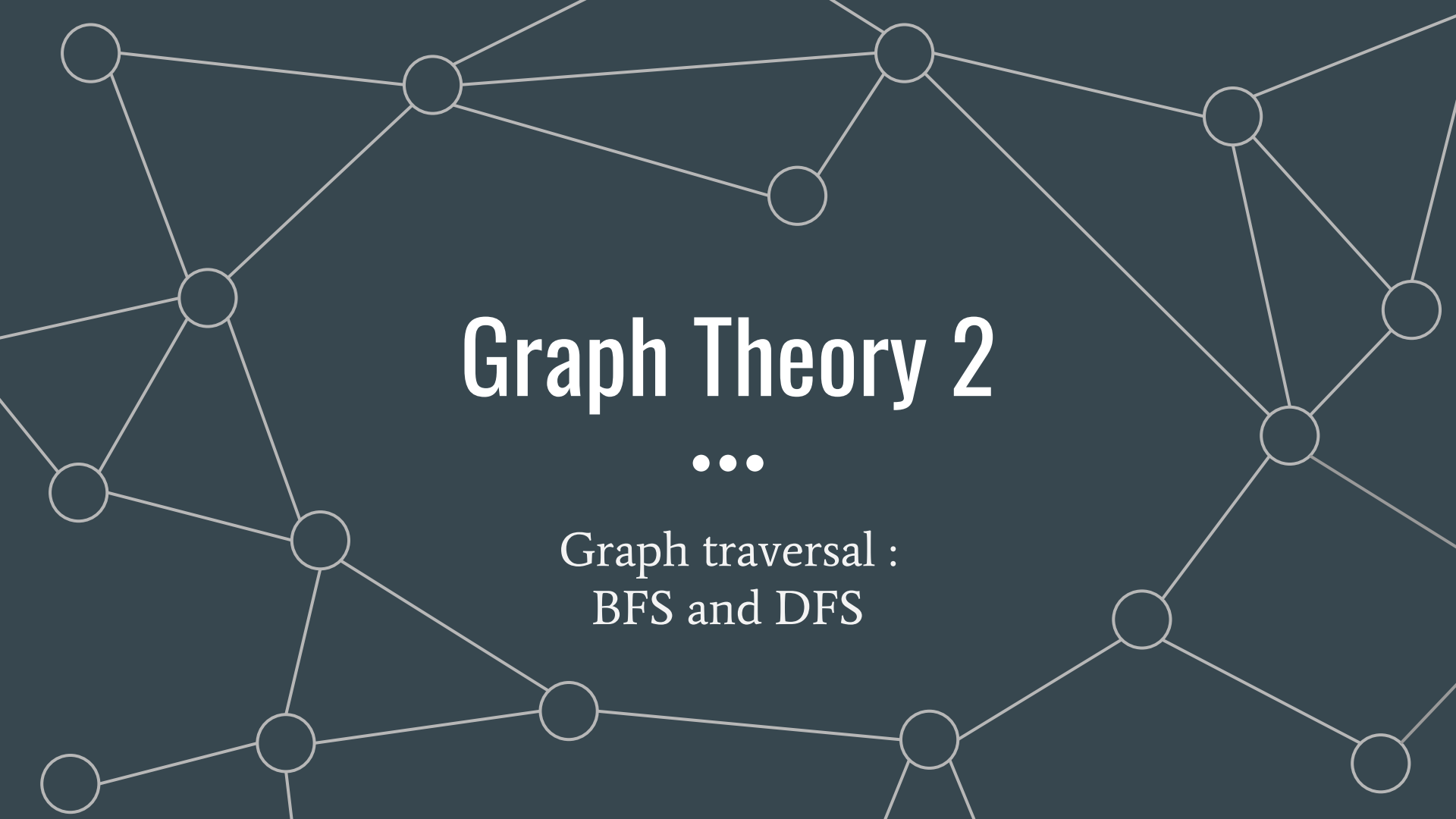


Graph Theory 2

...

