

## Dynamics in complex networks

### Introduction

I've developed the algorithm using Python and Networkx library. You can see the code in the PAC4.py file (attached in this zip file).

These are the parameters:

```
python PAC4.py
Usage: python PAC4
    network (Pajek file)
    u (spontaneous recovery probability - in %)
    B (infection probability - in %)
    nrep (number of repetitions simulation)
    pinit (initial fraction of infected nodes - in %)
    tmax (maximum time steps of each simulation)
    ttrans (number of steps of the transitory)
```

For example,

```
python PAC4.py A3-networks/toy/star.net 10 100 30 10 100 90
```

the algorithm uses the star.net network with a spontaneous recovery probability of 10%, infection probability of 100%, and will do 30 different simulations. The initial fraction of infected nodes are 10%, the maximum time steps of each simulation = 100 and the algorithm will mark the first 90 steps as transitories.

The program returns a single line representing the infection probability and the final value of p ( the average over averages in the different simulations about the infected nodes). For this case, this is the value we get:

```
100    56.2176717133
```

this line means that, in this network and by using these parameters, with a infection probability of 100, the number of infected nodes will be about the 56% after the transitory steps using the mean in all the simulations.

Also, I've developed a simple script to launch the algorithm by changing the infection probability. This is the code of this launch.sh (also attached in this zip file):

```
#!/bin/bash

for i in `seq 1 100`
do
    python PAC4.py A3-networks/toy/star.net 10 $i 30 100 100 90 >> data.dat
done
```

It is possible to plot this data.dat using GNUPlot software.

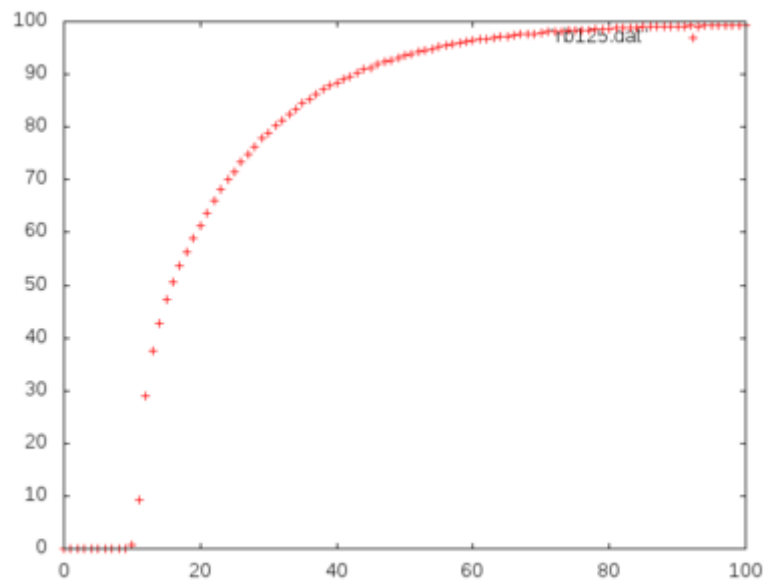
Right now, we will analyze, in different networks and different infection probabilities, the evolution of this final value p in function of the infection probability B.

