

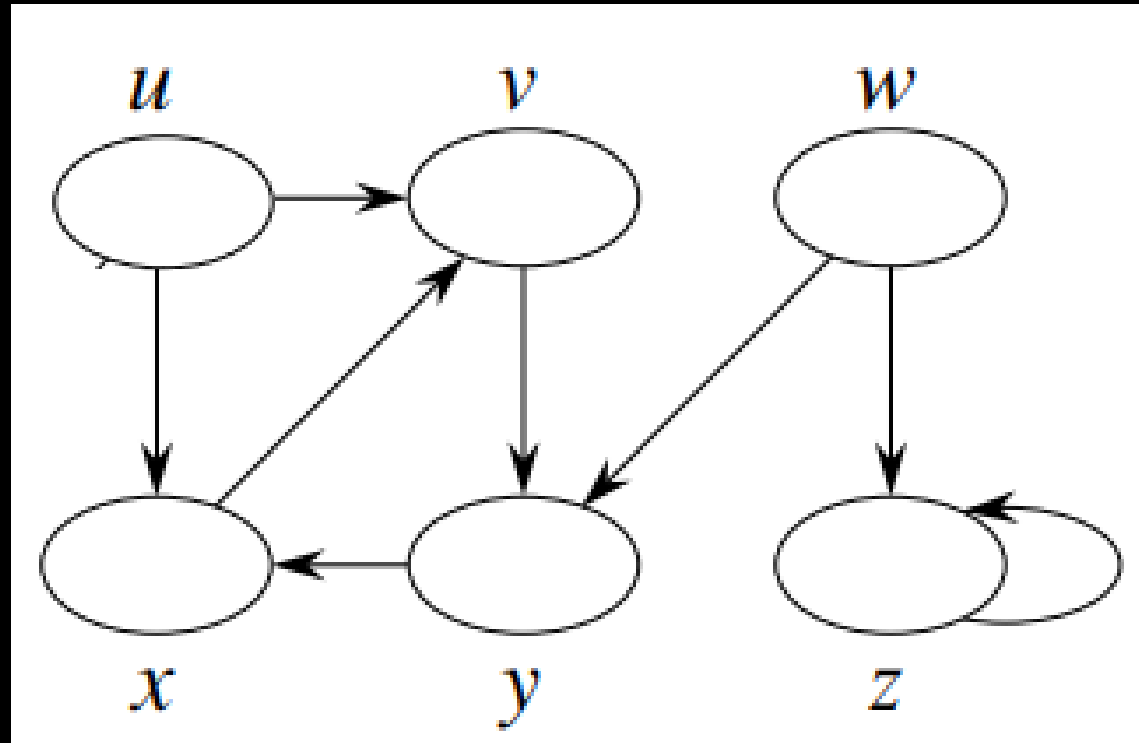
Search-DFS

Arun Chauhan@Sitare

Computer Science and Engineering

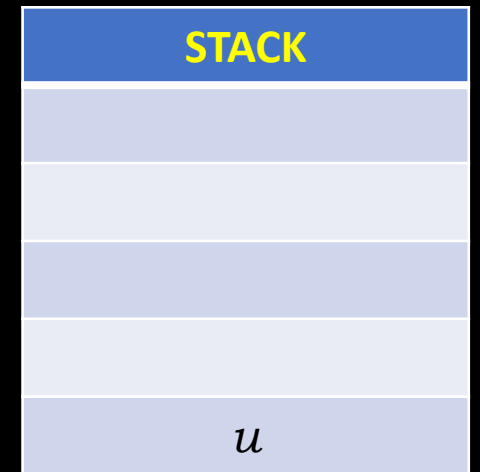
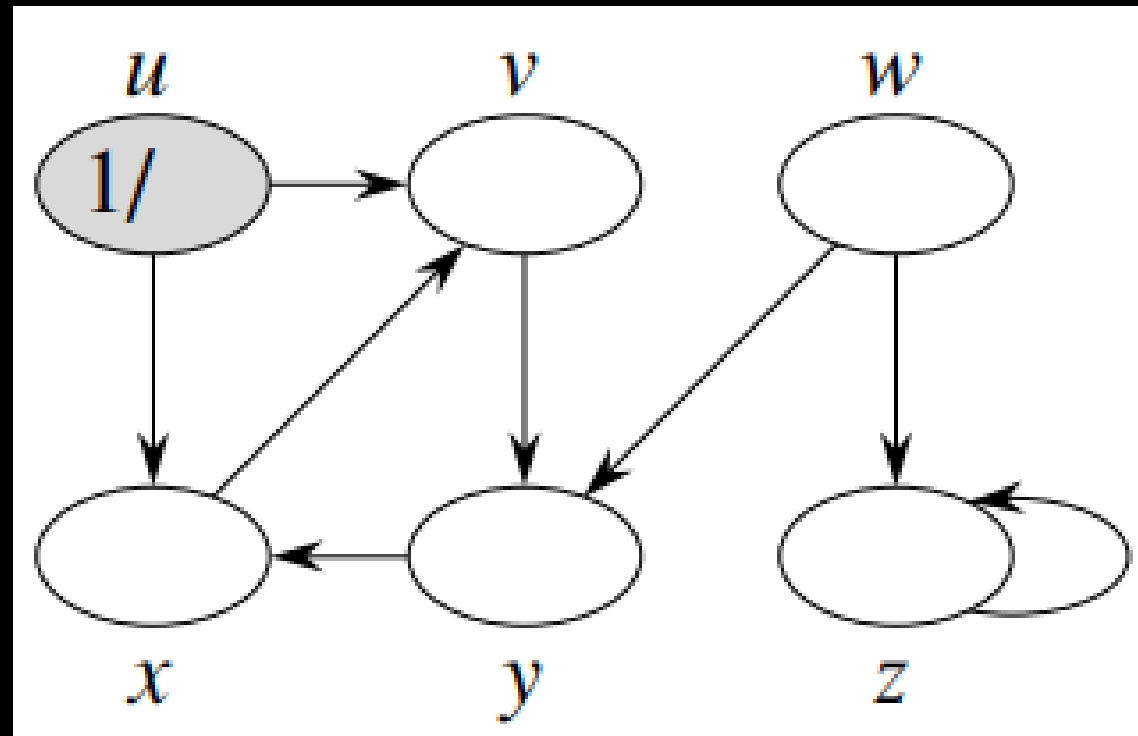
Depth-first search (DFS)

u	v	w	x	y	z
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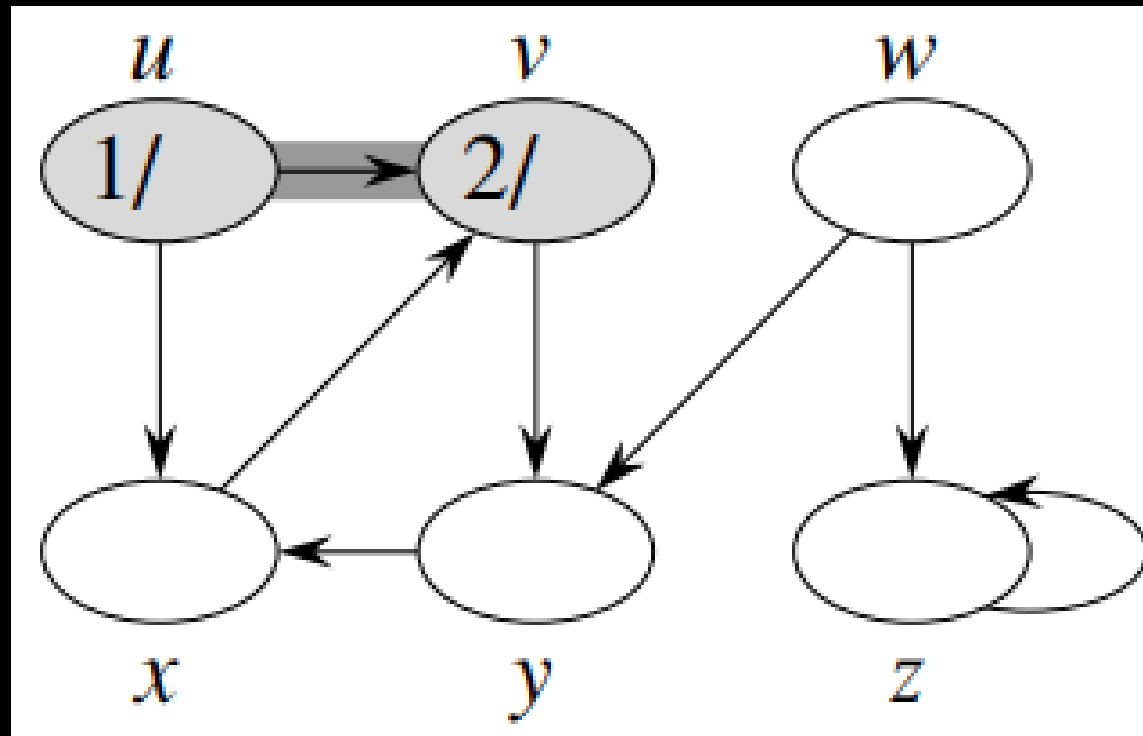
Depth-first search (DFS)

u	v	w	x	y	z
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Depth-first search (DFS)

