Willis Allstead
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CS 491

<center>Lab 2</center>

Social Networks

Exercise 1.6.6: The usage patterns of users between two websites can range from very similar to completely different. Some behaviors that tend to stay consistent might include what a user is interested in and what they attempt to either find information or entertain themselves with. The activities a user engages in changes from site to site based on the purpose of the site. Sites like Reddit and Hacker News promote behavior such as commenting on shared links and text posts, while sites like Etsy promote behavior such as rating sellers and purchasing items from small businesses or individuals. A reason for these differences can be as simple as websites needing to differentiate what they offer. These websites might be labeled as services, but they are also products in the way that they are iterated upon and developed for their users. And as products need to stand out amongst their competition, so do websites.

Exercise 1.6.9: One prominent concept regarding information sharing on social media that has become very well known in our culture is that of "over-sharing". Over-sharing is the phenomena when you are on, say, Facebook and you see a friend share something that they probably shouldn't have shared in such a public way. You might feel embarrassment for that person, but what they are doing is not as much out of the ordinary as it once was. Another arguably more pressing side effect of information sharing on social media that relates to over-sharing is that of echo-chambers. Echo-chambers are created when groups of like-minded individuals find each other and create communities of people who only reaffirm each other's thoughts. These echo chambers can be very negative in the way that they can split larger groups into small factions of people who only think a certain way and are not open to any other ways of thinking. If a social network is not designed to inhibit the growth of echo chambers, they could see their network devolve into disconnected groups of like-minded individuals.

Graph Essentials

Exercise 2.9.2: Assuming the graph is a finite undirected graph, this set of degrees is not possible since by the Handshaking Lemma, only every finite undirected graph has an even number of vertices with odd degree. This graph has 3 vertices with an odd degree, proving that this graph cannot exist.

Exercise 2.9.3: (labeling rows and columns 0-8 from top to bottom and left to right)
Adjacency List:

```
0 -> 1, 2
1 -> 0, 2
2 -> 0, 1, 3, 4
3 -> 2, 4, 5, 6
4 -> 2, 3, 5, 6
5 -> 3, 4, 6, 7
6 -> 3, 4, 5, 7
7 -> 5, 6, 8
8 -> 7
```

```
(Edge list on next page)
```

Edge List:

```
[[0,1], [0,2],
 [1,2],
 [2,3], [2,4],
 [3,4], [3,5], [3,6],
 [4,5], [4,6],
 [5,6], [5,7],
 [6,7],
 [7,8]]
```

Bonferroni's Principle
Exercise 1.2.2:

If someone is picking out of 1000 items, only 10 items there are $\binom{1000}{10}$ ways that those items can be chosen and there is a $1/\binom{1000}{10}$ probability of another person choosing that same items. If each person out of the 100 million people goes to the supermarket 100 times per year and buys 10 out of the 1000 items the supermarket sells, we need to figure out how many pairs of people will be buying things at the same time. $100\binom{100,000,000}{2}$ is the amount of pairs of people buying things in the store at the same time. To figure out the probability of one of those pairs buying the exact 10 items at the same time, we simply divide the amount of pairs on any day by the probability that a single pair would choose the exact same 10 items. Our result is

$$\left(100\binom{100,000,000}{2}\right) * \left(\frac{1}{\binom{1000}{10}}\right) \approx 1.89 * 10^{-6}$$

This very small probability means that our error rate should be extremely low using the rules set by the prompt. Therefore, if we found a pair of people that fall under the rules of the prompt, we can almost guarantee that they are terrorists.