

Graphs - II

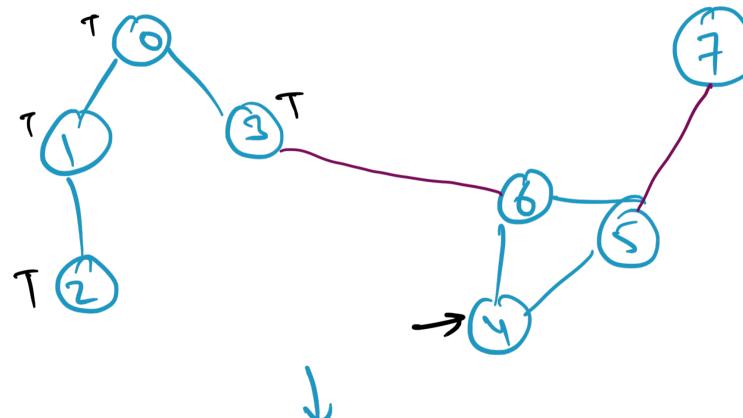


Number of connected components in a Graph

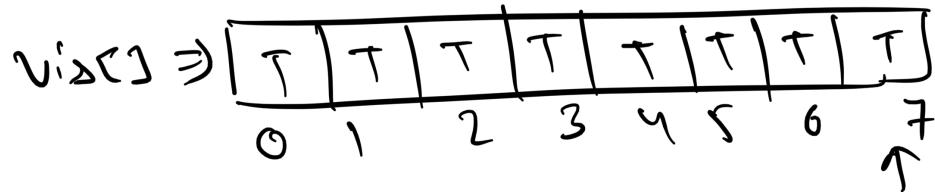
$\rightarrow dp(0)$

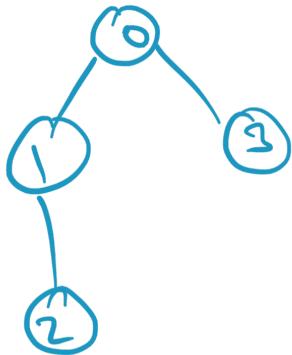
$dp(1)$

$dp(2)$

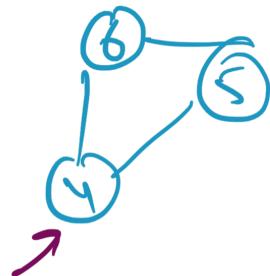


Count = 3





7



Count = 3

\uparrow
 $dp(0)$
 \uparrow
 $dp(1)$
 \uparrow
 $dp(2)$

\uparrow
 $dp(4)$
 \downarrow
 $dp(5)$
 \downarrow
 $dp(6)$

