Graphs and Simulation

29 February 2024
This is why we write tests.
Chemical bonds
Facebook helps you connect and share with the people in your life.

Dystopian proxies for friendship
Each of these structures consists of

a collection of objects and
links between those objects.

We'd like to find a general framework for describing these objects and their properties.
A **graph** is a mathematical structure for representing relationships between entities.
A graph consists of a set of *nodes* (or *vertices*) connected by *edges* (or *arcs*).
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Some graphs are *directed*. 
Some graphs are *undirected*.
Every undirected graph can also be represented as a directed graph, albeit with twice the edges.
How can we represent a graph?
data Graph:
  | vertex(name :: String, neighbors :: List<Graph>)
end
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  | vertex(name :: String, neighbors :: List<Graph>)
end

This breaks horribly if there are cycles in the graph.
Better plan:

```java
data Vertex:
    | vertex(name :: String, neighbors :: List<String>)
end
```

Now a graph is a `List<Vertex>`.

This is called an “adjacency list” representation.
Example: London Underground
This isn't a complete model. We could keep adding directional edges – and, in fact, all of the stations that are connected would eventually have edges going both ways.
Exercise

Let’s use a reactor to simulate a traveller riding the subway, following the connections in the graph.
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Starter code:

tinyurl.com/101-2024-02-29-starter
Code:
tinyurl.com/101-2024-02-29
Challenge exercise

Update the simulation to allow any number of travellers at the same time.
Code:

tinyurl.com/101-2024-02-29-rush-hour
Acknowledgments

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