



NETWORKS

Investigating Six Degrees of Separation

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Networks, Graphs, Small Worlds

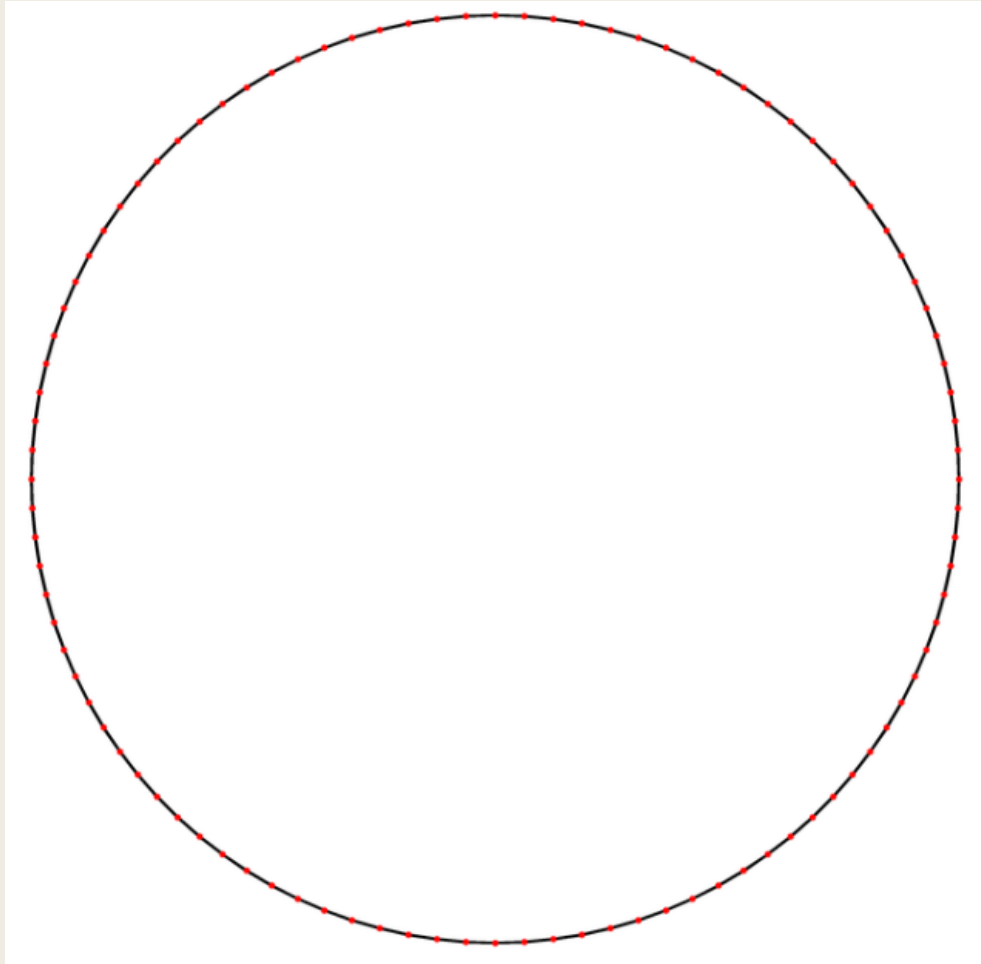
- A network or graph contains a set of objects/nodes
 - *Example: People*

- Objects are in some way related through edges/lines
 - *Example: Relationships among people*