\uparrow
 $dp(7)$
 \downarrow

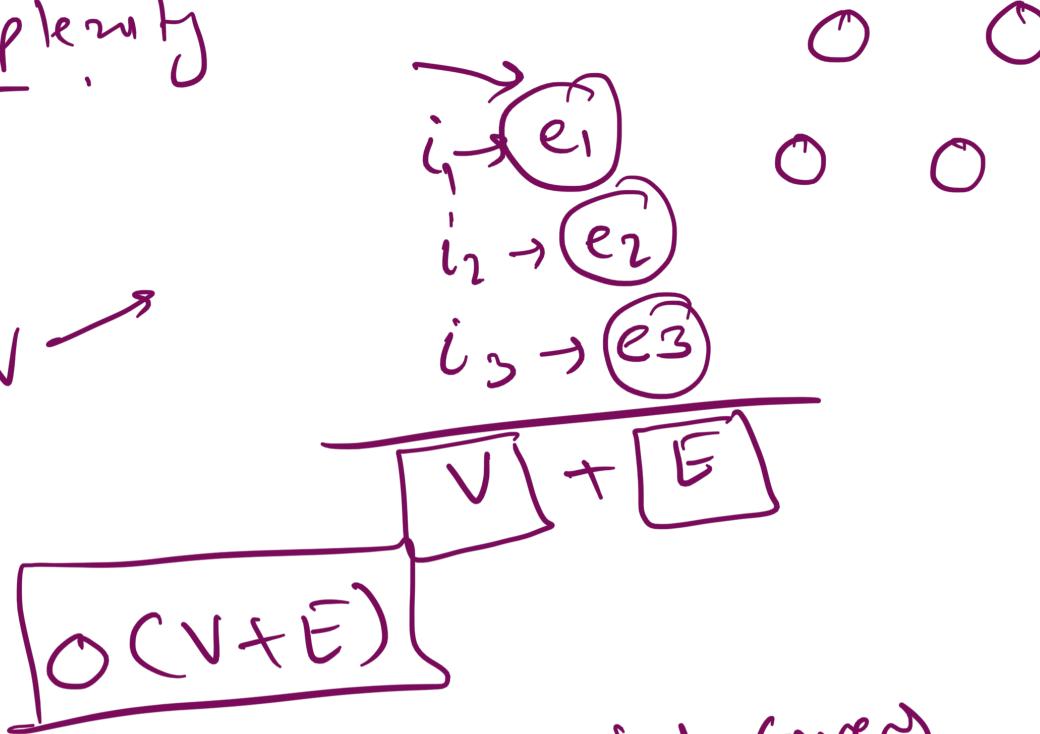
DFS
0, 1, 2, 3, 4, 5, 6, 7

BFS
0, 1, 3, 2, 4, 5, 6, 7

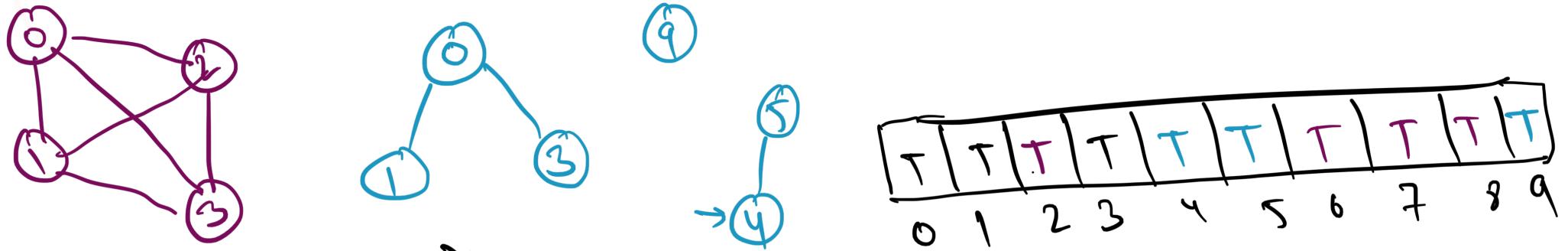
Time Complexity

$dp()$

$V \rightarrow \checkmark \rightarrow$



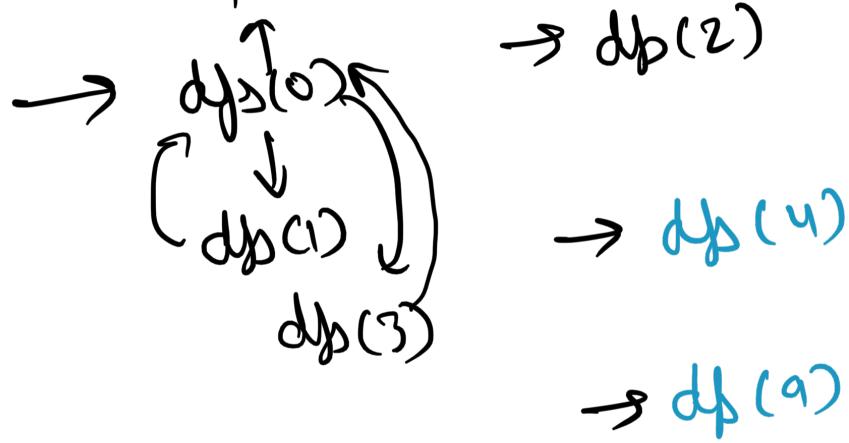
upper bound $>$ which covers
all cases.



```

int count = 0
for (i=0..n)
    if (!vis[i])
        count++
        dfs(i)
    }