**A1-networks/model/rb125.net**

```

u (spontaneous recovery probability - in %): 50
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 100
pinit (initial fraction of infected nodes - in %): 20
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

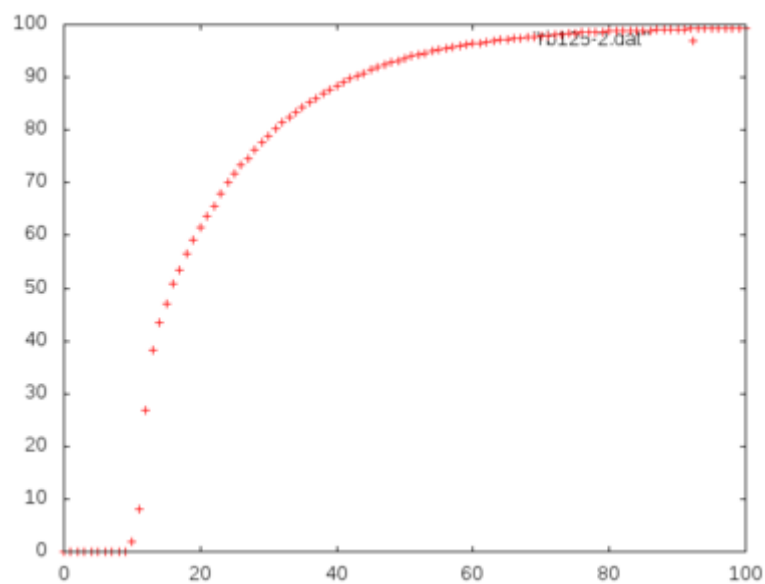
```



```

u (spontaneous recovery probability - in %): 50
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 100
pinit (initial fraction of infected nodes - in %): 60
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

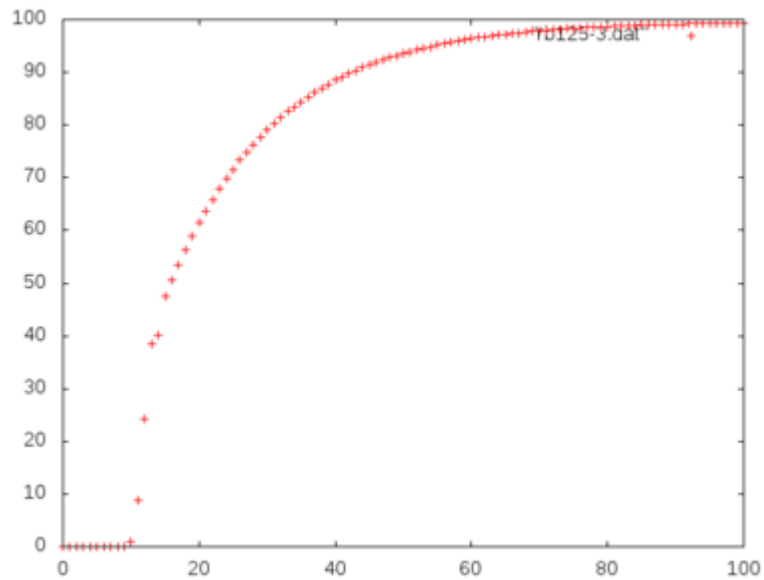
```



```

u (spontaneous recovery probability - in %): 50
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 100
pinit (initial fraction of infected nodes - in %): 90
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

