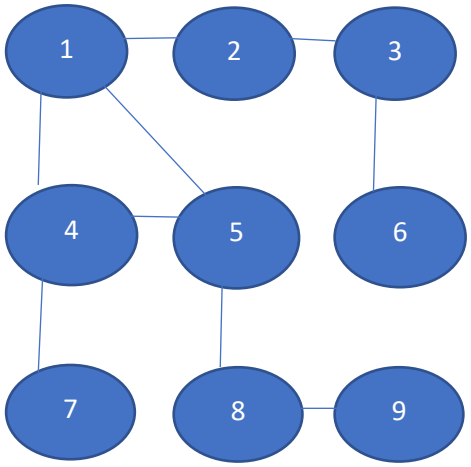
Playbook Notes: Depth First Search (DFS)

A DFS is a graph search that will search deep first then the next unexplored node.

Let's start with an undirected graph:



If we have more than one node to choose from, how do we pick a node?

This can be defined any way you want; different examples will use different rules.

Rule: Since each node has a value, we will use the rule that the smaller values will go first. When we push unvisited nodes onto the stack, the smaller values will get pushed first.

DFS Algorithm:

```
Every node will have a Boolean named visited with a false value.
Add the beginning node to the stack.
While the stack is not empty:
   Set current = pop the stack
   If current is not visited:
      Visit the node and set visited to true.
      For each neighbor:
         If the node is not visited, push the node on to the stack.
```

Algorithm Trace:

We start at node 1, so we push the 1 onto the stack.
Stack: **1**
Visted**:**

Pop the stack (1) and visit. Push unvisited neighbors onto the stack (2, 4, 5)
Note: Pushing the smaller node first, means, the 5 is at the top of the stack.
Stack: **2, 4, 5**
Visted**: 1**

Pop the stack (5) and visit. Push unvisited neighbors onto the stack (4, 8)
Stack: 2, 4, **4, 8**
Visted**:** 1, **5**

Pop the stack (8) and visit. Push unvisited neighbors onto the stack (9)
Stack: 2, 4, 4, **9**
Visted**:** 1, 5, **8**

Pop the stack (9) and visit. There are no new nodes to push onto the stack.
Stack: 2, 4, 4
Visted**:** 1, 5, 8**, 9**

Pop the stack (9) and visit. There are no new nodes to push onto the stack.
Stack: 2, 4, 4
Visted**:** 1, 5, 8**, 9**

Pop the stack (4) and visit. Push unvisited neighbors onto the stack (7)
Stack: 2, 4, **7**
Visted**:** 1, 5, 8**,** 9, **4**

Pop the stack (7) and visit. There are no new nodes to push onto the stack.
Stack: 2, 4
Visted**:** 1, 5, 8**,** 9, 4, **7**

Pop the stack (4), but this has already been visited, so we move on.

Pop the stack (2) and visit. Push unvisited neighbors onto the stack (3)
Stack: **3**
Visted**:** 1, 5, 8**,** 9, 4, 7, **2**

Pop the stack (3) and visit. Push unvisited neighbors onto the stack (6)
Stack: **6**
Visted**:** 1, 5, 8**,** 9, 4, 7, 2, **3**

Pop the stack (6) and visit and there are no more unvisited nodes.
Stack:
Visted**:** 1, 5, 8**,** 9, 4, 7, 2, 3, **6**

And we are done!

Reference:

YouTube: Bro Code, “Learn Depth First Search in 7 Minutes”

https://www.youtube.com/watch?v=by93qH4ACxo&t=27s

Another Helpful Video:

https://www.youtube.com/watch?v=PMMc4VsIacU