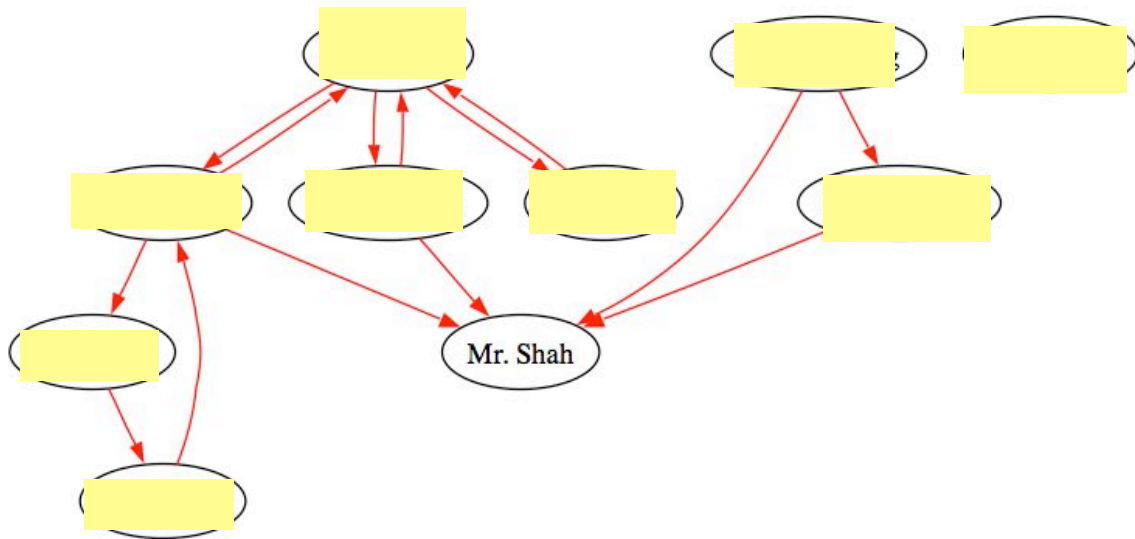


Matrices, Facebook, and Food Webs: Oh My!

So I was browsing (okay: stalking) PackerFacebook late last night and noticed some Packer faculty were on it. “Interesting... Very interesting...” I thought as the online stalking began. The thing I love about PackerFacebook is that someone can claim to be friends with you, but you don’t have to be friends with them. Can we say: DRAMA?!

And I noticed that quite a few teachers have some pretty messed up “friendships” – if we can even call it that.



There are a ton of things to notice. Like how Dr. [redacted] has no friends!

Take a moment and list three interesting social dynamics you see in the chart above:

1.
2.
3.

One of my professors in graduate school was an anthropologist. She told me: if you have two friends, the number of relationships in that mini-social system is TWO.

Can you explain what my meant? Or was she just off her rocker?

We've been working with matrices recently. We've talked about how matrices can be an easy way to represent a lot of complicated information. Take a moment with your group and see if you can't come up with an idea about how to represent the complicated information above from the network in matrix form. (Be sure to think about how many rows and columns the matrix must have, and how to represent if person A is friends with person B, and vice versa.) Write your matrix below.

Let's have a group discussion about your ideas!

Let's analyze the matrix we decided to use as a class – that we wrote on the board. Let's call it **Matrix F** for "Friend Matrix."

Look at the row for Mr. [redacted] and add up all the numbers. What is that sum?

Look at the row for Mrs. [redacted] and add up all the numbers. What is that sum?

What do the sum of all the numbers in a row represent?

Look at Mr. Shah's column and add up all the numbers. What is that sum?

Look at Mrs. [redacted]'s column and add up all the numbers. What is that sum?

What do the sum of all the numbers in a column represent?

Who likes the most number of people?

Who is liked by the most number of people?

Who likes the least number of people?

Who is liked by the least number of people?

Now I'm going to tell you something pretty fantastic. We have Matrix \mathbf{F} . If we calculate \mathbf{F}^2 we can get a lot more information! This is where matrices get pretty darn powerful!

In your groups, enter Matrix \mathbf{F} in your calculators and find out what \mathbf{F}^2 equals. Write it down below for easy reference.

Now that you have calculated \mathbf{F}^2 – and this is the hardest part! – take a moment with your group and discuss what the numbers in the matrix mean. You know what the numbers in \mathbf{F} mean because you created it. See how the numbers in \mathbf{F}^2 are calculated. Can you guess what they mean? Write your conjecture below. **Don't turn to the next page and spoil the fun of figuring this out!**

Let's have a group discussion about your ideas!

As we have discussed, it turns out that F^2 is a matrix which talks about relationships with *one degree of separation*. For example, Mr. [redacted] is not friends with Mr. [redacted] but Mr. [redacted] is friends with [redacted] who is friends with Mr. Rojas. Therefore, Mr. [redacted] has *one degree of separation* with Mr. [redacted].

The relationship between Mrs. [redacted] and Mr. Shah is interesting in this matrix. Can you explain what's so interesting about it? What about the relationship between Mrs. [redacted] and herself?

Mrs. [redacted] and Mr. Shah:

Mrs. [redacted] and herself:

What do you think the matrix F^3 will represent? F^4 ? F^5 ?

How many degrees of separation are Mr. [redacted] from Mr. [redacted]? Is it likely they'll ever be friends?

How many degrees of separation are Mr. [redacted] and Mrs. [redacted]? Is it likely they'll ever be friends?

Conclusion: It turns out that matrices are used to analyze networks all the time. You can use it with phones (who is talking with whom), computers (who is connected with whom), airline flights (how many different ways can you get from city A to city B), and ecological networks. Your homework tonight is to analyze an ecological network, a food web, in a method similar to our network analysis in class.