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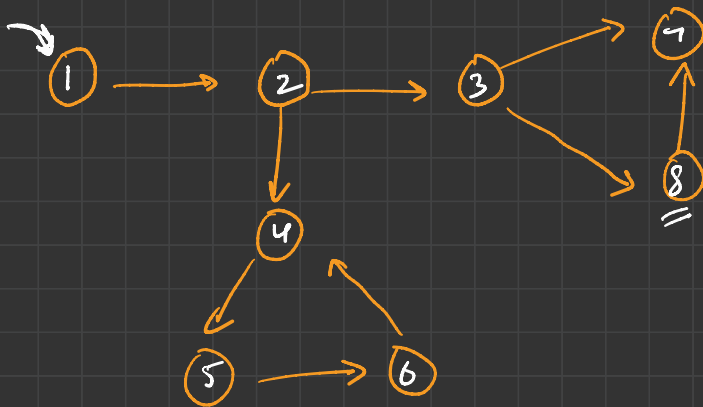


# Cycle Detection

$$\text{via}[\cdot] = \{RUS$$
$$1 = f_{\text{cor}}$$

$f \rightarrow \text{cycle}$

## DFS


$$\frac{G \times 10^4}{G}$$

```
for (int i = 1; i <= n; i++)
    if (!vis[i])
        dfs(i);
```

visited

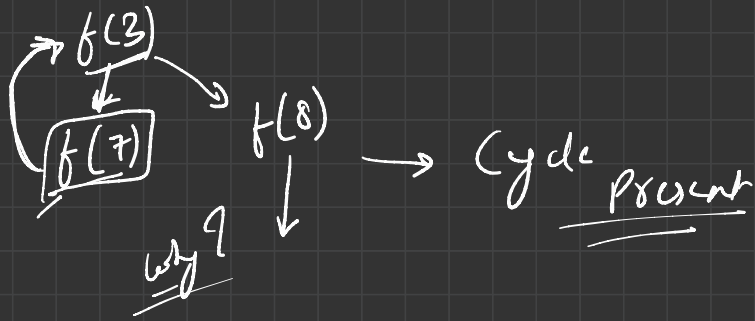
10	8	5	0	0	0	5	5
1	2	3	4	5	6	7	8

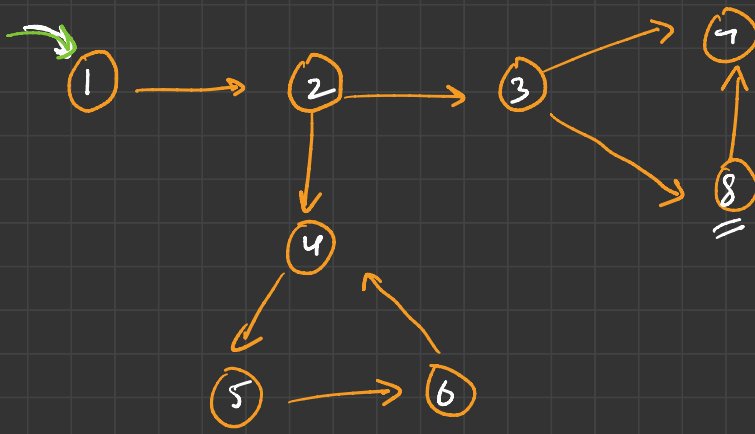
✓✓ adj List

$1 \rightarrow \boxed{2}$   
 $\underline{2} \rightarrow \boxed{3}, 4$   
 $3 \rightarrow \boxed{\underline{7}}, \boxed{8}$   
 $4 \rightarrow 5$

$f(1)$   
 $\downarrow$   
 $f(2)$   
 $\downarrow$

5 → 6  
6 → 4  
7 →  
8 → 7





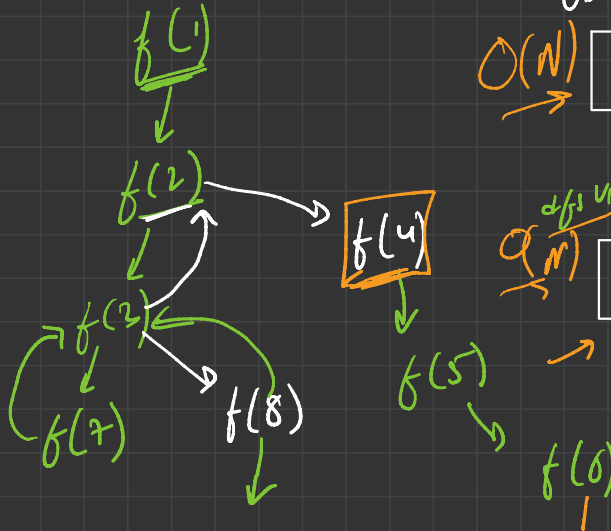
```

for (int i = 1; i <= n; i++)
    if (!vis[i])
        dfs(i);
  
```

bool ans = f();  
if (ans == 1)  
return T;

adj List

- 1 → 2
- 2 → 3, 4
- 3 → 7, 8
- 4 → 5
- 5 → 6
- 6 → 4
- 7 →
- 8 → 7



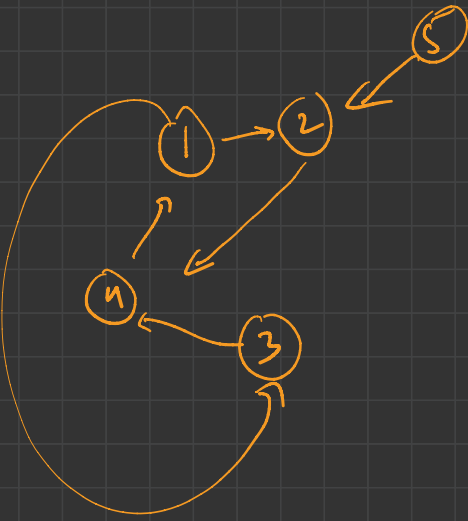
visited

$O(N)$

1	0	1	0	1	0	1	0	1	0
1	2	3	4	5	6	7	8		

$O(M)$

1	0	1	0	1	0	1	0	1	0
1	2	3	4	5	6	7	8		



T.C  
 $\hookrightarrow O(N+E)$

$f(4)$

S.C  $\hookrightarrow$  linear

- 1  $\rightarrow$  2, 3
- 2  $\rightarrow$  4
- 3  $\rightarrow$  4
- 4  $\rightarrow$  1
- 5  $\rightarrow$  2

$f(1)$   
 $\downarrow$   
 $f(1)$   
 $\downarrow$   
 $f(4)$   
 $\downarrow$

$$\frac{vis[node] = T}{2}$$

$$dfs[node] = T$$

Cycle present  
 in directed graph

- |                   |                   |
|-------------------|-------------------|
| 1 $\rightarrow$ T | 1 $\rightarrow$ T |
| 2 $\rightarrow$ T | 2 $\rightarrow$ T |
| 4 $\rightarrow$ T | 4 $\rightarrow$ T |







