```

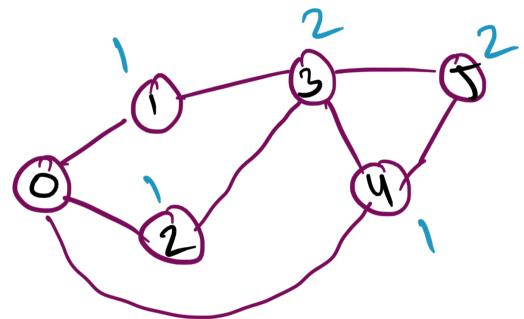


$O(V) + O(E)$

$O(V+E)$

Shortest Path in a Graph

BFS.

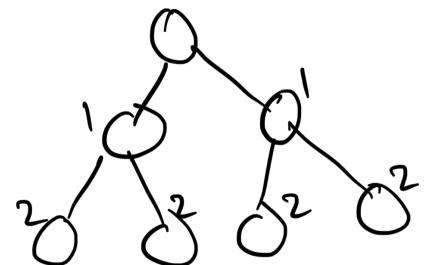


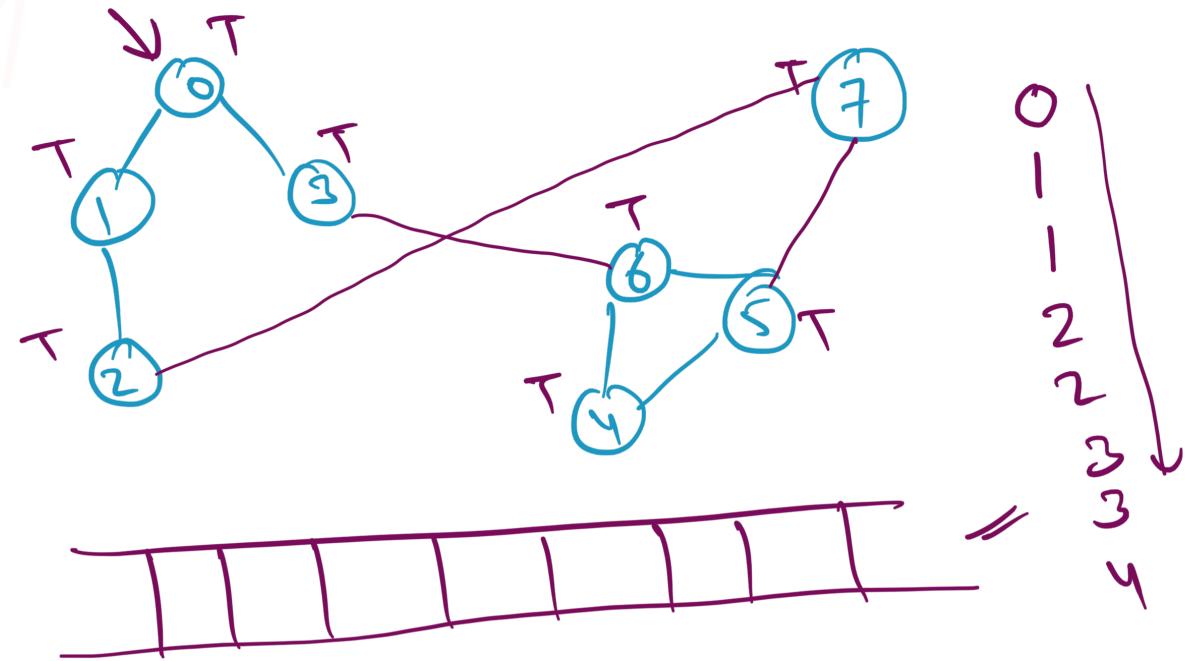
bfs(0).