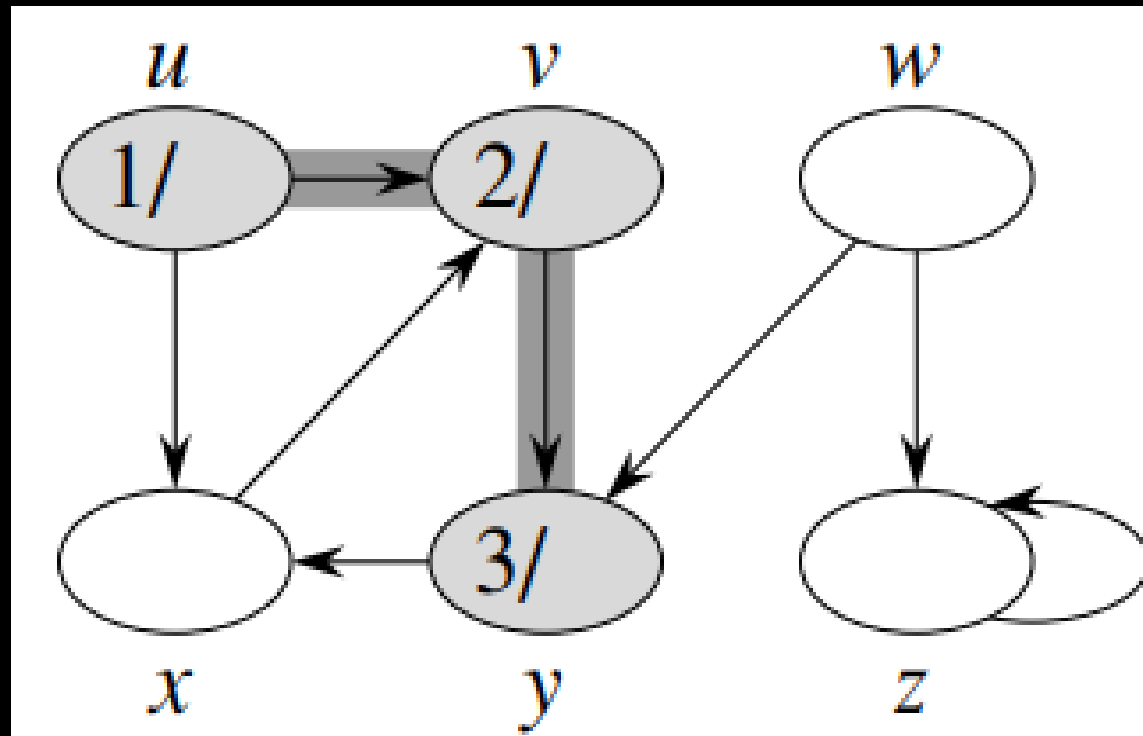
u	v	w	x	y	z
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STACK
v
u

Depth-first search (DFS)

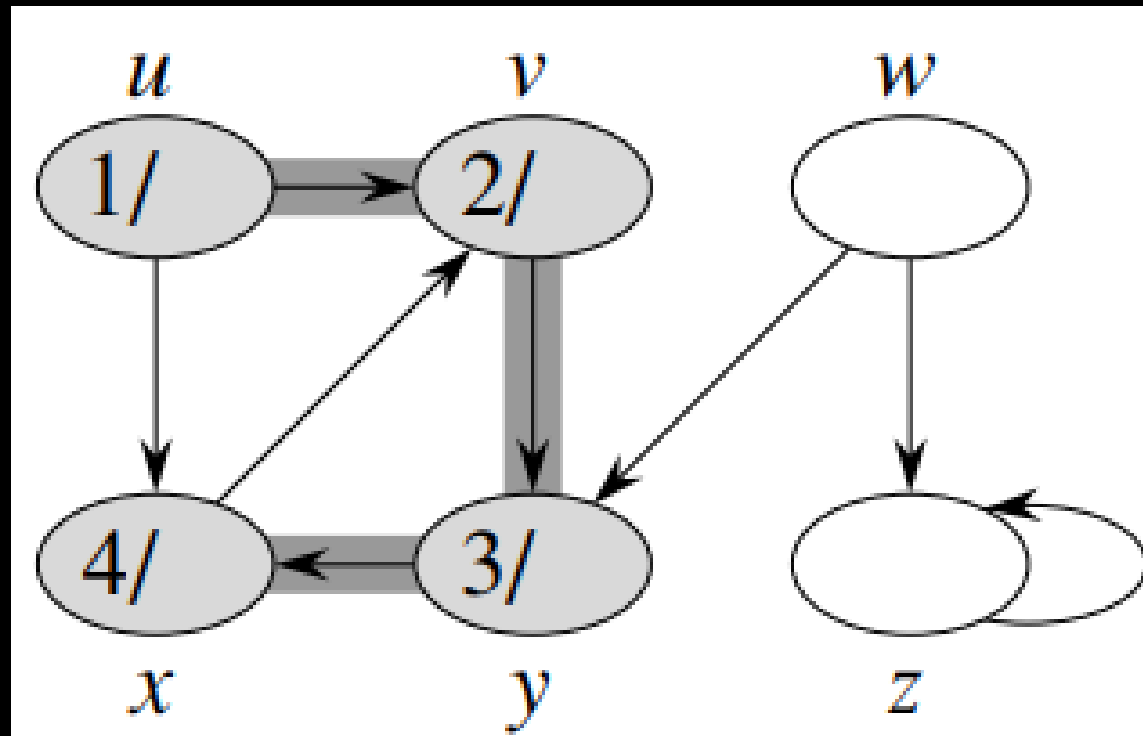
u	v	w	x	y	z
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STACK
y
v
u

Depth-first search (DFS)

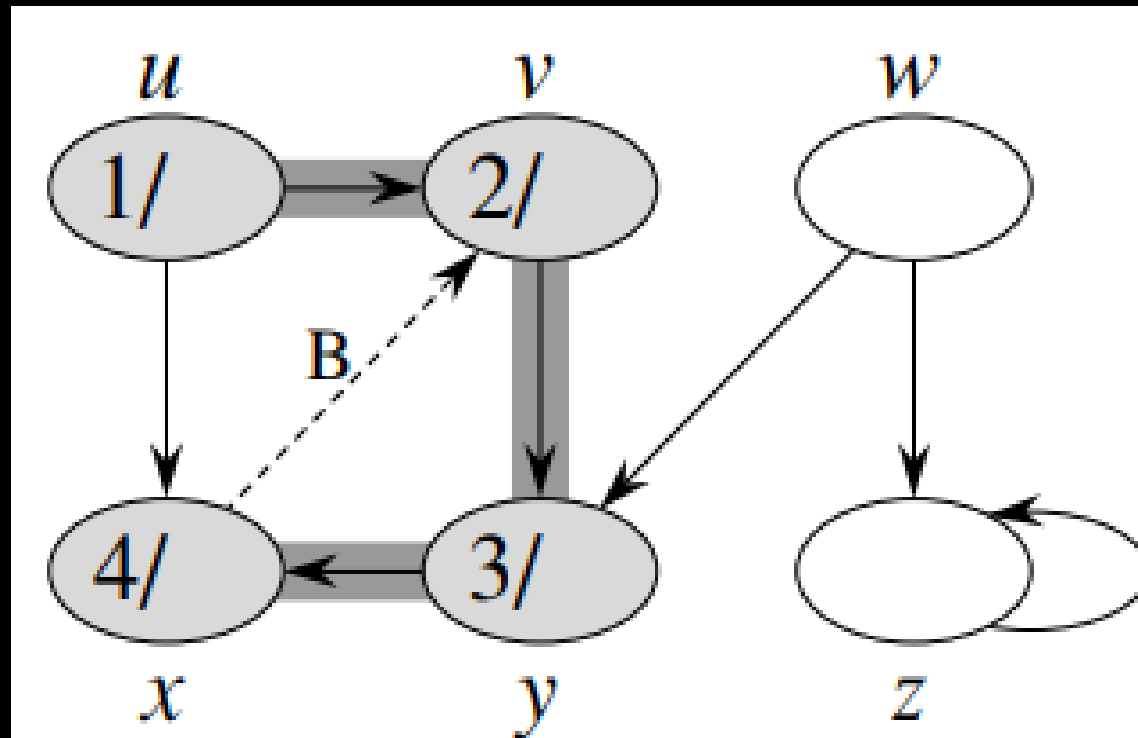
u	v	w	x	y	z
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STACK
x
y
v
u

Depth-first search (DFS)

