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CSCI 3104, Algorithms **Profs. Grochow & Layer**
Explain-It-Back 10 **Spring 2019, CU-Boulder**

One of your colleagues studies the foraging patterns in ants and wants to better characterize the movements of a particular colony. Her graduate students have already performed aerial surveys of the routes these ants use, and she wants to know how many sensors she needs to best capture the ebb and flow of the colony. While many ants go in and out from the various tunnel entrances, they are most interested in tracking those ants that venture all the way to end of the surveyed routes. Explain to your colleague how this problem can be modeled as a flow network and how algorithms on these networks could help inform where to place the sensors.

Dear geologist,

I was walking around campus the other day and I heard about your study of the movement of ants. I was very intrigued by this and began asking questions. After an interesting conversation, one of your students mentioned that you are interested in looking at different aspects of the ant movements, but that you are unsure of how to best go about this. Which brings me to the point of this letter. I think I have some ideas that could help you and your students better analyze and track these movements.

First off, it would require a setup. There are many useful algorithms that analyze something called 'flow networks', and that is exactly what we have here. A network in general has two main components.

1) Vertices – which can be pictured as points, or cities on a map, or, in our case each tunnel entrance
2) Edges – which are the paths or lines that connect the vertices.

As you can see, this perfectly represents your ant situation. Now what I mean by a 'flow network' is a specialized network that adds a 'weight' to each edge. In other words, a number is associated with each path or edge between vertices. This number can represent many things. In your situation, it could represent the number of ants that use that edge in a 24-hour time span. This weight would help us find many things. It can help us find the path that most ants travel or most populated route. It can help us find the shortest path between to vertices. And, most importantly for your study, it can help analyze the flow of each vertex. Or, in other words, how many ants go in and out of each individual tunnel.

Anyway, I don't mean to be pushy, but if you'd like some help in analyzing your data, I would be more than willing! I've spent the good part of this semester studying different types of systems like the one you and your colleagues have presented, and I think I could prove useful. It wouldn't take very long, and I think we could really expand your data. Thank you for your time!

Sincerely,
Trevor Buck

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