$\text{dis}(0) \rightarrow \text{dis}(1) \rightarrow \text{dis}(3) \rightarrow \text{dis}(4) \rightarrow \text{dis}(5)$

$0 \rightarrow 5$

dis_2

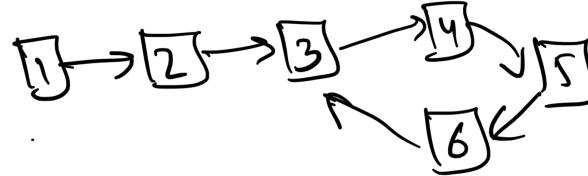




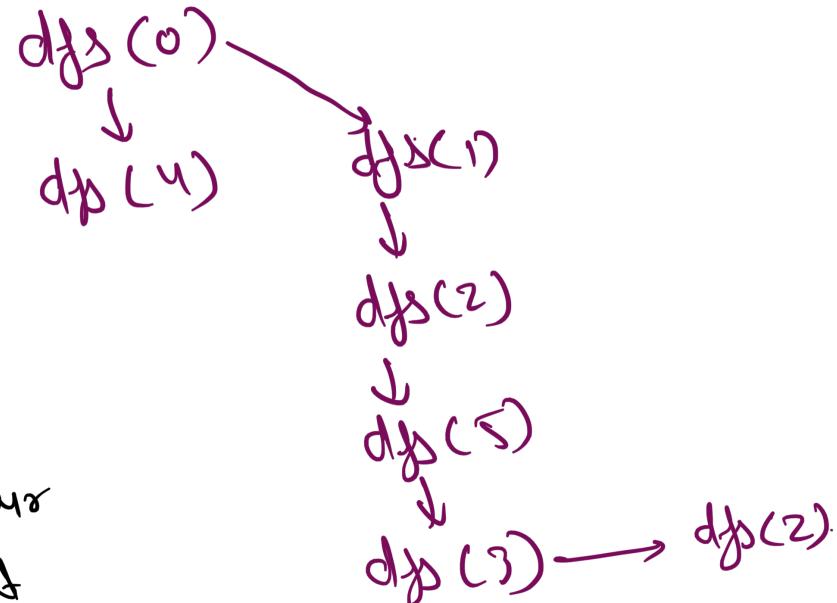
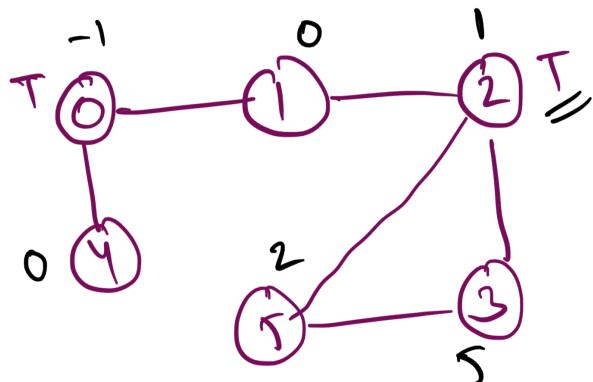
$\text{curr} = 7$