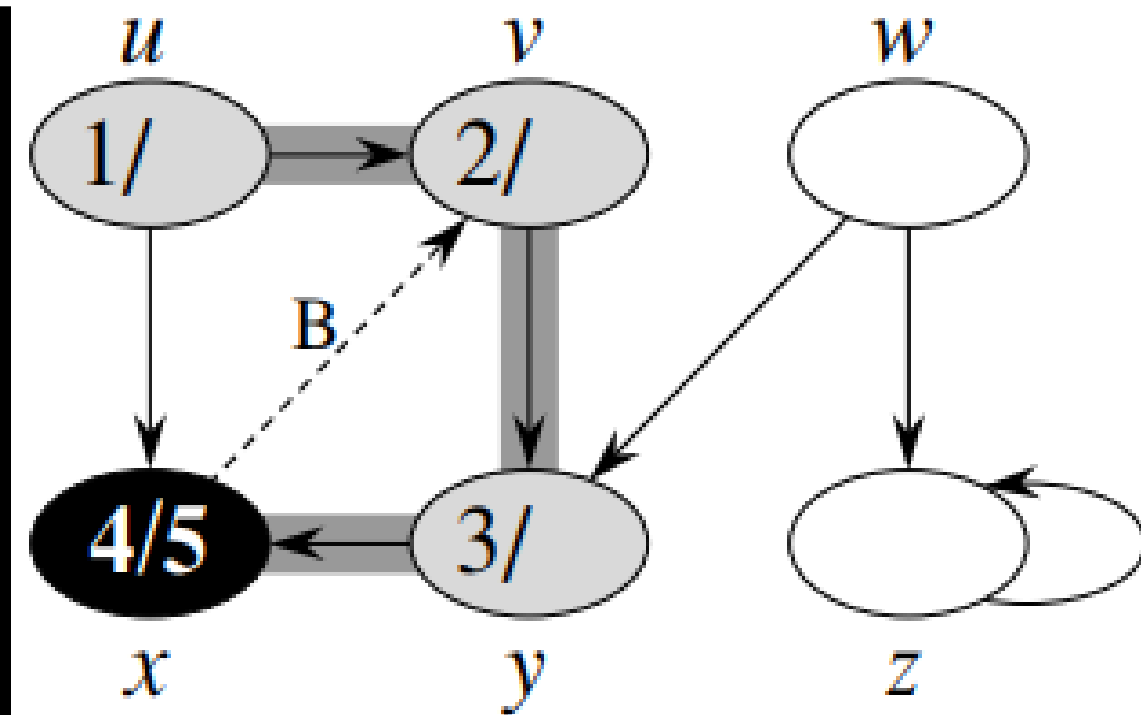
u	v	w	x	y	z
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STACK
x
y
v
u

Depth-first search (DFS)

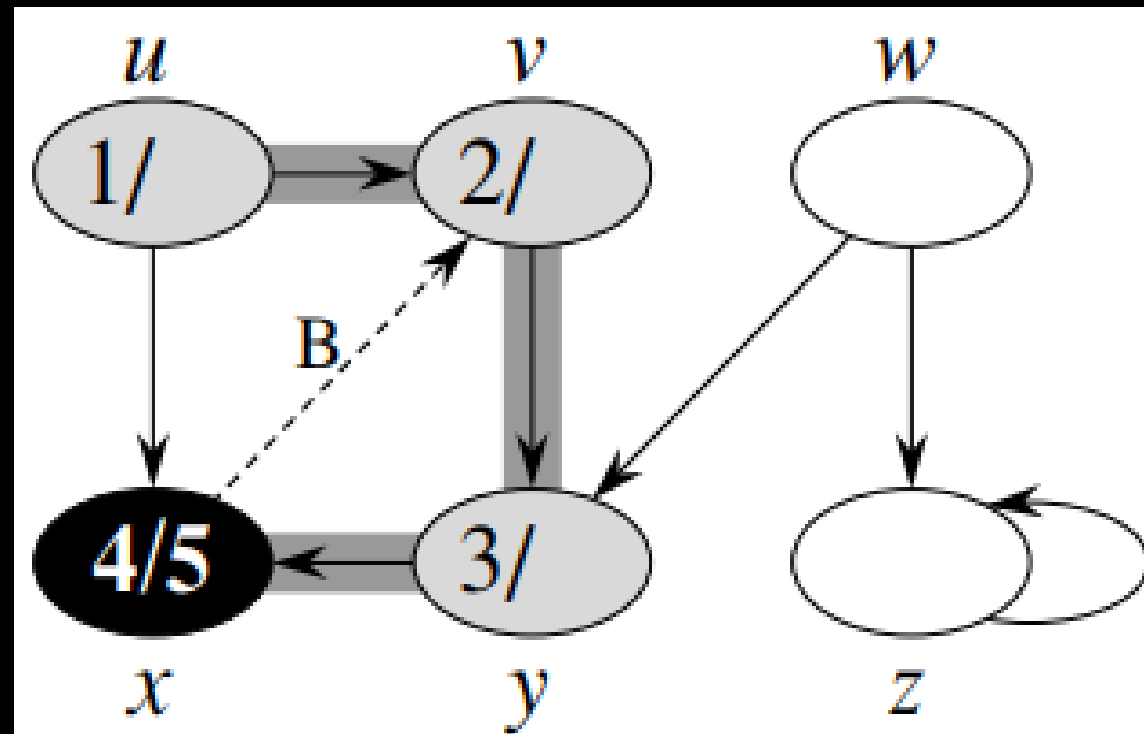
u	v	w	x	y	z
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STACK
x
y
v
u

Depth-first search (DFS)

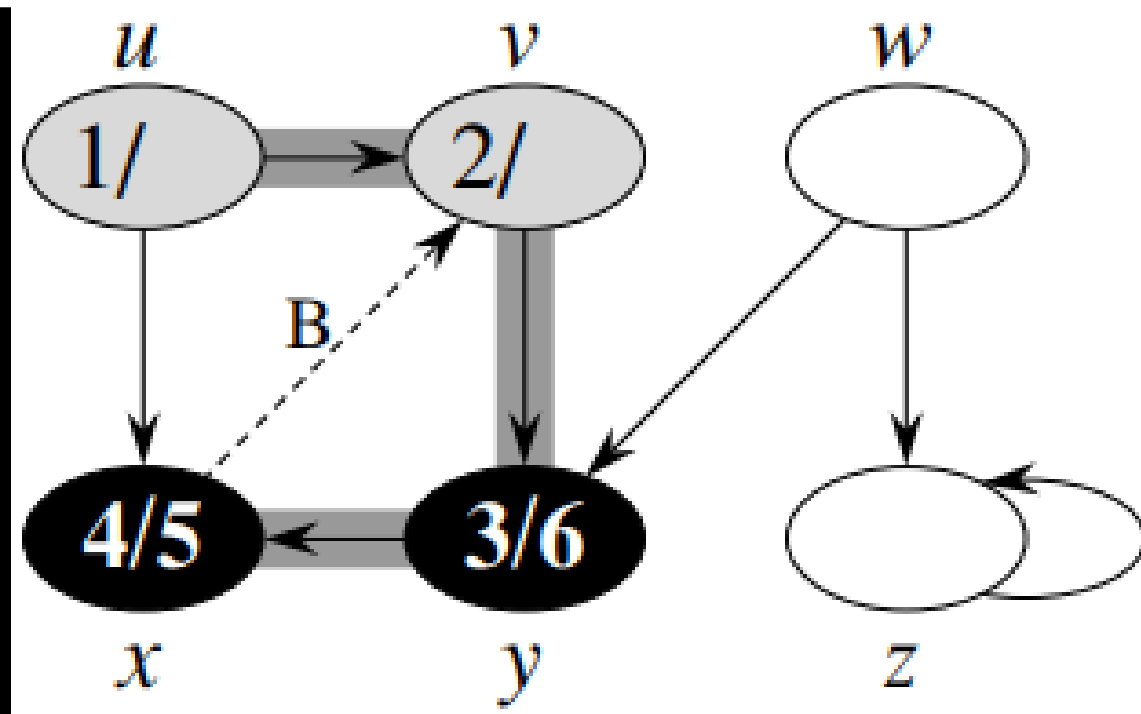
u	v	w	x	y	z
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STACK
y
v
u

Depth-first search (DFS)

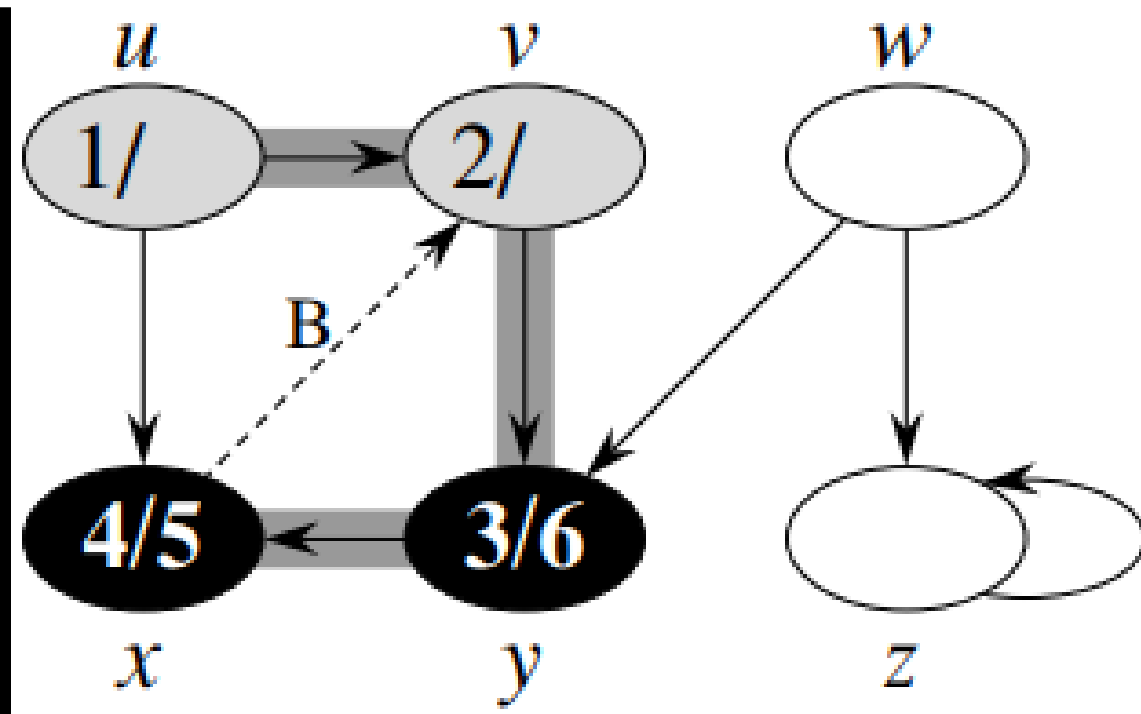
u	v	w	x	y	z
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STACK
y
v
u

