My talk today is “A new branch of graph theory” and this is joint work with John.

Now, this will be a theory talk, but if you’re not a theoretician, don’t worry – I’ve included all of powerpoint’s most ridiculous animations to keep you entertained.

Let’s start with some context about the old branches of graph theory.
In classical graph theory we view a graph as a combinatorial object, and do combinatorics on it to learn about it.

In spectral graph theory, we take the same graph

Turn it into a matrix

Do linear algebra on that matrix

And then use the linear algebra to understand the underlying graph

These are beautiful areas but I’ve developed a whole new branch of graph theory called

Deep

Graph theory!

[pause for boos]

Yes!

And unlike other areas of computer science with “deep” in their names, everything I say today will be justified, and rigorous.

But what exactly is “deep graph theory?”

In deep graph theory our goal is to be like this emoji, and think really really hard about graphs

We want to think so hard about graphs, that we take graph theory statements out of context, and examine their philosophical implications.

What do I mean by philosophical implications? Well I think the best thing to do is give you an example

Our example is going to be trees and forests.

I’m sure everyone remembers their discrete math courses, so you’ll recall that a Forest is an undirected acyclic graph and a tree is an undirected acyclic and connected graph.

The definitions should be enough to understand these objects, but I’m told non-theorists sometime need examples, so let’s go through some.
This is the audience interaction part of the talk, where I try to keep you awake by asking simple yes-or-

no questions, so please just shout out whatever answer you feel like, you have at least a 50% chance of being correct

Is this a tree

No (disconnected)
Yes undirected acyclic and connected.

Forest?

Yes undirected and acyclic

Yes! Even though it's a tree, it's still a forest.

And if you look back at the definitions that's always true – Every tree is a forest And

That is our graph theory statement for the day. Now what are the deep, philosophical implications of this statement?

Well, what do you think of when you say "forest" ? You probably think about a bunch of trees all in the same place. Well deep graph theory tells us that's wrong. A single tree, on it's own, is a forest.

You might wonder if this observation has any applications. Well I think there's a huge opportunity in the

Motivational poster space. Isn't that super motivational? That tree on its own is being a forest. Think about what you can do on your own. If you don't like that application, remember, this is a theory talk. You're lucky I used the word application at all.

Let me wrap up with some future work

Classical and spectral graph theory have discovered caterpillar graphs and butterfly graph. I ask you – how did we go from the caterpillar graphs to the butterfly graph? There is no theory on cocoon graphs. I think deep graph theory is the way to finally find them.

Next I think we can use the Petersen graph to predict Coach Petersen's success with Husky football next year. And those of you who care about real-world applications, remember you can gamble on football games.

Finally, this is a great chance to think of more graph theory jokes non-theorists can understand.

Let me leave you with: every tree is a forest.