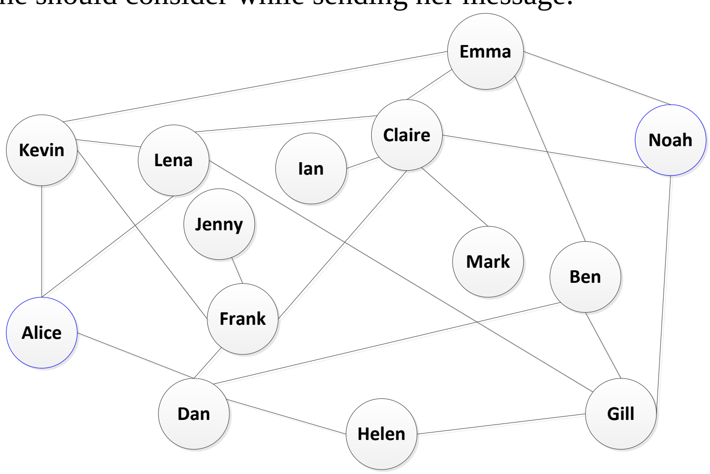
CSCI 561: Foundations of Artificial Intelligence

Instructor: Prof. Laurent Itti

Homework #1: Uniformed Search

Due on February 13 at 11:59pm, Los Angeles time, 2013

In this assignment, we will re-examine the small-world experiment in social network using uniformed search algorithms. For those who are not familiar with the experiment, please refer to [1][2]. To give you a realistic and modern context, we twist the experiment and put it into a limited scope of a simplified social network. Suppose ***Alice*** is a graduate student in computer science at USC, and she wants to start her own IT company by applying a great idea. She has to look for investment from industry. ***Noah*** catches her eye as a CEO of a notable venture capital company. ***Alice*** plans to send ***Noah*** a message and give her an outline of the startup plan. To make herself reliable, ***Alice*** thinks it's good to send the message via Facebook to someone ***Noah*** trusts and who is also her friend in an effort to convey the message. Thanks to Facebook, ***Alice*** is able to see the friends ***Noah*** has. Unfortunately, ***Alice*** cannot find any mutual friends she has with ***Noah***. However, with the help of one of her friends, who is an expert in social network mining, she manages to find the relevant people who might be able to forward her message. The following figure depicts the social network, where links between two nodes represent "friend" relationship between the two people. There are three factors she should consider while sending her message:



1. To transmit the message as efficiently as possible, ***Alice*** will use a postscript in her message to tell anyone who receives the message that she/he should only forward it to her/his friend(s). This means the message is forwarded along the "friendship" links in the social network. Otherwise, Alice could be at risk of failure in delivering the message since one would not forward the message if she/he receives from someone unknown to her/him.
2. The delivery time is one of ***Alice***'s concerns. Her expert friend helped estimate the reaction time it takes for one to receive a message from another person and forward the message. It was done by mining the social interactions in Facebook. To deliver the message as soon as possible, ***Alice*** should choose a traversal path that is optimal.
3. As you know, online social networks such as Facebook are not quite reliable in terms of privacy protection. While sending the message, there is a certain chance that the message

gets disclosed and becomes “public”. This is definitely not what Alice wants. Her expert friend also calculated a risk value for the message getting disclosed when it is sent between two people. A higher risk value indicates a greater risk.

You will need to write a program to implement the following search algorithms, to help ***Alice*** find optimal traversal path(s) to send her message to reach ***Noah***.

1. Breadth-first search (30 pts)
2. Depth-first search (30 pts)
3. Uniform-cost search
   - Using time as cost (20 pts)
   - Using risk as cost (20 pts)

Input: You are provided with a file social-network.txt based on Figure 1. Each line describes the reaction time for the recipient to forward the message, and the risk of disclosing the message as well. A sample line would be:

Lena Claire 17 39

This represents that it takes 17 hours for ***Claire*** to react and forward the message if ***Lena*** send the message to ***Claire***. The risk of disclosing the message is 39 while sending the message between them. Please note that you may assume the friendship is mutual, so it also takes equal amount of time to send the message from ***Claire*** to ***Lena***. It also applies to the risk value.

Output: The program should output the nodes (separated by “-”) in the order that show the path of forwarding the message. For example, Alice-Dan-Ben-Emma-Noah**.**

There should be four .txt output files for all algorithms (one for each algorithm).

1. breadth-first.result.txt
2. depth-first.result.txt
3. uniform-cost.time.result.txt
4. uniform-cost.risk.result.txt

Suggestion: To make sure your program outputs the right results. You may compute each result manually and compare it with that of your program.

Deliverables:

1. You are required to hand in well documented code that implements the specified program, and your output files as well. Please include a readme.txt that describes how to compile and execute your code, as well as any comments you may have. Please turn in all materials as a **.zip** file via the **Blackborad** by **11:59pm, Feb. 13, 2013** with the title format [firstname]_[lastname]_HW1.zip (e.g., Mark_Zuckerberg _HW1.zip).
2. Implementation language is not important. You are free to choose the one that you feel most comfortable with. However, if you code in C, C++, C#, or Java, the TA will be better able to assist you ☺.

References

[1]. http://en.wikipedia.org/wiki/Small-world_experiment
[2]. http://www.cs.cornell.edu/home/kleinber/swn.d/swn.html