```

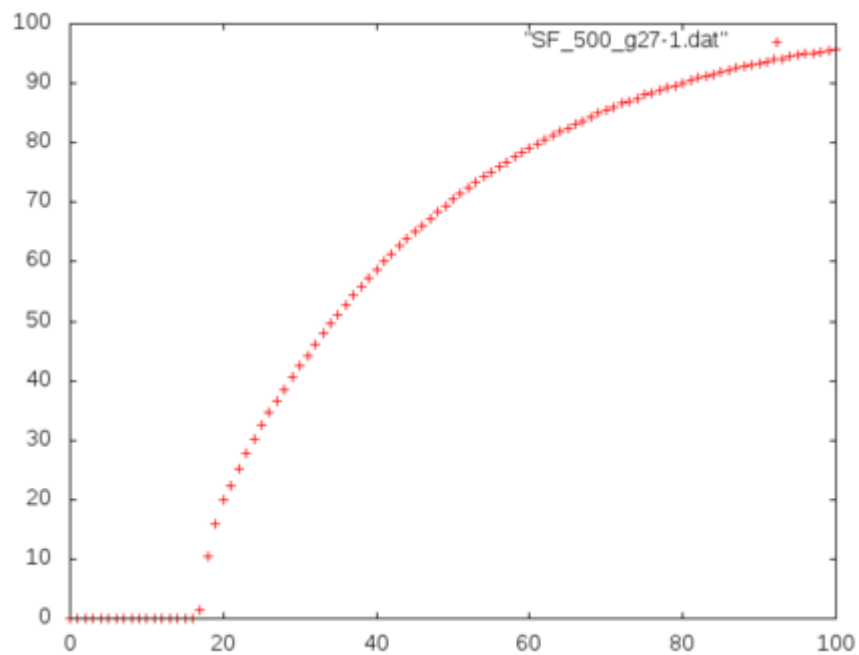


### A1-networks/model/SF\_500\_g2.7.net

```

u (spontaneous recovery probability - in %): 50
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 100
pinit (initial fraction of infected nodes - in %): 20
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

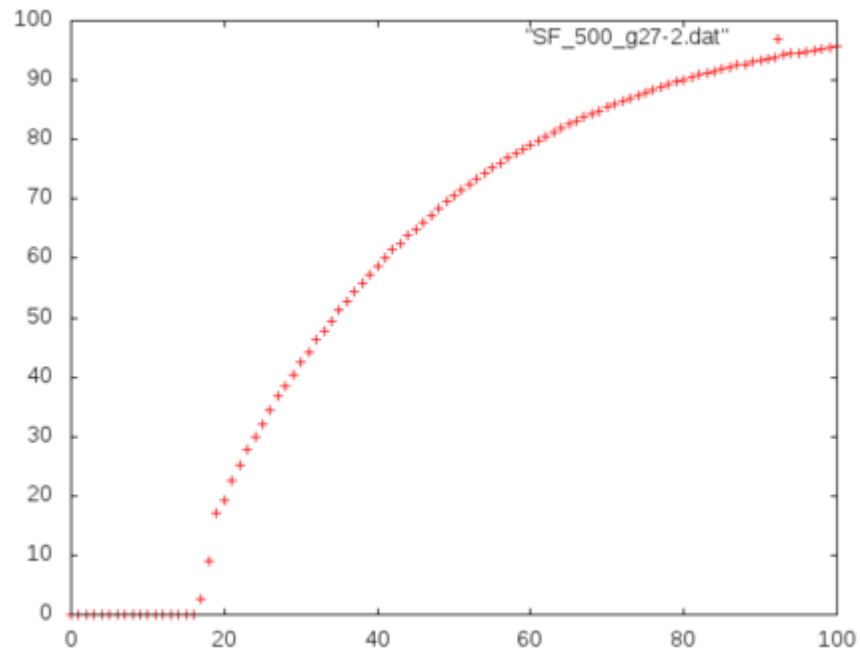
```



```

u (spontaneous recovery probability - in %): 50
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 100
pinit (initial fraction of infected nodes - in %): 60
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

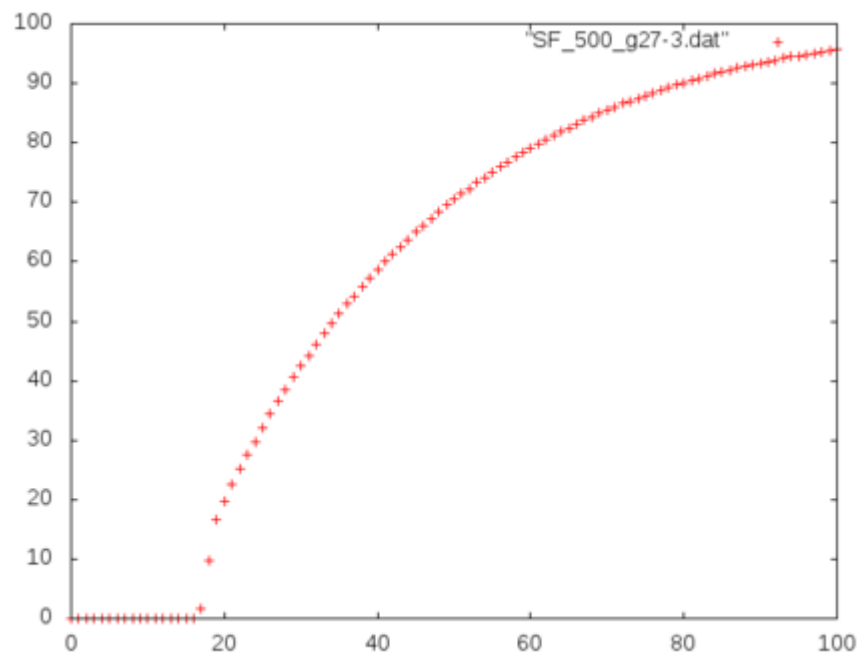
```



```

u (spontaneous recovery probability - in %): 50
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 100
pinit (initial fraction of infected nodes - in %): 90
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