Depth-first search (DFS)

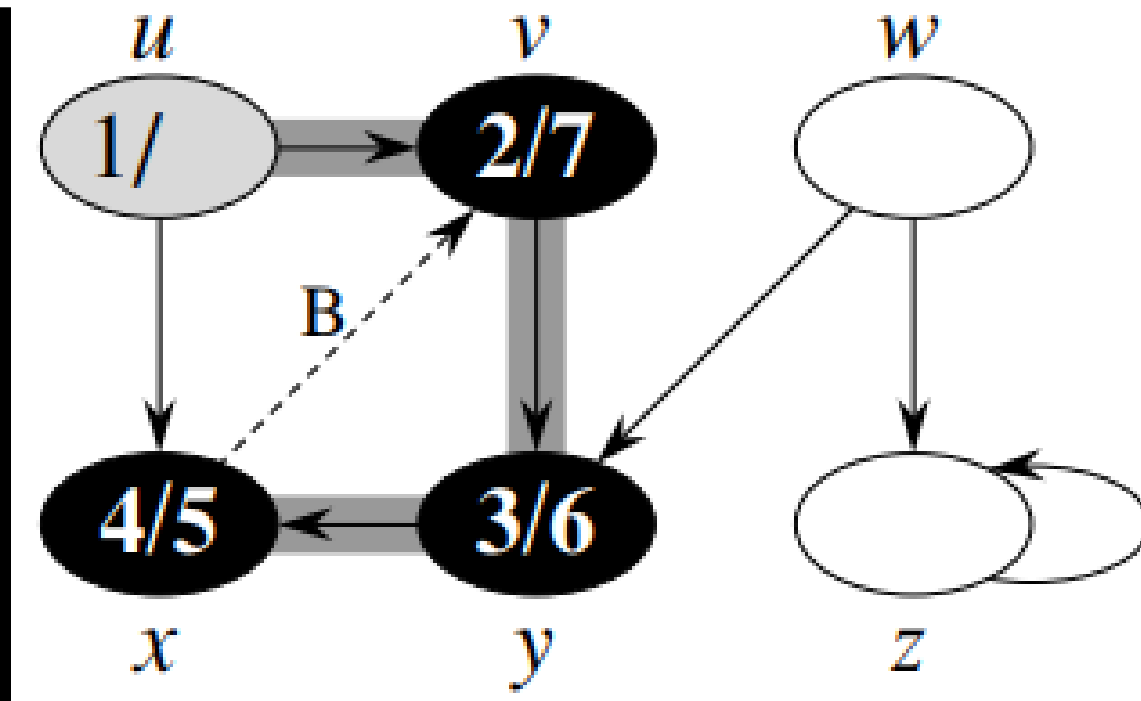
u	v	w	x	y	z
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STACK
v
u

Depth-first search (DFS)

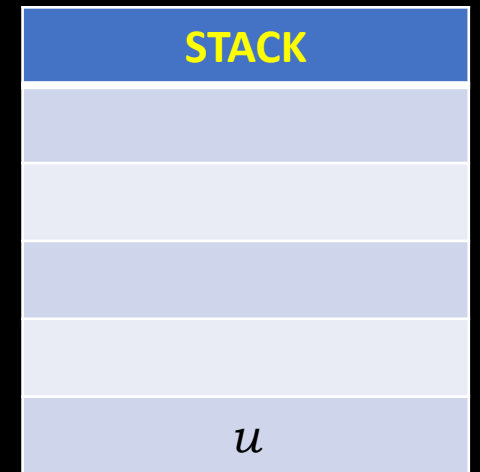
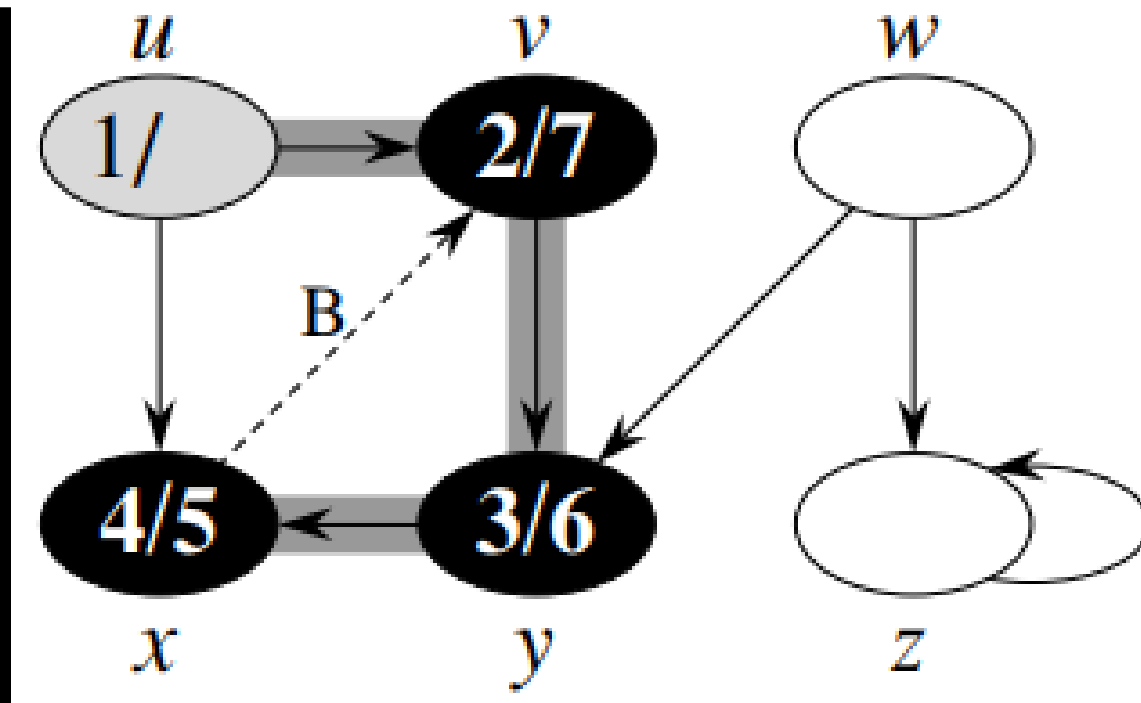
u	v	w	x	y	z
-----	-----	-----	-----	-----	-----



STACK
v
u

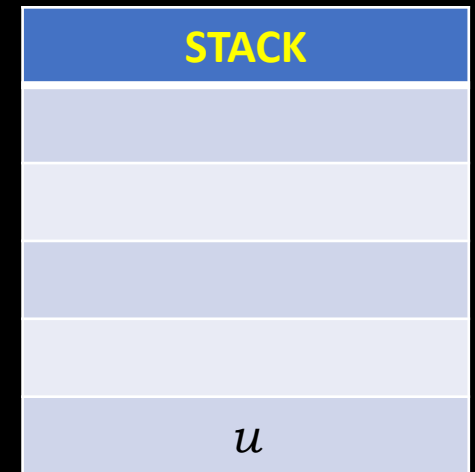
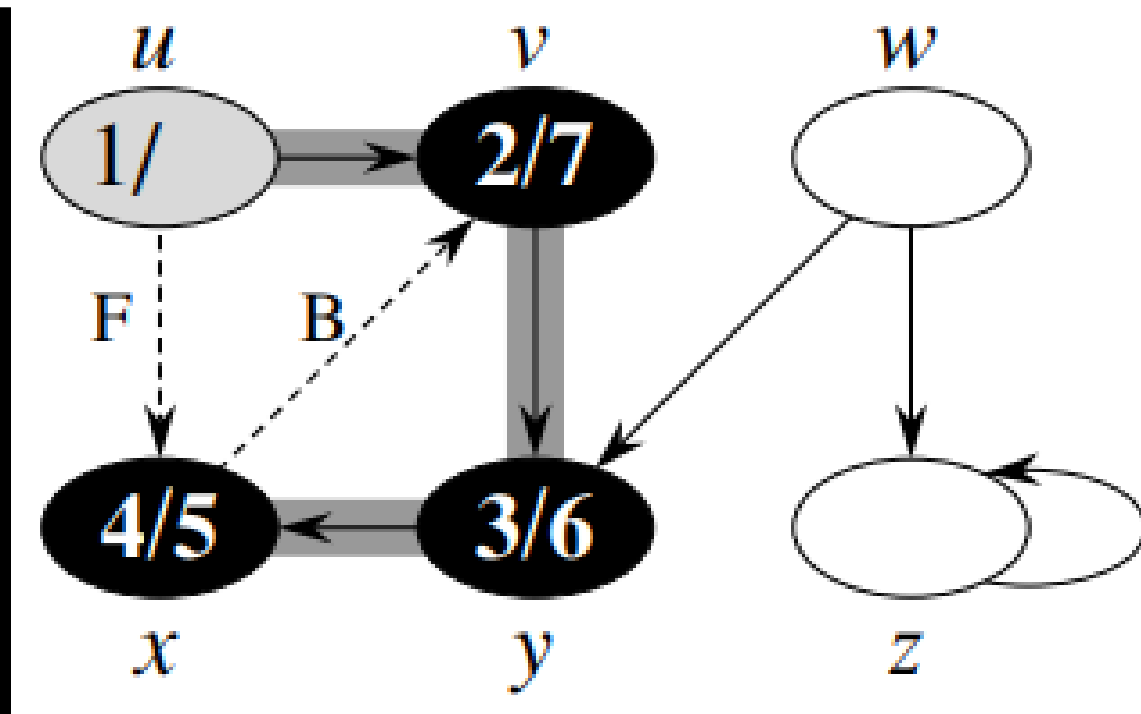
Depth-first search (DFS)