Graph traversal :
BFS and DFS

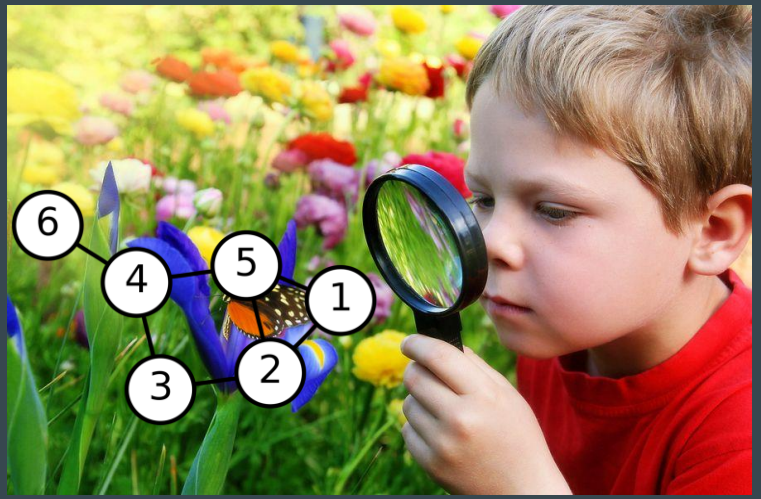
Graph traversal

What is it ?

-> A method to explore a graph from a given node (every node accessible)

Purpose ?

- Quickly explore the graph (useful for some problems).
- Foundation for more advanced algorithms (we'll see this in the following weeks).



Big notions used

- **Visited/unvisited:**

To explore the graph optimally (a node is explored only once) we need to keep track of which node has been already visited

- **Main data structure:**

The data structure used to keep track on which node will be visited next.

- **Additional data structure:**

May be used to keep track of various informations depending on the context

Two algorithm for the price of one:

BFS

Breadth-first search

-

Explore first the nearest nodes from the current position

FIFO - Queue

DFS

Depth-first search

-

Go as deep as you can and backtrack when you’re in a dead end

LIFO - Stack

A small demonstration

BFS

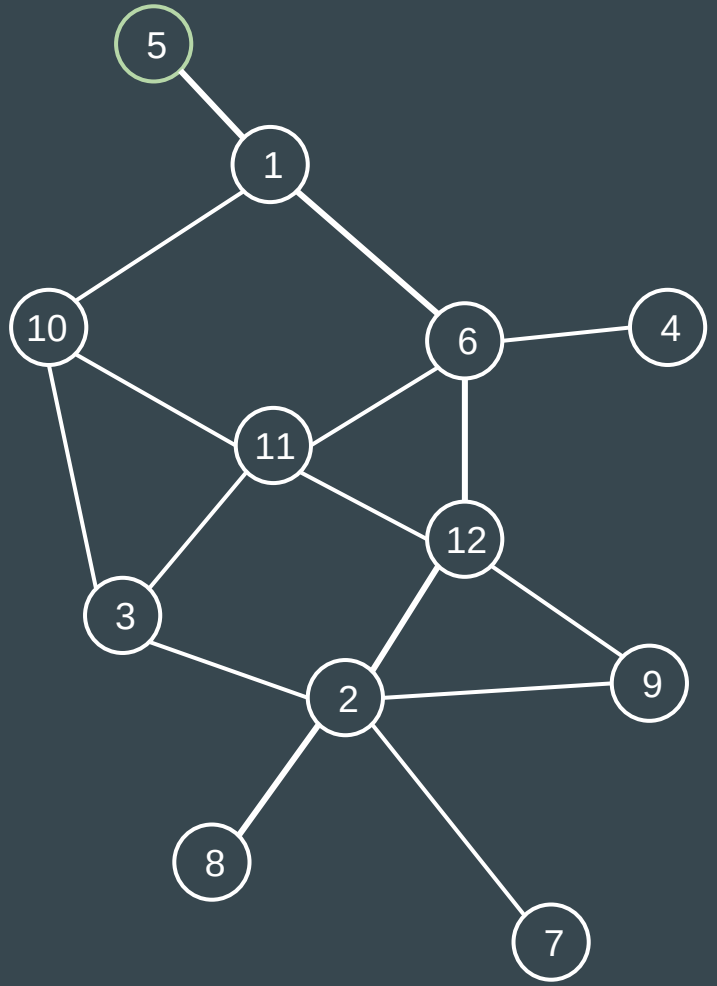
DFS

BFS

```
BFS(G, start):
    let q be a queue
    add start to the queue
    set every node of G to unvisited
    set start to visited

    while q is not empty:
        current is the next node from q

        for every node a_i adjacent to current:
            if current is visited: skip
                set current to visited
                put a_i in q
```



Complexity : O(E+V)

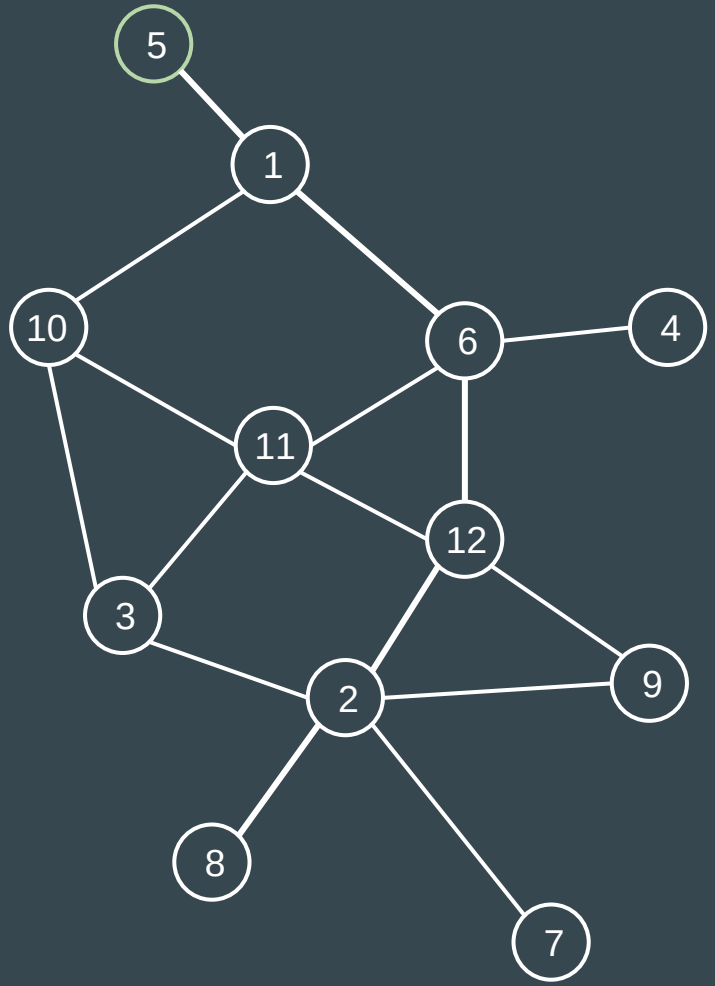
DFS

```
DFS(G, start):
    let s be a stack
    add start to the stack
    set every node of G to unvisited
    set start to visited

    while q is not empty:
        current is the next node from s

        for every node a_i adjacent to current:
            if current is visited: skip
                set current to visited
                put a_i in s
```

Complexity : O(E+V)



Why two variants ?

BFS

- Find the shortest path between two nodes when the edges' weights are equals

DFS

- Possibility to implement a recursive version
- Give the topological order of the node in an oriented graph (which can be useful for some shortest path application)

Credits

More resources:

- DFS : https://en.wikipedia.org/wiki/Depth-first_search
- BFS : https://en.wikipedia.org/wiki/Breadth-first_search
- Cours de 3IF : https://moodle.insa-lyon.fr/pluginfile.php/317641/mod_resource/content/1/cours.pdf

Slides: Sebastien Goll for INSAlgo