0	1	2	1	3	3	2	4
0	1	2	3	4	5	6	7

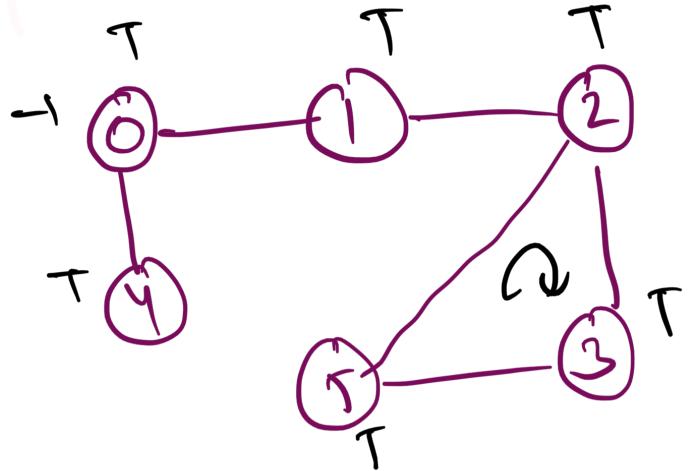




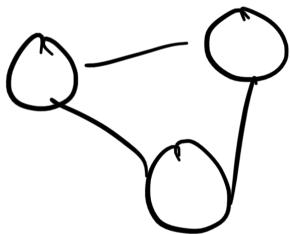
Detect cycle in an ~~Directed~~ Graph



If found a visited vertex which is not parent of our vertex. Then cycle is present.

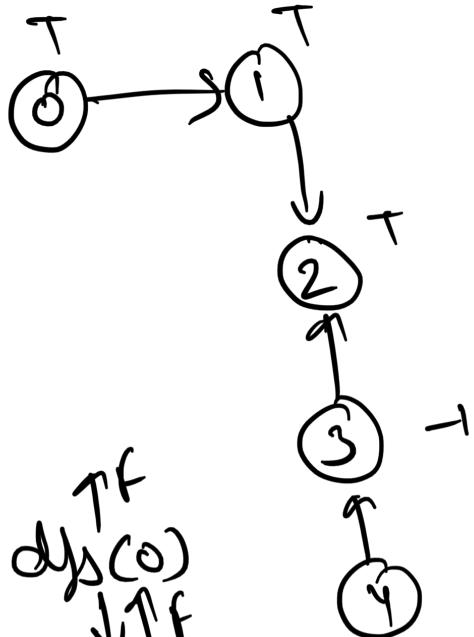


$\text{dp}(0, -1)$
 $\downarrow \uparrow F$
 $\text{dp}(4, 0)$
 $\downarrow \uparrow T$
 $\text{dp}(1, 0)$
 $\downarrow \uparrow T$
 $\text{dp}(2, 1)$
 $\downarrow \uparrow T$
 $\text{dp}(3, 2)$
 $\downarrow \uparrow T$
 $\text{dp}(5, 3)$
 $\downarrow \uparrow T$



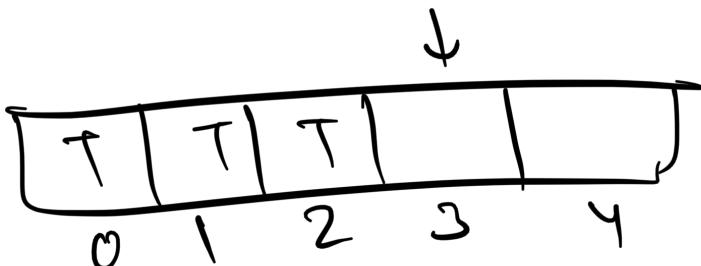
$0 \rightarrow \boxed{1 \mid 4}$
 $1 \rightarrow \boxed{0 \mid 2}$
 $2 \rightarrow \boxed{\begin{matrix} 1 & | & 5 \mid 3 \end{matrix}}$
 $3 \rightarrow \boxed{2 \mid 5}$

$4 \rightarrow \boxed{0}$
 $5 \rightarrow \boxed{2 \mid 3}$



$\overset{T}{dps}(0)$
 $\downarrow T^F$
 $dps(1)$
 $\downarrow T^F$
 $dps(2)$

$dps(3)$



Practice Problems

1. Detect cycle in an ~~undirected~~ directed Graph
 - a. Solution: <https://www.youtube.com/watch?v=GLxfoaZIRqs>
2. Check whether a given graph is Bipartite or not
3. Check whether a path exists