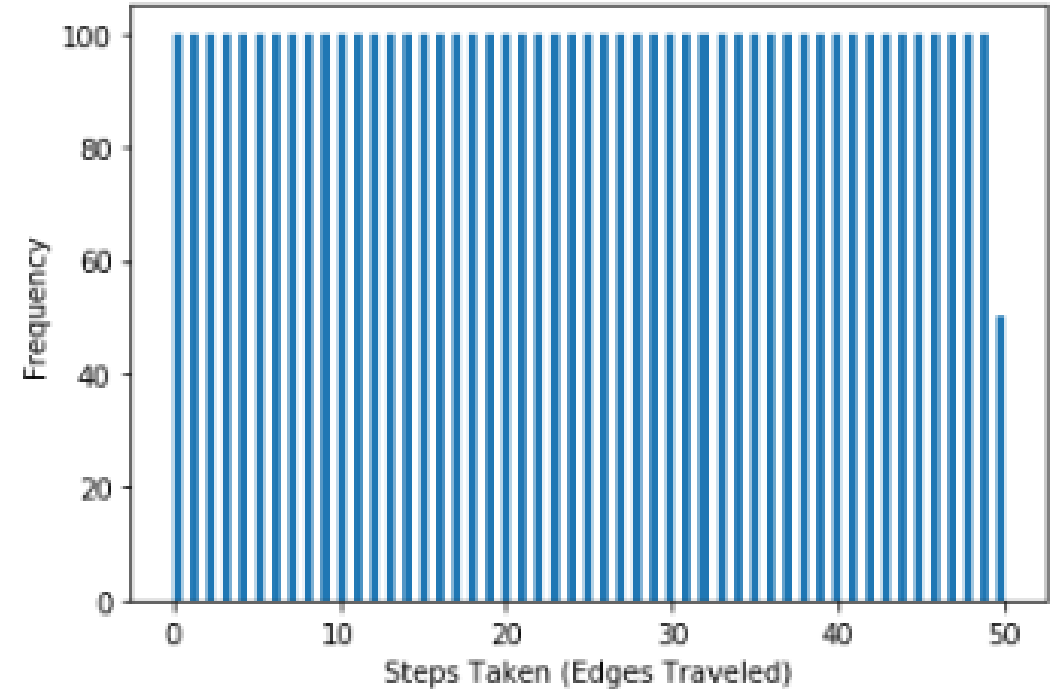
What is 'Six Degrees of Separation?'

- The idea that any random pair of people are connected by a short chain of people
- Typically thought to be around 6
- We can model this with networks or 'Small Worlds'
 - *We will use a small world of 100 people*
 - *Each person has a relationship with their 2 nearest neighbors*
 - *Ringed shape*

Small World of 100 people

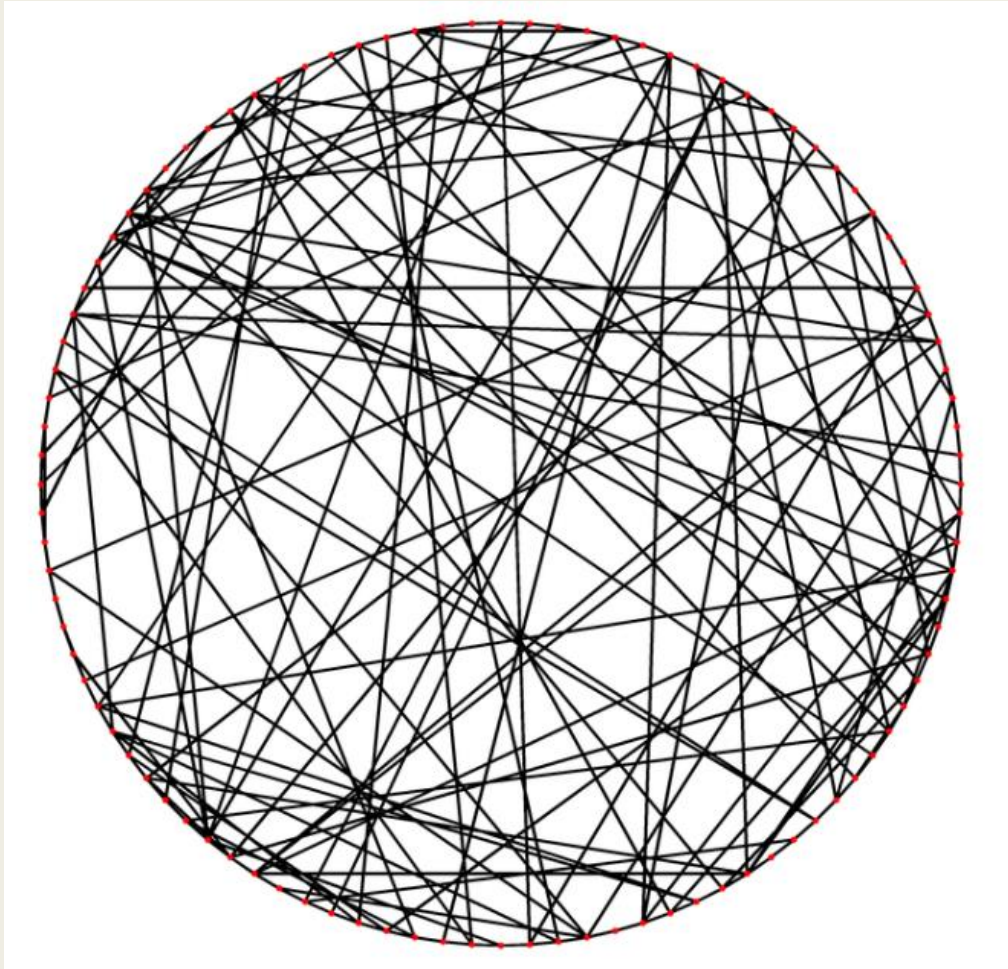


Distribution of Number of Edges Traveled For Every Pair of Nodes.

