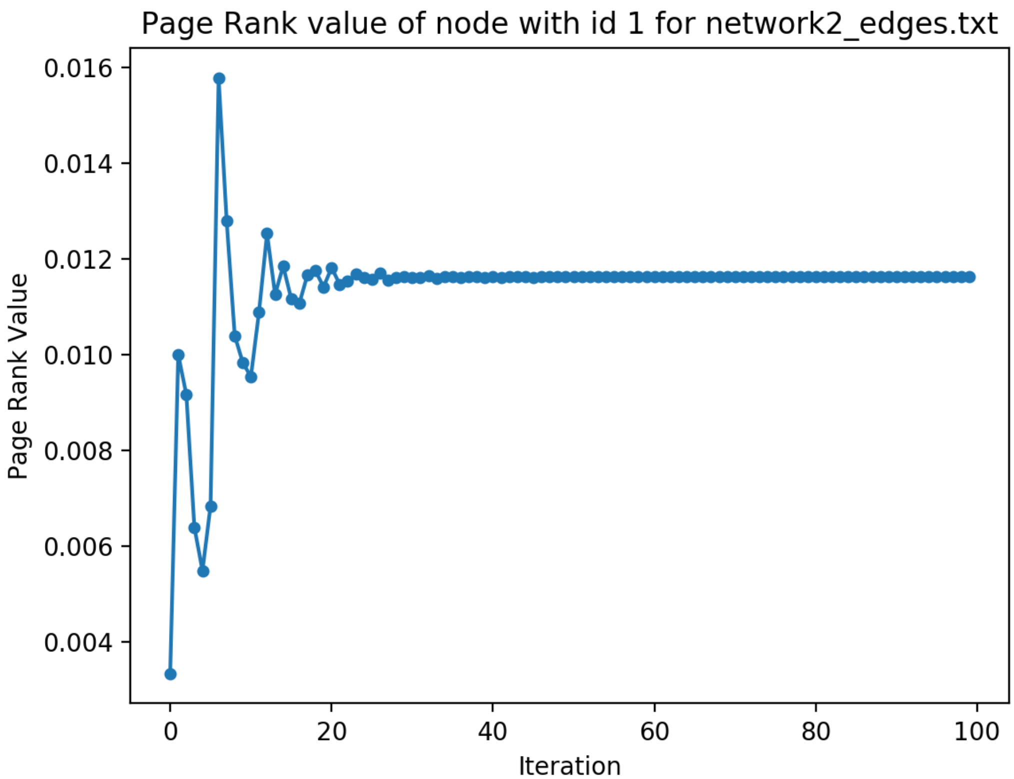
2. For a search query on category Politics, list out the top-10 nodes in decreasing order of pagerank for network2.

No.	Node	Value
1	30	0.051742896164872605
2	59	0.03836912833787751
3	57	0.03038112410481666
4	56	0.02877948949505145
5	33	0.0249041637599057
6	49	0.019186021715327593
7	31	0.01748788290177016
8	39	0.014388138711190181
9	65	0.014388138711190181
10	60	0.012935762500057324

3. Plot a graph showing the variation in page rank value of node with id 1 for network1 over 100 iterations.



4. Plot a graph showing the variation in page rank value of node with id 1 for network2 over 100 iterations.



5. Explain the difference in the page rank of Node 1 for the two networks.

   Because node with id 1 has no in-coming edge in network1, its value stays at 0 after the first iteration. On the other hand, there is a edge from 2 to 1 in network2 that causes the page rank value to converge at around 0.0116.