u	v	w	x	y	z
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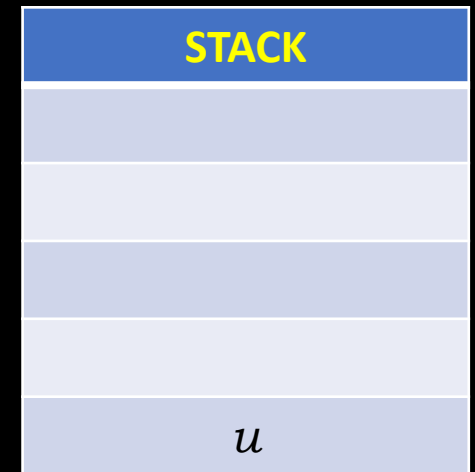
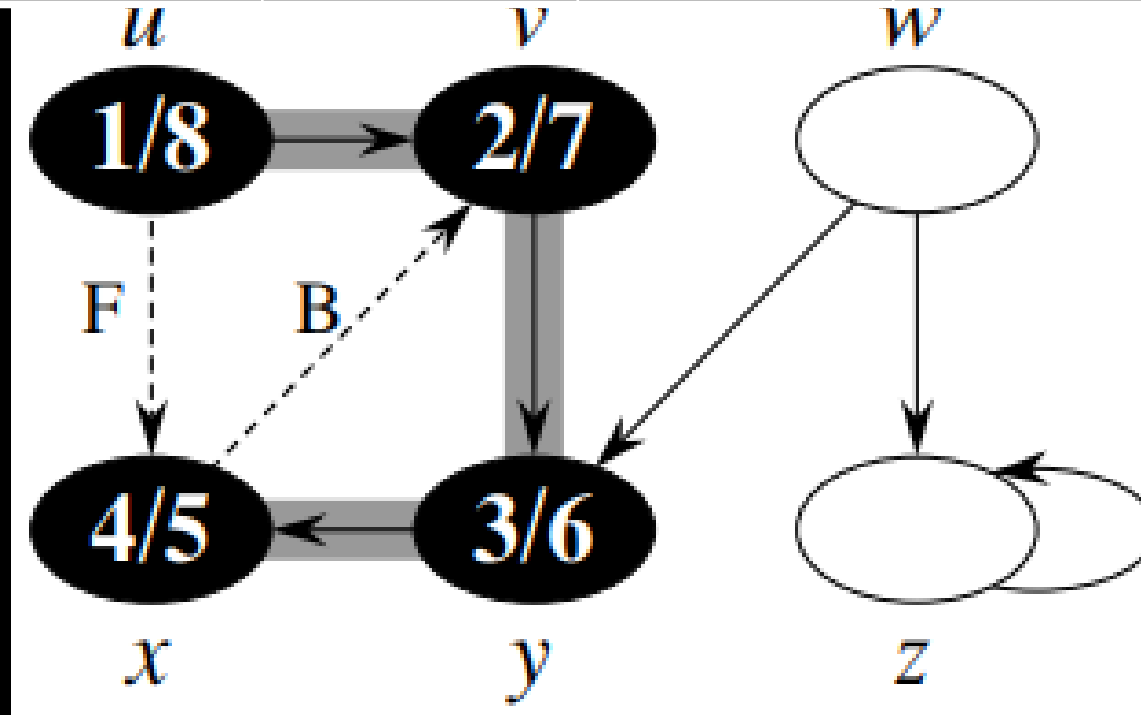
Depth-first search (DFS)

u	v	w	x	y	z
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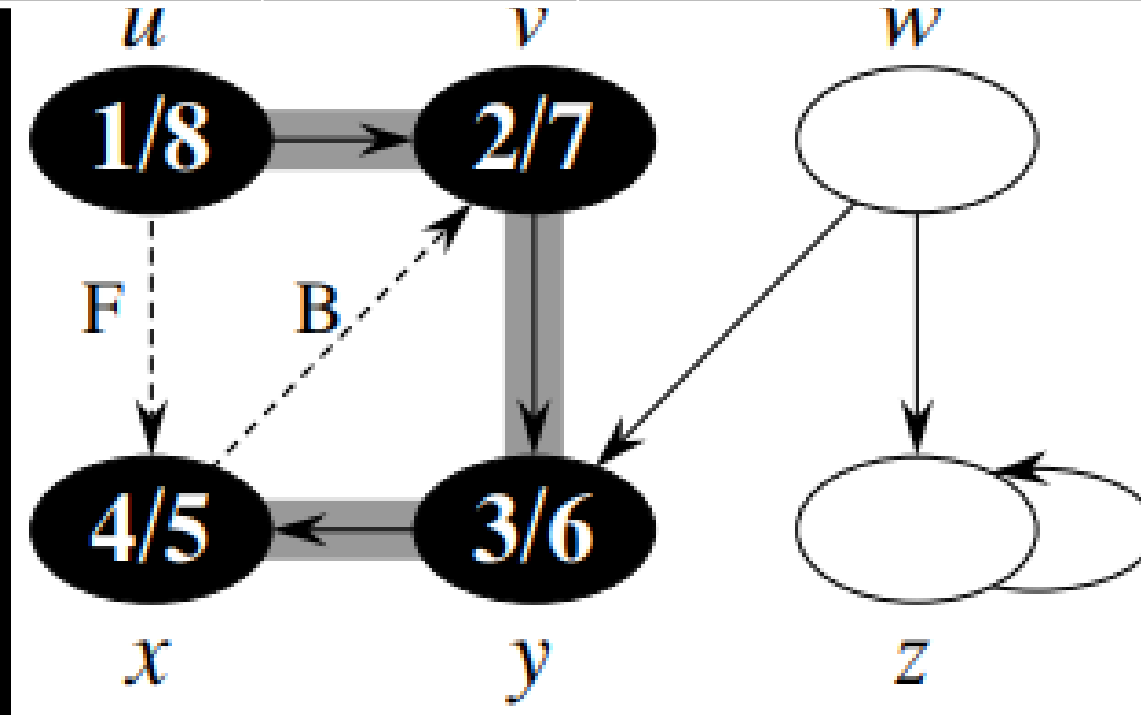
Depth-first search (DFS)