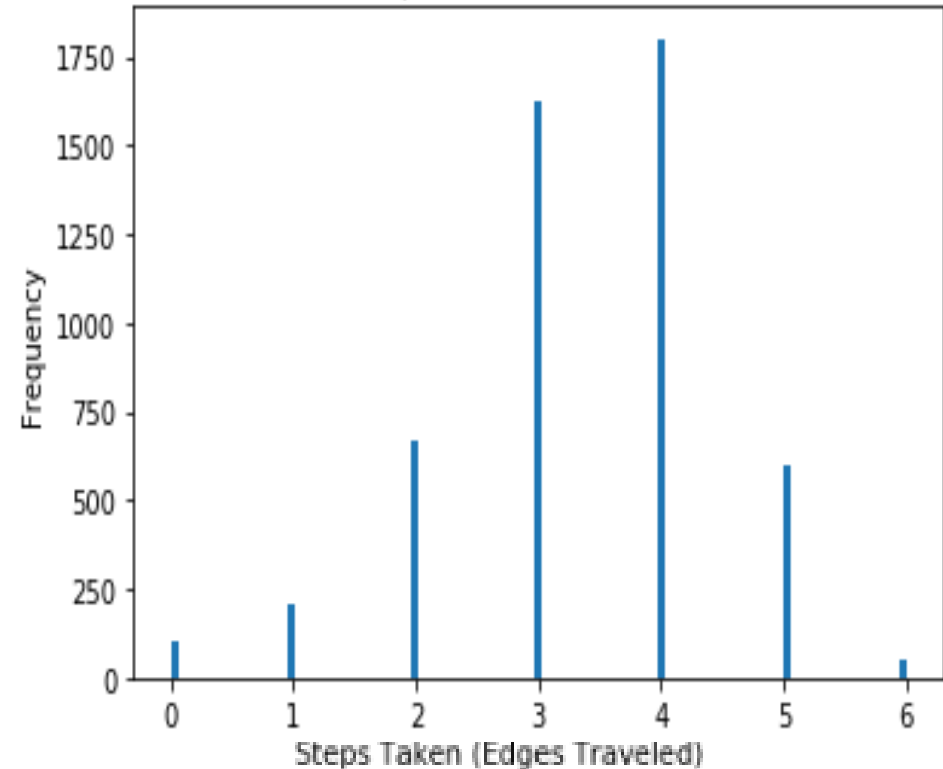


How many additional random lines must we add to achieve six degrees?

