Social Network Analysis (Assignment)

Name: Dheeraj Chaudhary

Roll: 17BCS009

Requirements/Instruction to execute this file

- Install Python (I've used Python3.7) using the command

  ```
  sudo apt install python3.7
  ```

- Install Jupyter Nodebook using the command

  ```
  pip install notebook
  ```

- Install Networkx package using the command

  ```
  pip install networkx
  ```

- Install igraph package using the command

  ```
  pip install python-igraph
  ```

  Run the cells of this notebook using Shift + Enter

I have taken a dataset of Karate and dolphin network and applied **SEIRS** model at variying value of *time of seednode, probability, time of expose, time of recovery and time of being infectious*. I request you to please uncomment the respective line to test on the network you want. Though i have mentioned to uncomment whereeevr required

I got the following table of values (number of nodes in each state of epidemic) considering *Karate* network at a time after 10th day of Epidemic, at 0.4 probability

values of [seed_input], t_i, t_e, t_r	Susceptible	Exposed	Infected	Recovered
[2, 3], 2, 2, 2	6	11	5	12
[1, 6], 1, 4, 2	13	11	0	10
[1, 3, 7], 1, 5, 6	18	9	2	5
[1, 4, 5, 6, 9], 2, 7, 1	20	7	7	0

I got the following table of values (number of nodes in each state of epidemic) considering *Dolphin* network at a time after 10th day of Epidemic, at 0.4 probability

values of [seed_input], t_i, t_e, t_r	Susceptible	Exposed	Infected	Recovered
[2, 4], 1, 2, 3	39	14	5	4
[2, 5, 7], 2, 3, 1	34	17	7	4

values of [seed_input], t_i, t_e, t_r	Susceptible	Exposed	Infected	Recovered
[7, 9], 2, 4, 5	42	9	3	8
[1, 2, 3, 4, 5], 2, 3, 1	29	19	11	3

Infact, You can also test the code by giving manual input of all values of [seed_input], t_i, t_e, t_r along with changing the value of probability

In [1]:

```
import matplotlib.pyplot as plt
import networkx as nx
from igraph import *
import random
```

In [26]:

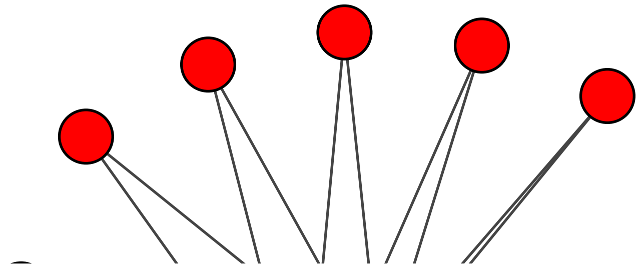
```
#karate network
graph_ = Graph.Read('/home/dheeraj/my_projects/my_project_env/practice/6th_sem_Acad


#dolphin network         UNCOMMENT BELOW LINE TO TEST ON DOLPHINS NETWORK
#graph_ = Graph.Read('/home/dheeraj/my_projects/my_project_env/practice/6th_sem_Aca
```

In [27]:

```
plot(graph_)
```

Out[27]:



In [16]:

```
graph_.vcount()
```

Out[16]:

```
34
```

In [22]:

```
# MAIN CODE
susceptiple_nodes = {0: {"status": "susceptible","color": "green", "timestamp": 0 }
for i in range(1, graph_.vcount()):
    susceptiple_nodes[i] = {"status": "susceptible","color": "green", "timestamp":
    susceptiple_nodes.update(susceptiple_nodes)

#INITIALIZE SEED NODE
# t_i = 1
# seed_node = [2,3]

t = int(input('Enter the day number on which you want to check the condition of epi

seed_node = []                                     ## Create an empty list for infec
n= int(input("Enter number of inital seeds(which are infected) that you want to giv

for i in range(0,n):
    seed_val = int(input('Enter seed value(infected seeds): '))
    seed_node.append(seed_val)                     ## Appending the seeds

print(' seed input given by the user is: ', seed_node)        ## Prints the seed li



for key in seed_node:
    susceptiple_nodes[key]["status"] = "infectious"
    susceptiple_nodes[key]["color"] = "red"
    susceptiple_nodes[key]["timestamp"] = t_i

#INITIALIZE TIMESTAMPS AND PROBABILITY
# t_e = 1
# t_r = 1
p = 0.4
t_i = int(input('Enter the time of infection: '))
t_e = int(input('Enter the time of exposed: '))
t_r = int(input('Enter the time of recovery: '))
# p = input('Enter the probability of spreading in neighbors: ')
# # susceptible_nodes = list()
exposed_nodes = list()
recovered_nodes = list()

def neighbors(graph_,node):
    neighbour_nodes = graph_.neighbors(node)
    return neighbour_nodes

# INITIALIZE t for number of iterations
# t=10
day = 0
while(t):


    day = day + 1
    print("DAY"+ str(day) )
    # TRANSITION SUSCEPTIBLE TO EXPOSED
    for node in seed_node:
        for j in neighbors(graph_,node):
            prob = random.uniform(0,1)
            if prob <= p and susceptiple_nodes[j]["status"] == "susceptible" :
                susceptiple_nodes[j]["status"] = "exposed"
                susceptiple_nodes[j]["timestamp"] = t_e
                susceptible_nodes[j]["color"] = "yellow"


    # TRANSITION INFECTIOUS TO RECOVERED
    for i in range(0, graph_.vcount()):
        if susceptible_nodes[i]["status"] == "infectious":
            if susceptible_nodes[i]["timestamp"] >= 0:
                susceptible_nodes[i]["timestamp"] = susceptible_nodes[i]["timestamp
            else:
                seed_node.remove(i)
                susceptible_nodes[i]["status"] = "recovered"
                susceptible_nodes[i]["timestamp"] = t_r
                susceptible_nodes[i]["color"] = "blue"

    # TRANSITION RECOVERED TO SUSCEPTIBLE
    for i in range(0, graph_.vcount()):
        if susceptible_nodes[i]["status"] == "recovered":
            if susceptible_nodes[i]["timestamp"] >= 0:
                susceptible_nodes[i]["timestamp"] = susceptible_nodes[i]["timestamp
            else:
                susceptible_nodes[i]["status"] = "susceptible"
                susceptible_nodes[i]["timestamp"] = 0
                susceptible_nodes[i]["color"] = "green"

    # TRANSITION EXPOSED TO INFECTIOUS
    for i in range(0, graph_.vcount()):
        if susceptible_nodes[i]["status"] == "exposed":
            if susceptible_nodes[i]["timestamp"] >=0:
                   susceptible_nodes[i]["timestamp"] = susceptible_nodes[i]["timest
            else:
                susceptible_nodes[i]["status"] = "infectious"
                susceptible_nodes[i]["timestamp"] = 0
                susceptible_nodes[i]["color"] = "red"
                seed_node.append(i)
    count1=0
    count2=0
    count3=0
    count4=0
    print("SUSCEPTIBLE NODES")
    for i in range(0, graph_.vcount()):
        if susceptible_nodes[i]["status"] == "susceptible":
#             print(i)
            count1=count1+1
    print(count1)
    print("EXPOSED NODES")
    for i in range(0, graph_.vcount()):
        if susceptible_nodes[i]["status"] == "exposed":
#             print(i)
            count2=count2+1
    print(count2)

    print("INFECTED NODES")
    for i in range(0, graph_.vcount()):
        if susceptible_nodes[i]["status"] == "infectious":
#             print(i)
            count3=count3+1
    print(count3)
    print("RECOVERED")
    for i in range(0, graph_.vcount()):
        if susceptible_nodes[i]["status"] == "recovered":
#             print(i)
```

```
            count4=count4+1
    print(count4)

    t= t-1
    print("\n")
```

```
Enter the day number on which you want to check the condition of epi
demic: 10
Enter number of inital seeds(which are infected) that you want to gi
ve: 2
Enter seed value(infected seeds): 2
Enter seed value(infected seeds): 3
 seed input given by the user is:  [2, 3]
Enter the time of infection: 2
Enter the time of exposed: 2
Enter the time of recovery: 2
DAY1
SUSCEPTIBLE NODES
27
EXPOSED NODES
5
INFECTED NODES
2
RECOVERED
0
```