Depth First Search

open site
blocked site
reachable from top via open sites

```
dfs(0, 0)
```

[Diagram of an N x N grid with open and blocked sites, showing the result of a depth-first search from the top left corner]
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

mark down right left up
Depth First Search

- open site
- blocked site
- reachable from top via open sites
Depth First Search

- open site
- blocked site
- reachable from top via open sites
Depth First Search

open site
blocked site
reachable from top via open sites

mark down right left up

dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

mark down right left up

```
dfs(1, 0)
dfs(0, 0)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

![Diagram](image-url)
Depth First Search

open site
blocked site
reachable from top via open sites

mark down right left up

dfs(1, 0)
dfs(0, 0)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS(0, 0)
mark down right left up

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
0 1 2 3 4
```

```
dfs(0, 0)
mark down right left up
dfs(0, 0)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
0 1 2 3 4
0 1 2 3 4
```

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0) dfs(0, 1) dfs(0, 2) dfs(0, 3) dfs(0, 4)
```

```
mark down right left up
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS(0, 0) DFS(0, 1) DFS(0, 2) DFS(0, 3) DFS(0, 4)

Flow()

mark down right left up

dfs(1, 2)

dfs(0, 2)

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

mark down right left up

dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```
```
dfs(0, 2)
dfs(1, 2)
dfs(2, 2)
```
```
flow()
```

Open site
Blocked site
Reachable from top via open sites

0 1 2 3 4

0 1 2 3 4

0 1 2 3 4

0 1 2 3 4

0 1 2 3 4

0 1 2 3 4
Depth First Search

- open site
- blocked site
- reachable from top via open sites

Mark down right left up

dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

open site
blocked site
reachable from top via open sites

dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)

mark down right left up

dfs(3, 2)
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
0 1 2 3 4
0 1 2 3 4
0 1 2 3 4
0 1 2 3 4
0 1 2 3 4
```

```
dfs(0, 0)  dfs(0, 1)  dfs(0, 2)  dfs(0, 3)  dfs(0, 4)
mark down right left up
```

```
dfs(3, 2)
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
 0 1 2 3 4
 0  |   |   |   |   |
 1  |   |   |   |   |
 2  |   |   |   |   |
 3  |   |   |   |   |
 4  |   |   |   |   |
```

mark down right left up

```
dfs(3, 2)
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(3, 2)
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(3, 2)
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
```

```
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```plaintext
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
flow()
```

```
mark down right left up
```

```
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
```

```
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

Mark down right left up

dfs(2, 1)
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

open site  
blocked site  
reachable from top via open sites

mark down right left up

dfs(2, 1)
dfs(2, 2)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
0 1 2 3 4
flow()
```

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(0, 2)
dfs(1, 2)
dfs(2, 2)
dfs(2, 1)
dfs(2, 0)
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

Diagram:
- `dfs(0, 0)`
- `dfs(0, 1)`
- `dfs(0, 2)`
- `dfs(0, 3)`
- `dfs(0, 4)`
- `dfs(1, 2)`
- `dfs(2, 2)`
- `dfs(2, 1)`
- `flow()`
Depth First Search

- open site
- blocked site
- reachable from top via open sites
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```python
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

Mark down right left up

```python
dfs(0, 2)
dfs(1, 2)
dfs(2, 2)
dfs(3, 2)
```

Open site

Blocked site

Reachable from top via open sites

Flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS(0, 0)
DFS(0, 1)
DFS(0, 2)
DFS(0, 3)
DFS(0, 4)

mark down right left up

dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
0 1 2 3 4
```

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

open site

blocked site

reachable from top via open sites

mark down right left up

dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

open site
blocked site
reachable from top via open sites

mark down right left up

dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

open site
blocked site
reachable from top via open sites

mark down right left up

dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
dfs(1, 0)
dfs(1, 1)
dfs(1, 2)
dfs(1, 3)
dfs(1, 4)
dfs(2, 0)
dfs(2, 1)
dfs(2, 2)
dfs(2, 3)
dfs(2, 4)
dfs(3, 0)
dfs(3, 1)
dfs(3, 2)
dfs(3, 3)
dfs(3, 4)
dfs(4, 0)
dfs(4, 1)
dfs(4, 2)
dfs(4, 3)
dfs(4, 4)