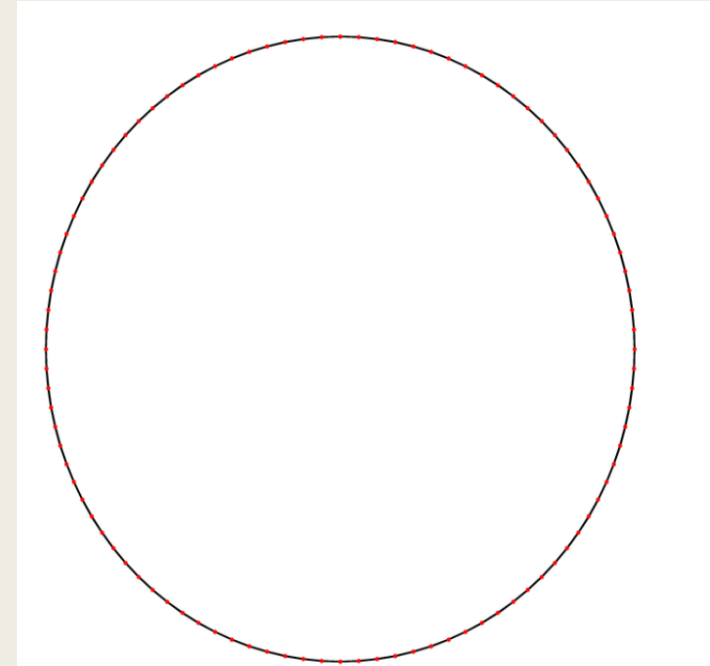
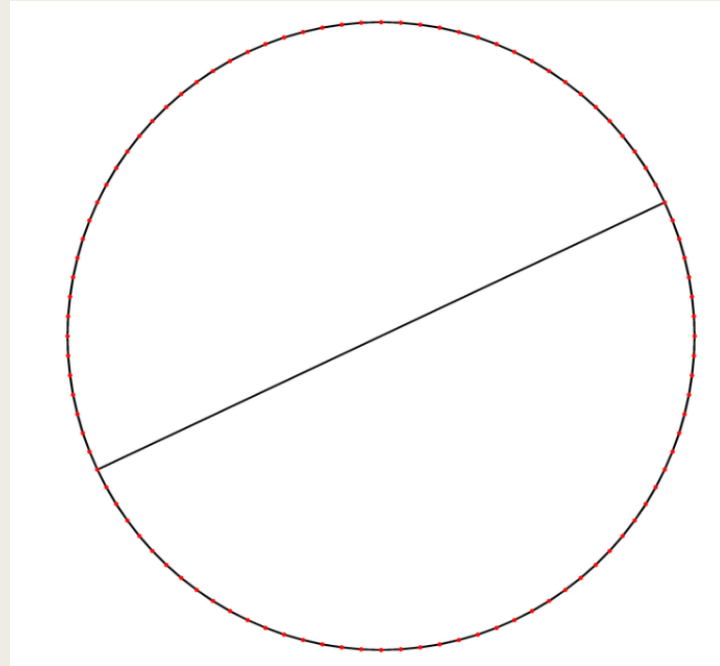
I found six degrees of separation with 106 additional random relationships



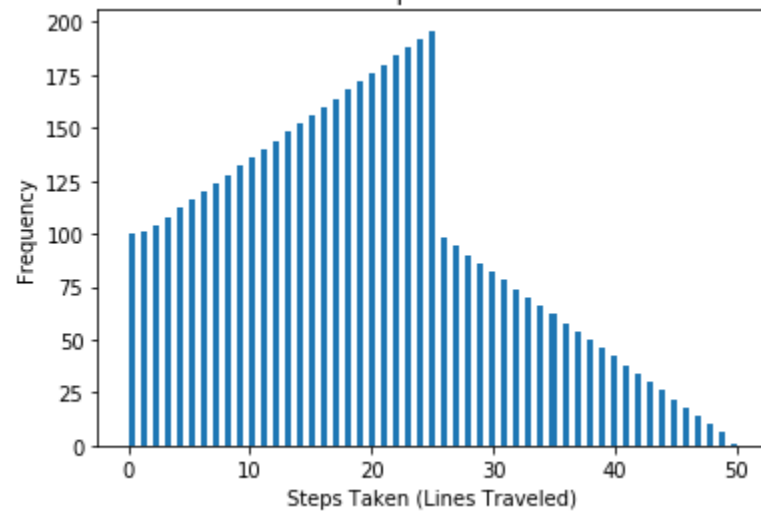
Distribution of Number of Steps From Each Node to All Other Nodes.



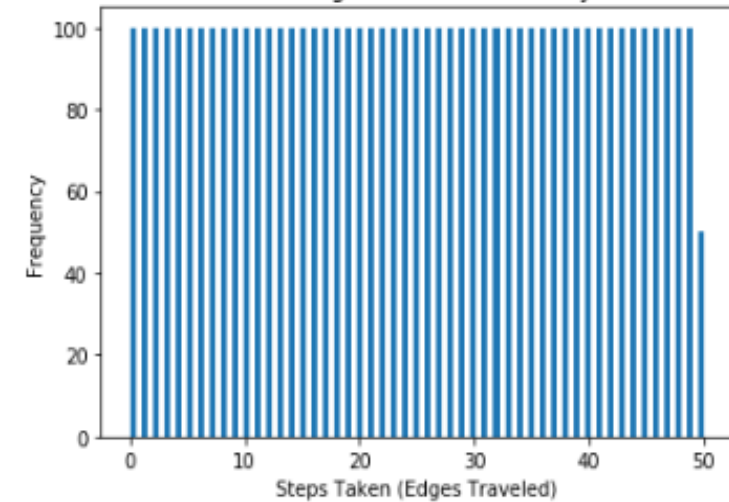
Why does Six Degrees Happen?