u	v	w	x	y	z
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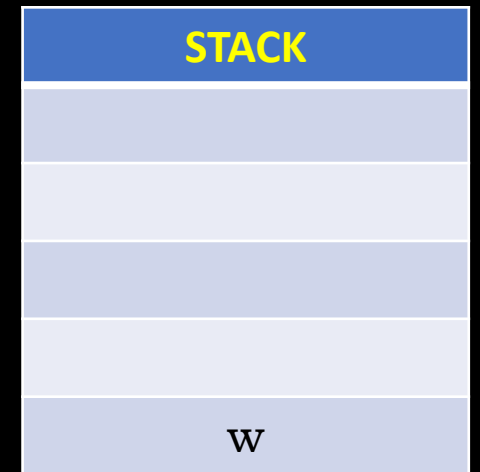
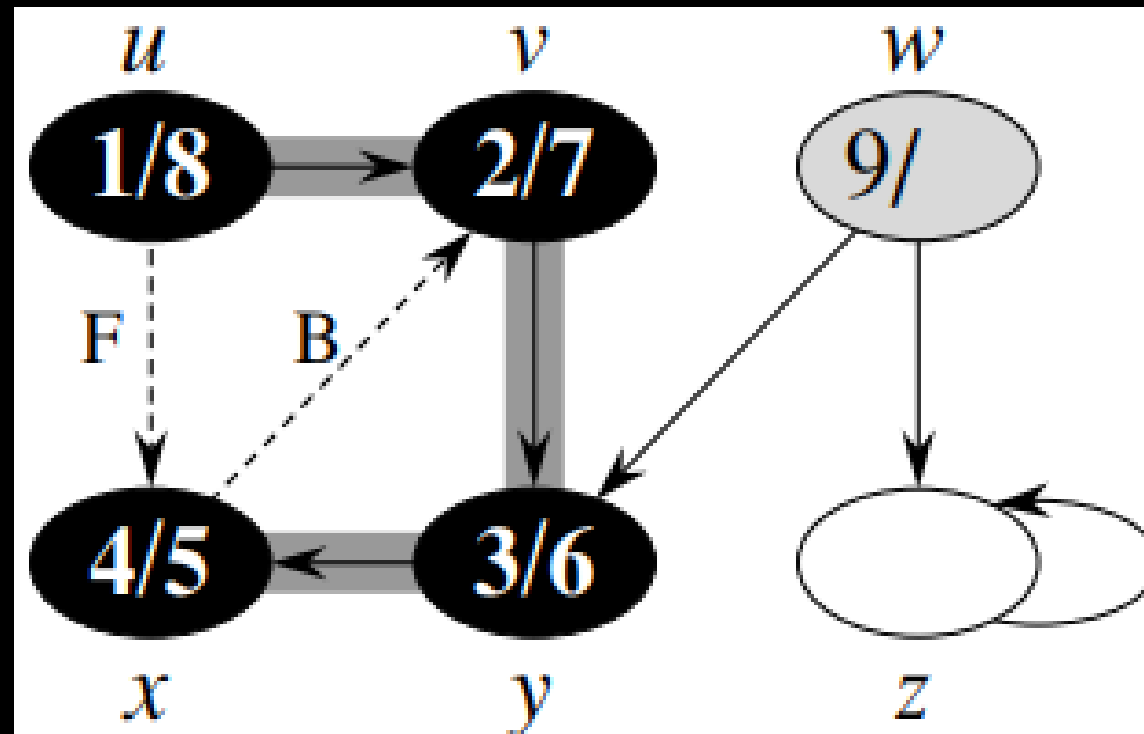
Depth-first search (DFS)

u	v	w	x	y	z
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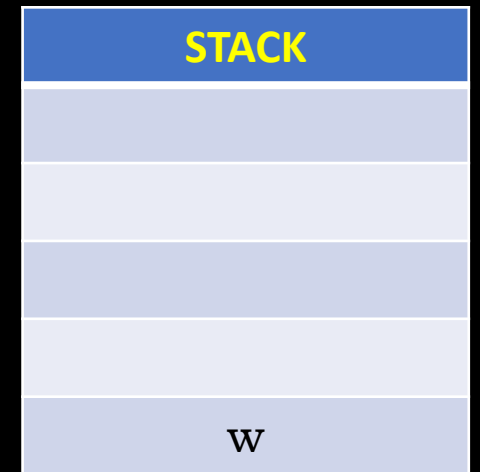
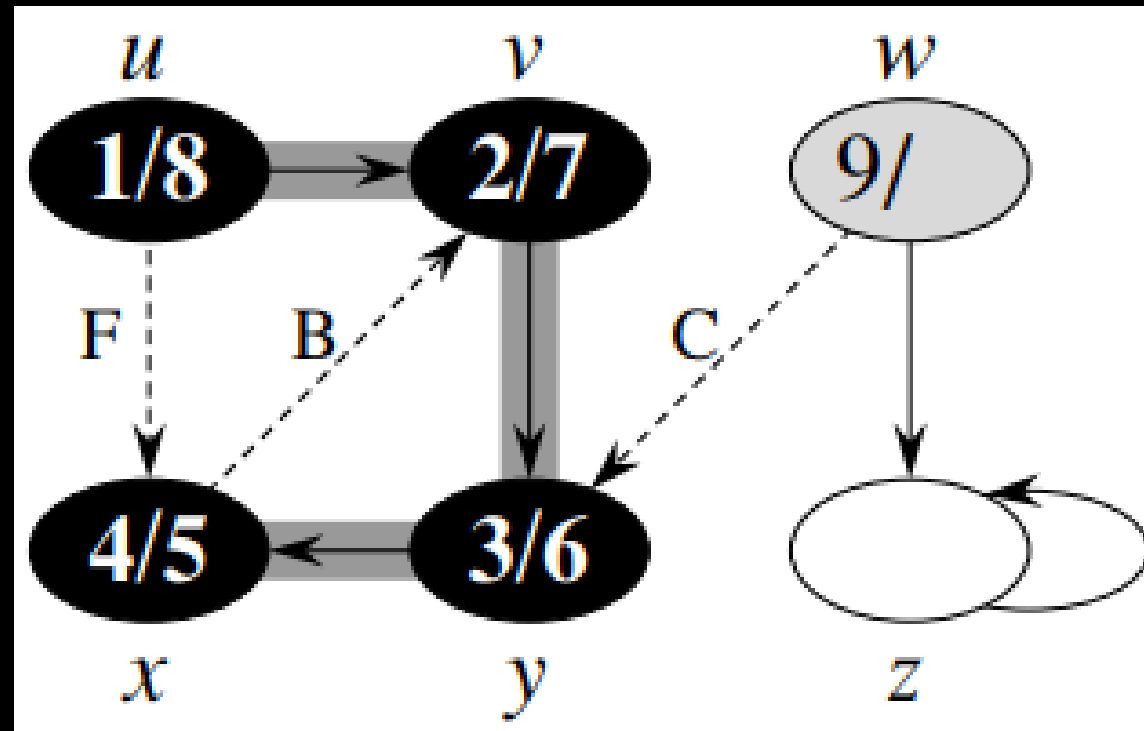
Depth-first search (DFS)

u	v	w	x	y	z
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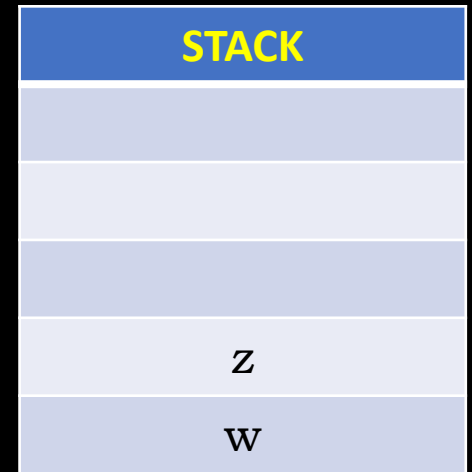
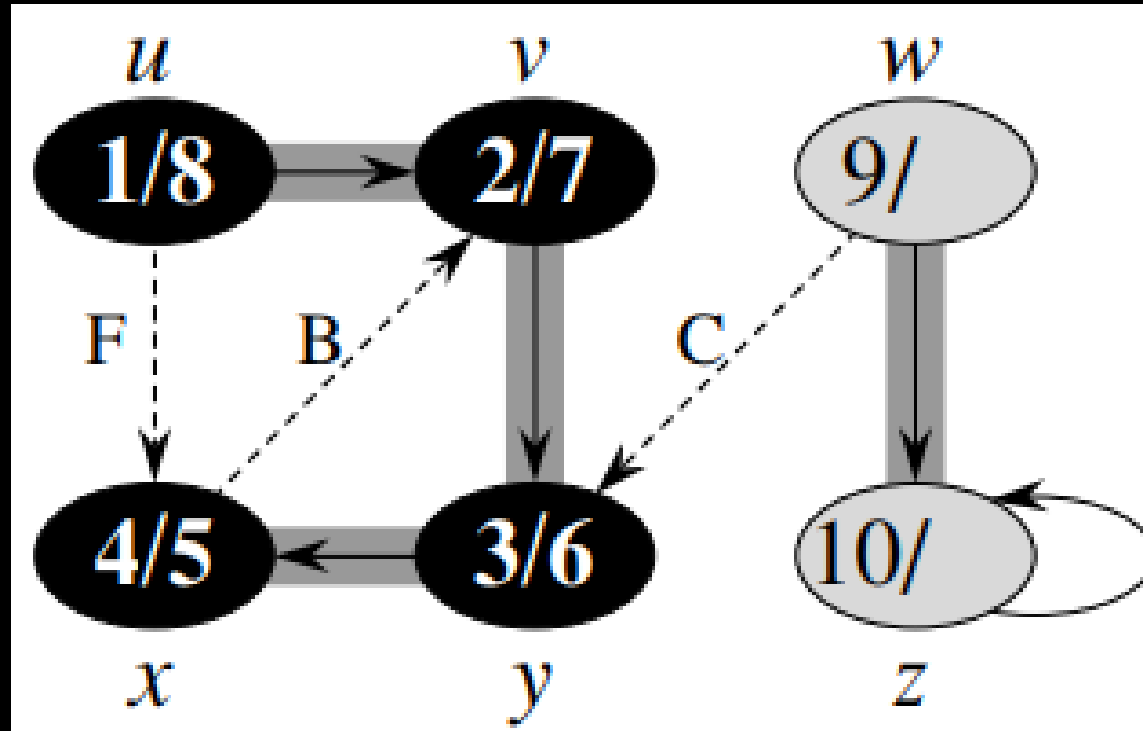


Depth-first search (DFS)

