Question: Graph Traversal

Question 1 (Coding)

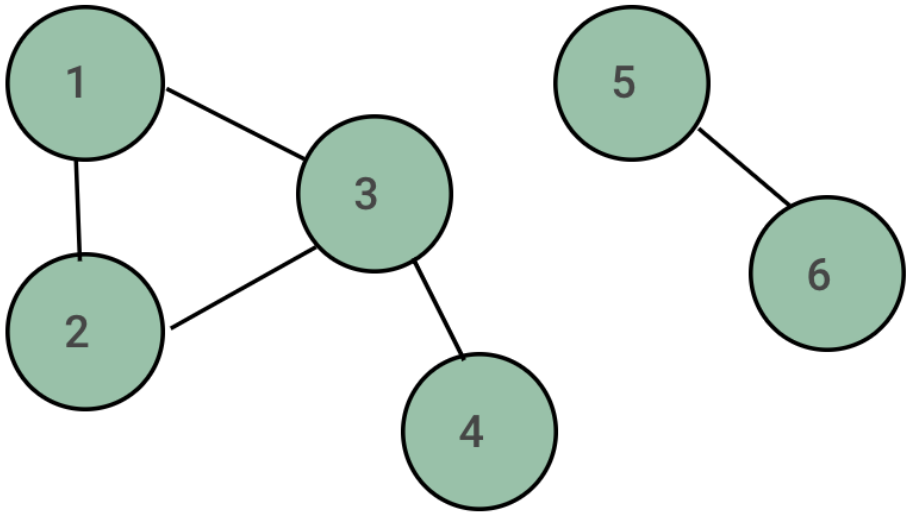
We track emails in our system, however sometimes a person can have more than 1 email. We need the ability to maintain and traverse a bi-directional graph representing when 2 or more emails are "linked" - belong to the same person. Fill in these three functions:

```
function addLink(int a, int b)
```
creates a bi-directional link between nodes a and b

```
function removeLink(int a, int b)
```
removes link between a and b

```
function isLinked(int a, int b): boolean
```
returns true if there is any path from a to b

Examples




```
addLink(1,2)
addLink(2,3)
addLink(1,3)
addLink(3,4)
addLink(5,6)

isLinked(1,5) : false
isLinked(1,4) : true

removeLink(1,3)
isLinked(1,4) : true
```

Requirements

1. Correct, tested code
2. Running time of isLinked must be no worse than O(n)
3. Memory footprint must be no worse than O(n)

Question 2 (Talking)

1. What is the running time of each function?
2. Can you change your implementation to make isLinked O(1)?