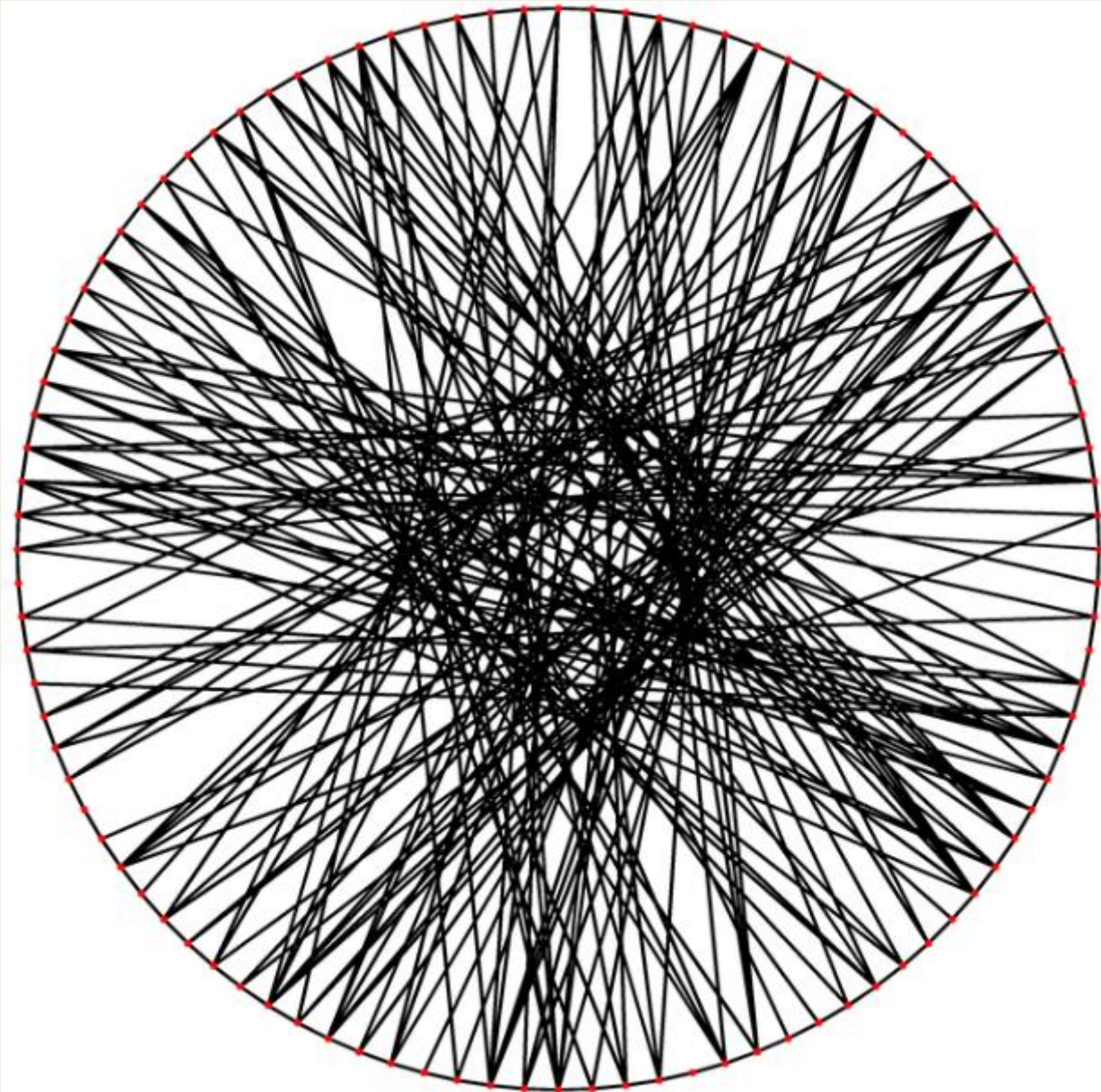
Depth = 50



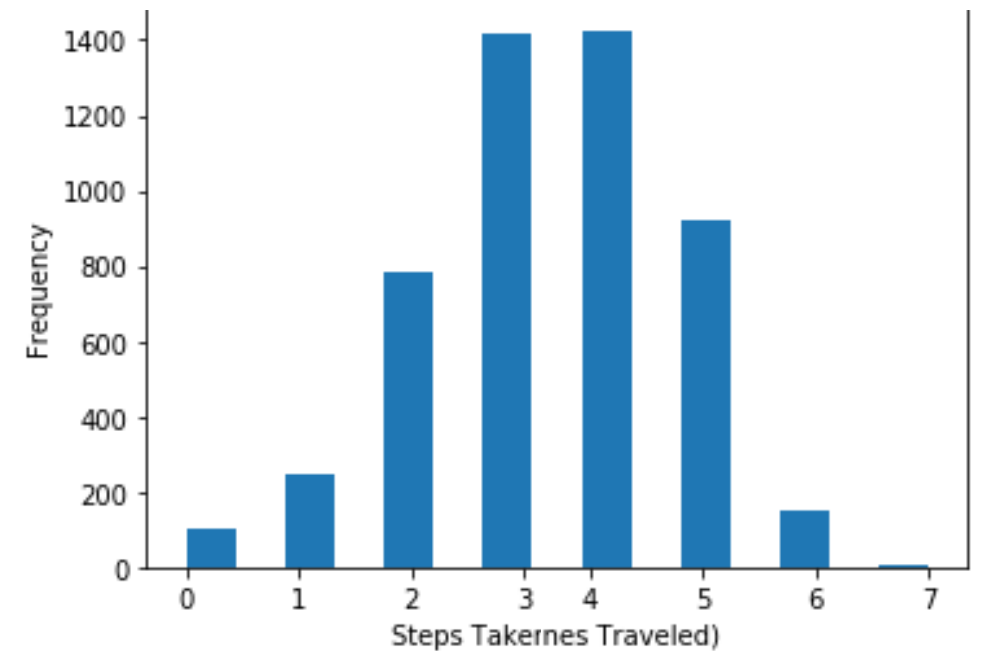
Distribution of Number of Edges Traveled For Every Pair of Nodes.