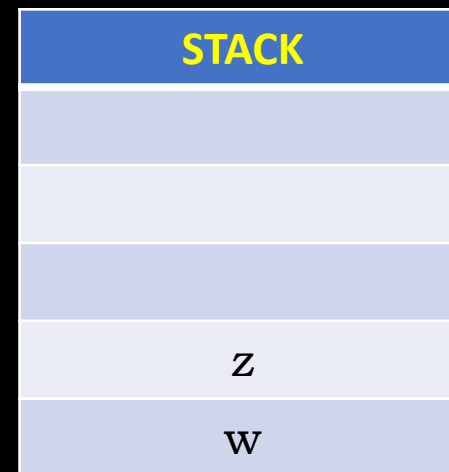
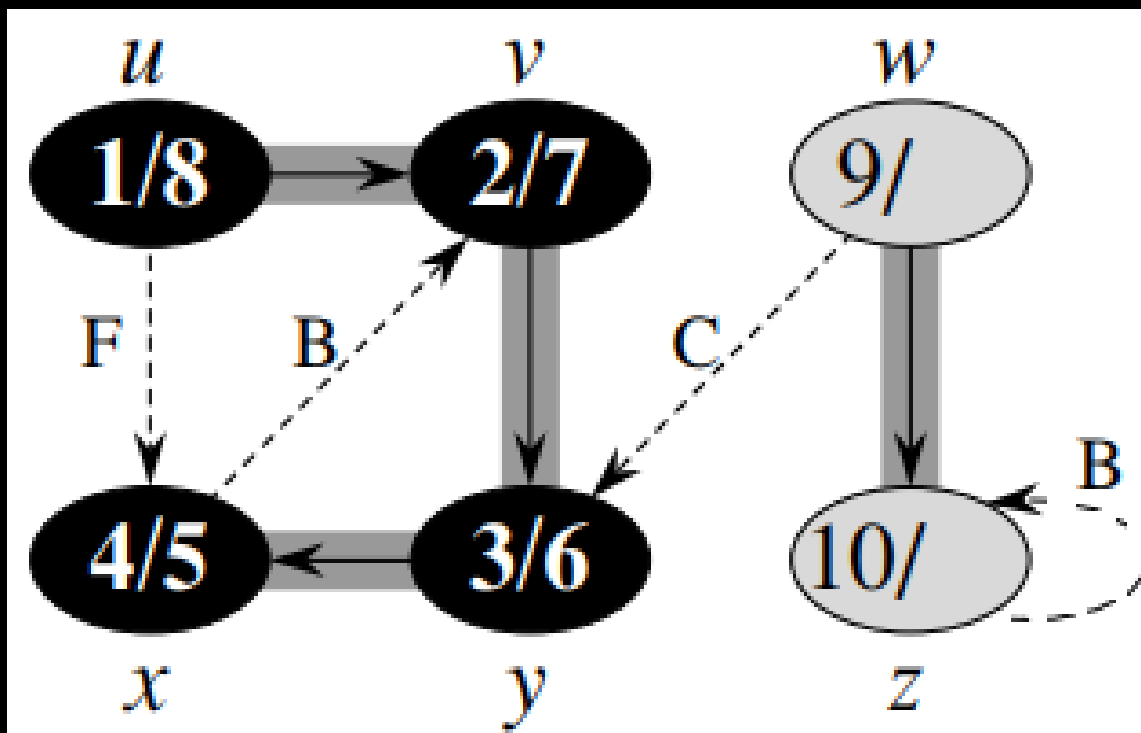
u	v	w	x	y	z
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Depth-first search (DFS)

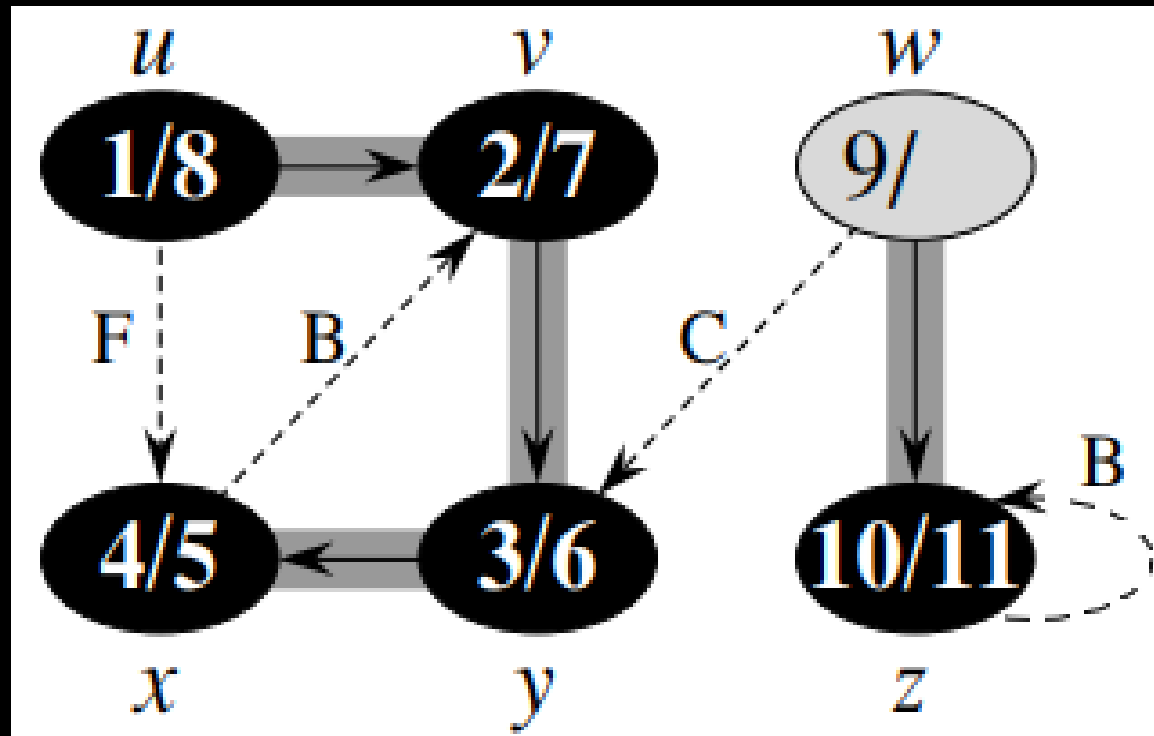


Depth-first search (DFS)



Depth-first search (DFS)

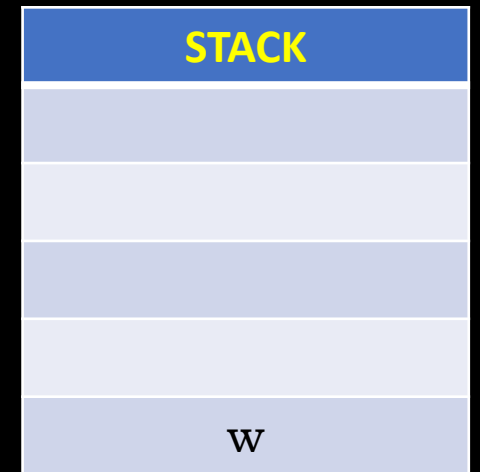
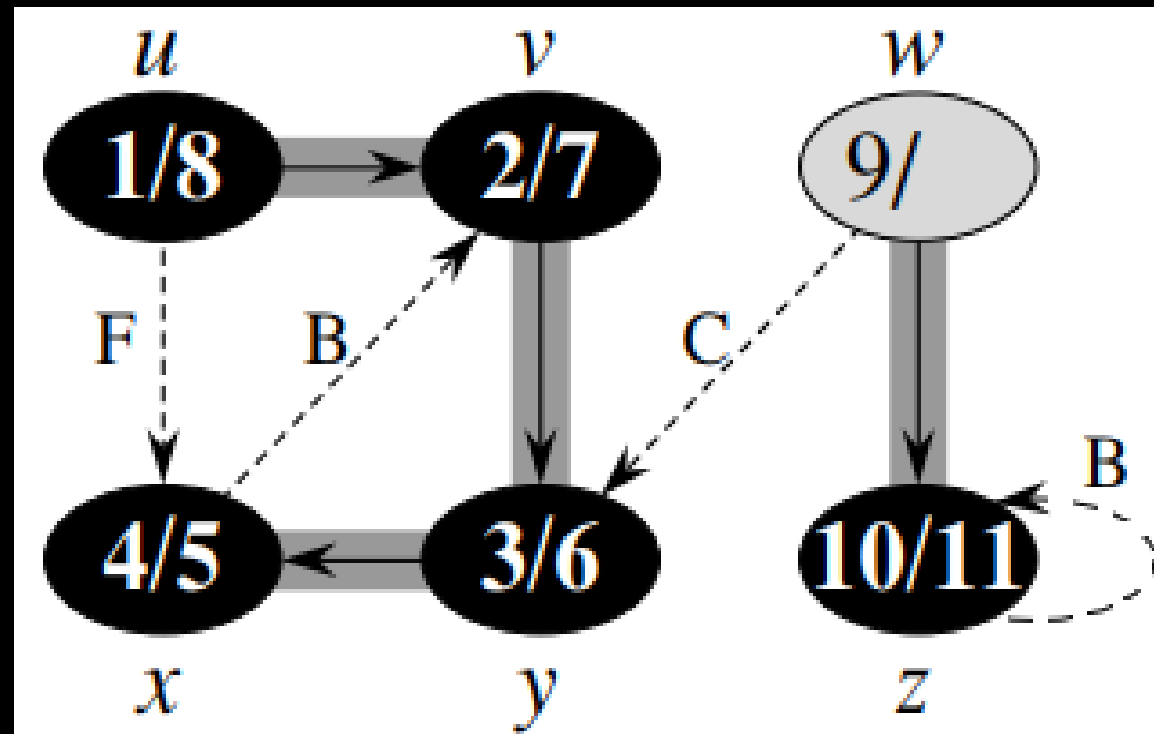
A horizontal sequence of six black boxes, each containing a white letter. The letters are u , v , w , x , y , and z from left to right. The letters v , w , y , and z are highlighted with a green background.