```

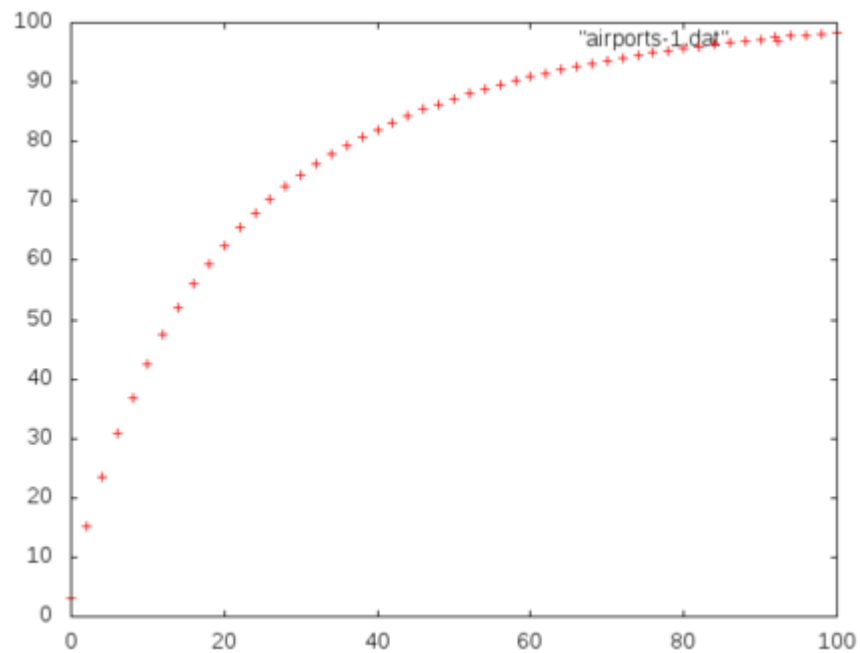


**A1-networks/real/airports\_UW.net**

```

u (spontaneous recovery probability - in %): 30
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 10
pinit (initial fraction of infected nodes - in %): 10
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

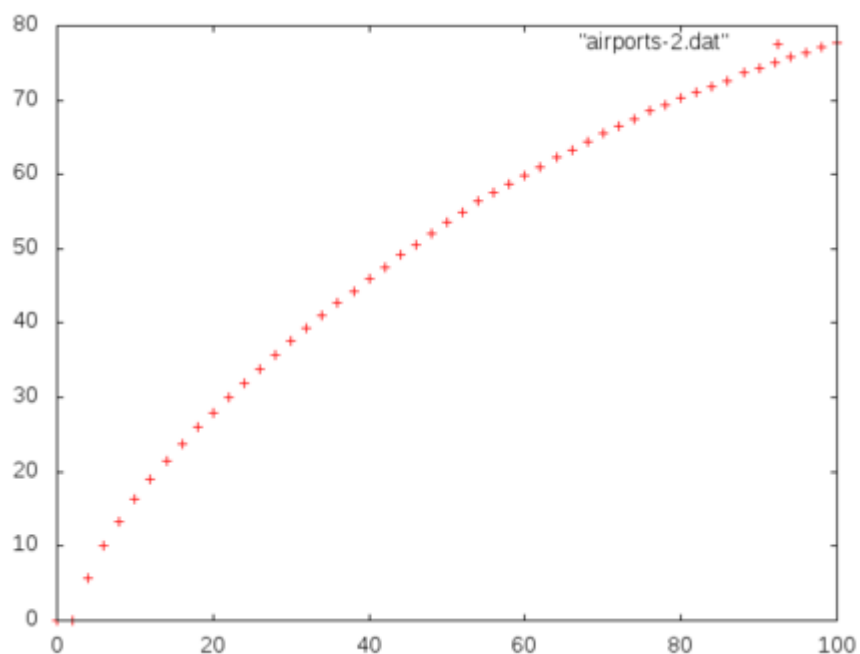
```



```

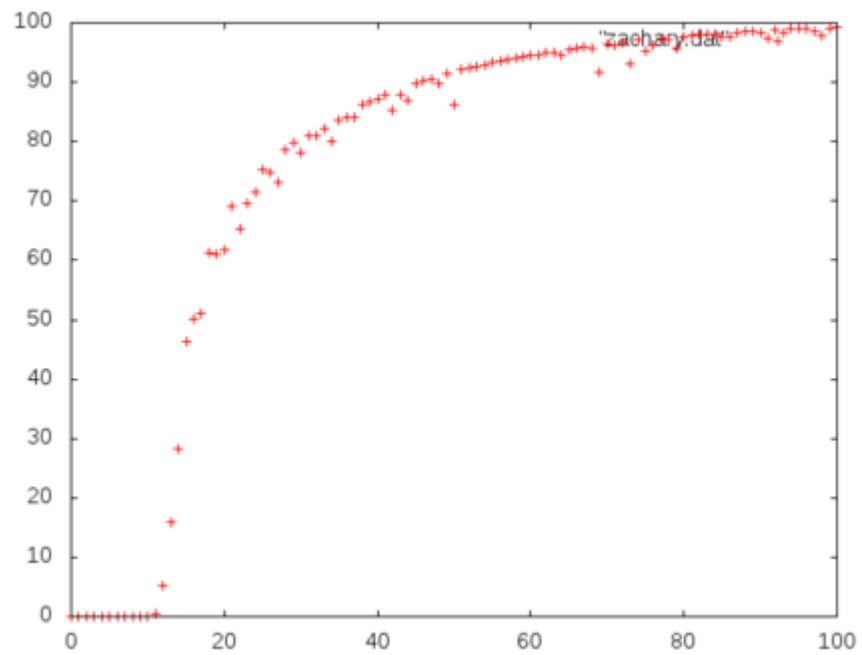
u (spontaneous recovery probability - in %): 80
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 10
pinit (initial fraction of infected nodes - in %): 60
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900

```



**A1-networks/real/zachary\_unwh.net**

```
u (spontaneous recovery probability - in %): 30
B (infection probability - in %): x axis
nrep (number of repetitions simulation): 100
pinit (initial fraction of infected nodes - in %): 20
tmax (maximum time steps of each simulation): 1000
ttrans (number of steps of the transitory): 900
```



**A1-networks/model/ER1000k8.net**

u (spontaneous recovery probability - in %): 30  
B (infection probability - in %): x axis  
nrep (number of repetitions simulation): 100  
pinit (initial fraction of infected nodes - in %): 20  
tmax (maximum time steps of each simulation): 1000  
ttrans (number of steps of the transitory): 900