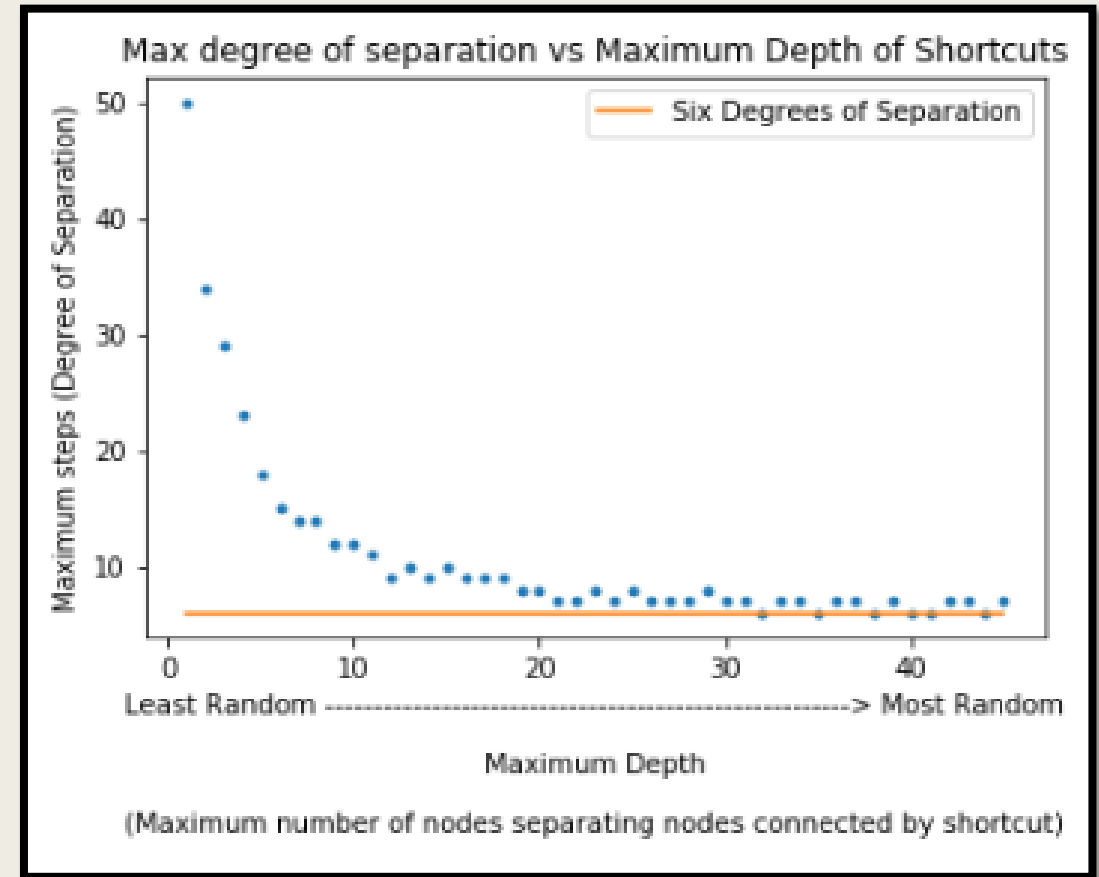
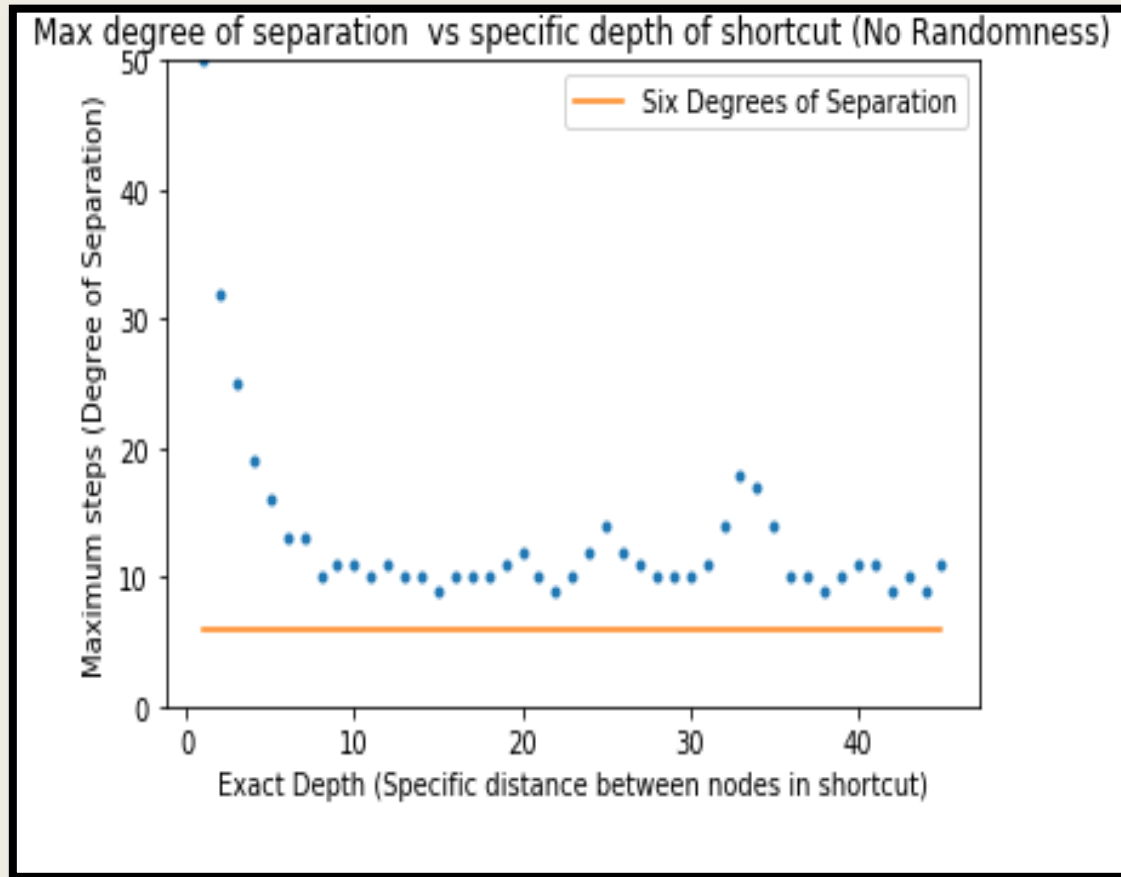
So do we just need long connections?



Long Relationships, 150 additional, depth = 41



We achieve six degrees of separation if there is randomness



- Constant 106 random lines drawn and constant 100 nodes; varied depth of relationships

Conclusion

- Randomness is needed to achieve six degrees of separation
- Example: Trying to get a package to someone in Beijing from U.S
- Need both:
 - *long relationships (large depth)*
 - *short relationships (short depth)*