STACK
Z
W

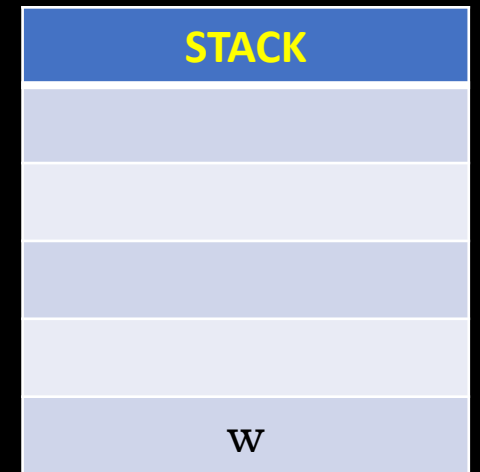
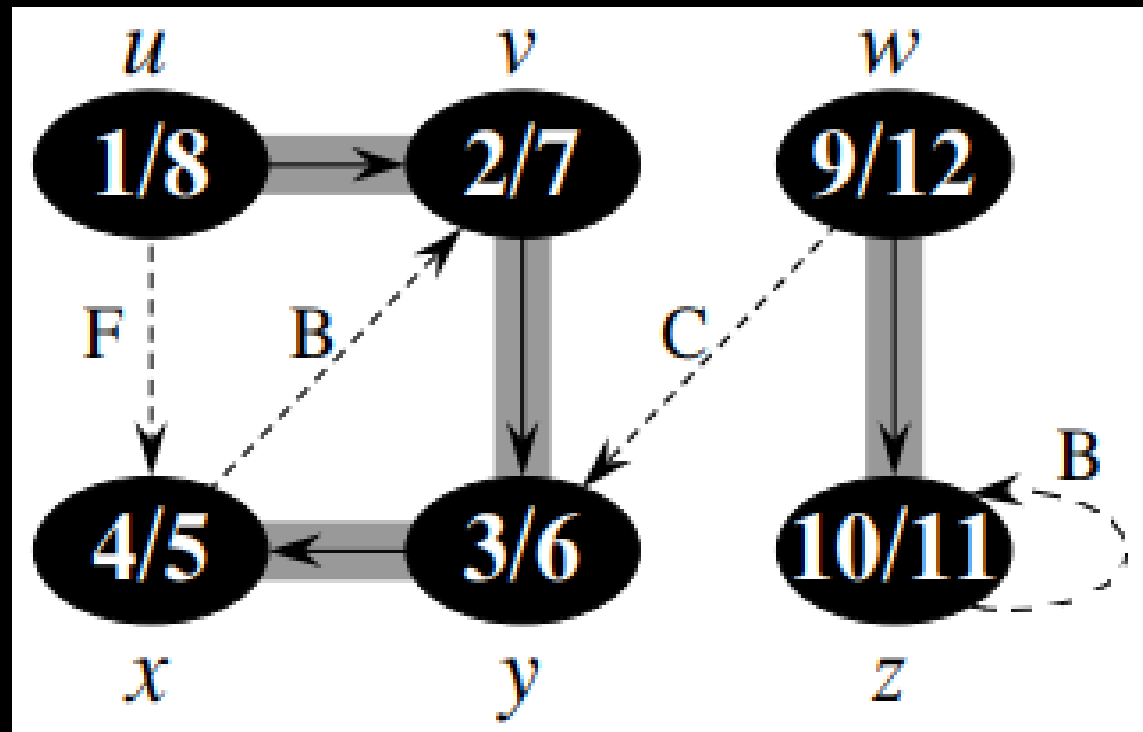
Depth-first search (DFS)

u	v	w	x	y	z
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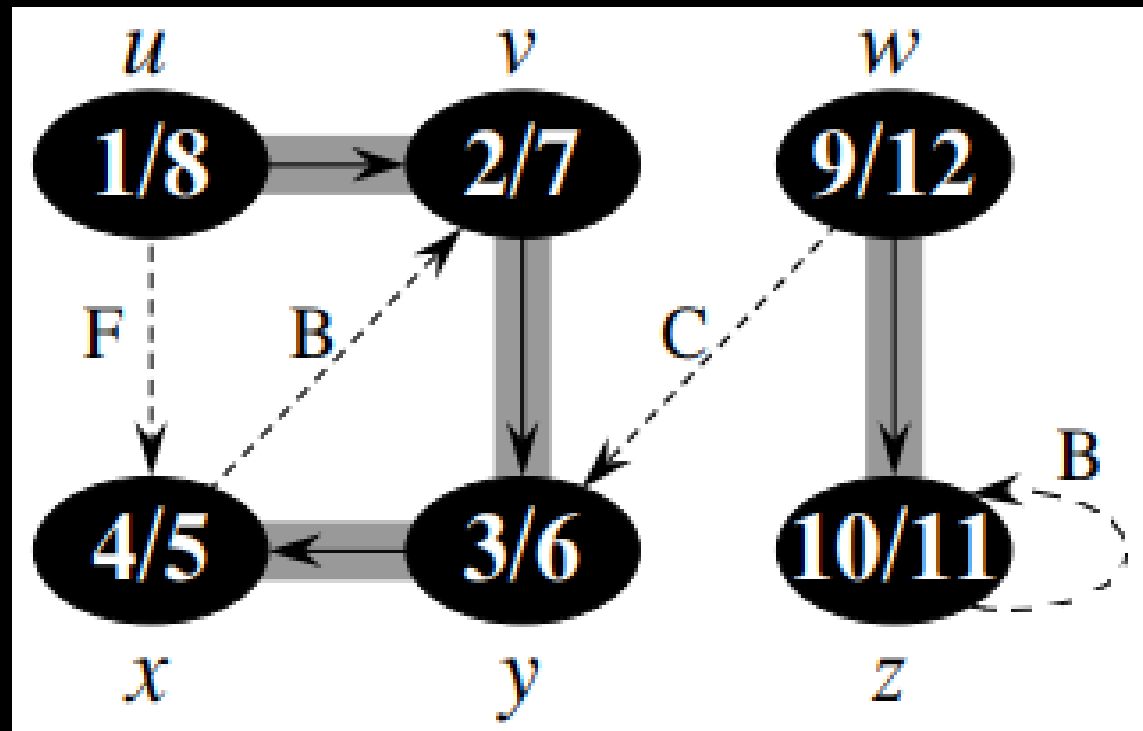
Depth-first search (DFS)

u	v	w	x	y	z
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Depth-first search (DFS)

u	v	w	x	y	z
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STACK

Depth-first search (DFS)

DFS(G)

```
1  for each vertex  $u \in V[G]$ 
2      do  $color[u] \leftarrow \text{WHITE}$ 
3       $\pi[u] \leftarrow \text{NIL}$ 
4   $time \leftarrow 0$ 
5  for each vertex  $u \in V[G]$ 
6      do if  $color[u] = \text{WHITE}$ 
7          then DFS-VISIT( $u$ )
```

DFS-VISIT(u)

```
1   $color[u] \leftarrow \text{GRAY}$ 
2   $time \leftarrow time + 1$ 
3   $d[u] \leftarrow time$ 
4  for each  $v \in Adj[u]$ 
5      do if  $color[v] = \text{WHITE}$ 
6          then  $\pi[v] \leftarrow u$ 
7              DFS-VISIT( $v$ )
8   $color[u] \leftarrow \text{BLACK}$ 
9   $f[u] \leftarrow time \leftarrow time + 1$ 
```

Analysis of DFS

DFS(G)

```
1  for each vertex  $u \in V[G]$ 
2      do  $color[u] \leftarrow \text{WHITE}$ 
3           $\pi[u] \leftarrow \text{NIL}$ 
4   $time \leftarrow 0$ 
5  for each vertex  $u \in V[G]$ 
6      do if  $color[u] = \text{WHITE}$ 
7          then DFS-VISIT( $u$ )
```

$O(V)$

DFS-VISIT(u)

```
1   $color[u] \leftarrow \text{GRAY}$ 
2   $time \leftarrow time + 1$ 
3   $d[u] \leftarrow time$ 
4  for each  $v \in Adj[u]$ 
5      do if  $color[v] = \text{WHITE}$ 
6          then  $\pi[v] \leftarrow u$ 
7              DFS-VISIT( $v$ )
8   $color[u] \leftarrow \text{BLACK}$ 
9   $f[u] \leftarrow time \leftarrow time + 1$ 
```

$O(E)$

$O(V + E)$

Depth-first search (DFS)

- https://github.com/aruntakhur/SitareUniversity/blob/main/DFS_AI_2025.ipynb

Questions?

References

- Introduction to Algorithms, Chapter 22.3 Depth First Search, Authors: Cormen, Leiserson, Rivest, and Stein.