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
dfs(1, 2)
dfs(1, 3)
dfs(1, 4)
dfs(2, 4)
```

mark down right left up

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS:
- dfs(0, 0)
- dfs(0, 1)
- dfs(0, 2)
- dfs(0, 3)
- dfs(0, 4)
- dfs(1, 2)
- dfs(1, 3)
- dfs(1, 4)
- dfs(2, 4)
- dfs(3, 4)

Flow:
- flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

Mark down right left up

dfs(3, 4)
dfs(2, 4)
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
mark down right left up
dfs(4, 4)
dfs(3, 4)
dfs(2, 4)
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
dfs(1, 2)
dfs(1, 3)
dfs(1, 4)
dfs(2, 4)
dfs(3, 4)
dfs(4, 4)
dfs(0, 2)
dfs(1, 2)
dfs(1, 3)
dfs(2, 4)
dfs(3, 4)
dfs(4, 4)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

0 1 2 3 4

dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
dfs(1, 2)
dfs(1, 3)
dfs(1, 4)
dfs(2, 4)
dfs(3, 4)
dfs(4, 4)

mark down right left up

flow()
Depth First Search

open site
blocked site
reachable from top via open sites

mark down right left up

dfs(4, 4)
dfs(3, 4)
dfs(2, 4)
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

- Open site
- Blocked site
- Reachable from top via open sites

DFS Algorithm:

1. DFS(0, 0)
2. DFS(0, 1)
3. DFS(0, 2)
4. DFS(0, 3)
5. DFS(0, 4)
6. DFS(1, 2)
7. DFS(1, 3)
8. DFS(1, 4)
9. DFS(2, 4)
10. DFS(3, 4)

Flow:
- mark down
- right
- left
- up

Open site

Blocked site

Reachable from top via open sites
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
mark down right left up
```

```
dfs(3, 4)
dfs(2, 4)
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

0 1 2 3 4

mark down right left up

dfs(3, 4)
dfs(2, 4)
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()

open site
blocked site
reachable from top via open sites
Depth First Search

open site

blocked site

reachable from top via open sites

mark down right left up

dfs(2, 4)
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
0 1 2 3 4
0 1 2 3 4
0 1 2 3 4
0 1 2 3 4
0 1 2 3 4
```

mark down right left up

- dfs(2, 4)
- dfs(1, 4)
- dfs(1, 3)
- dfs(1, 2)
- dfs(0, 2)

flow()
Depth First Search

open site
blocked site
reachable from top via open sites

mark down right left up

dfs(2, 4)
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
dfs(1, 2)
dfs(1, 3)
dfs(1, 4)
```

mark down right left up

```
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)  dfs(0, 1)  dfs(0, 2)  dfs(0, 3)  dfs(0, 4)
mark down right left up
dfs(1, 4)
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
dfs(1, 2)
dfs(1, 3)
dfs(1, 4)
dfs(0, 2)
```

mark down right left up

```
flow()
dfs(0, 2)
dfs(1, 2)
dfs(1, 3)
dfs(1, 4)
dfs(0, 4)
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

```
mark down right left up
```

```
dfs(1, 3)
dfs(1, 2)
dfs(0, 2)
flow()
```
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS function calls:
- dfs(0, 0)
- dfs(0, 1)
- dfs(0, 2)
- dfs(0, 3)
- dfs(0, 4)

Mark down right left up

DFS function calls:
- dfs(1, 2)
- dfs(0, 2)
- flow()
Depth First Search

open site

blocked site

reachable from top via open sites

mark down right left up

dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
dfs(1, 2)
dfs(0, 2)
flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS:
- dfs(0, 0)
- dfs(0, 1)
- dfs(0, 2)
- dfs(0, 3)
- dfs(0, 4)

Operations:
- mark down
- right
- left
- up

Sites:
- open site
- blocked site
- reachable from top via open sites

Flow:
- dfs(0, 2)
- flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS(0, 1, 2, 3, 4)

flow()

mark down right left up

dfs(0, 2)

flow()
Depth First Search

open site

blocked site

reachable from top via open sites

mark down right left up

dfs(0, 2)

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites

DFS:
- `dfs(0, 0)`
- `dfs(0, 1)`
- `dfs(0, 2)`
- `dfs(0, 3)`
- `dfs(0, 4)`
Depth First Search

- open site
- blocked site
- reachable from top via open sites

```
dfs(0, 0)
dfs(0, 1)
dfs(0, 2)
dfs(0, 3)
dfs(0, 4)
```

flow()
Depth First Search

- open site
- blocked site
- reachable from top via open sites