Yassin Dinana
52094480

Assessment 2
Part 3

Class Test 8

	A1	A2	A3	A4
A1	(0, 0)	(3,4)	(6,4)	(0, 5)
A2	(3,9)	(0, 0)	(3,5)	(3,9)
A3	(8,5)	(1,4)	(0, 0)	(3, 1)
A4	(10,9)	(5,1)	(4,6)	(0, 0)

A- In order to solve this question, the equation below will be used.

$$\frac{r-s}{r+s+2} \qquad (1)$$

Where r is presented as the sum of unsuccessful interactions that agents had with A4, unlike s, which is the sum of successful interaction that all agents had with A4.

$$r = r_{14} + r_{24} + r_{34}$$

$$r = 5 + 9 + 1 = 15$$

$$s = s_{14} + s_{24} + s_{34}$$

$$r = 0 + 3 + 3 = 6$$

In order to find the trust rescaled between -1 and 1, we use formula (1) provided above, therefore the answer will be:

$$Trust\ Value: \ \frac{15-6}{15+6+2} = \ 0.39$$

B- In order to formulate an opinion $w^{x}_{y} = (b^{X:Y}, d^{X:Y}, u^{X:Y})$, where w^{x}_{y} is agent X opinion on another agent which is agent Y. In order to formulate opinions, the following equations below are being used.

$$b(X:Y) = \frac{r-s}{r+s+2} \qquad (1)$$

$$d(X:Y) = \frac{r-s}{r+s+2} \qquad (2)$$

$$u(X:Y) = \frac{2}{r+s+2} \qquad 31)$$

As this problem is mainly based on belief and disbelief between different agents, the agents are presented differently, where *b* presented in the equations above is agent X belief in agent Y, where *d* is agent X disbelief in agent Y, and finally U presented in equation 3 is the successful interactions and communication between the two agents X and Y.

The equation above are also used to find the values of $w^{A4}_{A3} = (b^{A4:A3}, d^{A4:A3}, u^{A4:A3})$, $w^{A3}_{A1} = (b^{A3:A1}, d^{A3:A1}, u^{A3:A1})$, and finally $w^{A1}_{A2} = (b^{A1:A2}, d^{A1:A2}, u^{A1:A2})$.

Resulting in the answers below:

$$w^{A4}_{A3} = (0.50, 0.33, 0.17)$$

$$w^{A3}_{A1} = (0.33, 0.53, 0.13)$$

$$w^{A1}_{A2} = (0.14, 0.33, 0.22)$$

Finally, in order to calculate the discounted opinion $w^{A4}_{A3} \otimes w^{A3}_{A1} \otimes w^{A1}_{A2}$ the following equation is being used:

$$w^{A4}_{A3} \otimes w^{A3}_{A1} = w^{A4}_{A3} = (b^{A4:A3}, d^{A4:A3}, u^{A4:A3})$$

C- Below is matrix C with values C_{ij} ($i, j \in \{A_1, A_2, A_3, A_4\}$)

	A1	A2	A3	A4
A1	0.00	0.00	1.00	0.00
A2	0.00	0.00	0.00	0.00
A3	0.60	0.00	0.00	0.40
A4	0.20	0.80	0.00	0.00

The S matrix derived can be seen below:

$$S = \begin{bmatrix} 0 & -1 & 2 & -5 \\ -6 & 0 & -2 & -6 \\ 3 & -3 & 0 & 2 \\ 1 & 4 & -2 & 0 \end{bmatrix}$$

D- In order to solve this problem, the equation below will be used:

$$Tik = \sum_{j} CijCjk$$

Looking at t_{a3a2}, it can be computer using the equation above, the result would be

$$\boldsymbol{t_{A3A2} = C_{21}C_{12} + C_{22}C_{22} + C_{23C32} + C_{21}C_{42} = 0.32}$$

E- The algorithm below is the easiest to be used to compute the trust value of each student in the system using Eigentrust.

$\vec{t}^{(0)} = \vec{e};$
repeat
$\quad \vec{t}^{(k+1)} = C^T \vec{t}^{(k)};$
$\quad \delta = ||t^{(k+1)} - t^k||;$
until $\delta < \epsilon;$

The algorithm briefly states that the trust will be the same for all agents before actions start occurring, as there are 4 agents in our table, the agents will keep asking each other about the trust of the other agents' opinions such as A1 asking A2 about agent A3 for example. The algorithm will keep looking and repeating until all agents have asked each other and all agents have also been covered until the number of agents left is less than zero and no more than four.

This is the script I below it is producing a vector but problematically it only loops once. Which could be because n is not 'large':

```
import random
import numpy as np

eps = 0.001
C = np.array([[0,0,1,0], [0,0,0,0], [3/5,0,0,2/5],[1/5, 4/5, 0,0]])
C_T = C.T #transposing matrix C

t0=
np.array([[random.random()+0.01],[random.random()+0.01],[random.random()+0.01],[random.random()+0.01]])
```

```
t_final = []
delta = 0
t_old = t0
while delta <= eps:
t_new = np.matmul(C_T,t_old)
t_final.append(t_new)
delta = np.linalg.norm(t_new - t_old)

t_final = np.around(t_final,4)
print(t_final)
```