Assignment 1

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Assignment 1: Quizzes + A Coding Task

- Two sets of quizzes (20 ponts)
  - Basic C/C++ and secure programming
  - Vulnerability assessment.
- One coding task (10 ponts)
  - Practicing C++ graph traversal algorithm
  - A warm up coding task for later assignments.

You are encouraged to finish the quizzes before starting your coding task.

Assignment 1: C++ Coding Task

Graph Traversal

- You will be using what you have learned to build a C++ program.
- **Goal**: implement a depth first search on a graph and print path from a source node to a sink node on the graph

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Depth First Search (DFS)

- An algorithm to traverse or search a graph data structure.
- Exploring as far as possible along each branch before backtracking.

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Depth First Search (DFS)

- An algorithm to traverse or search a graph data structure.
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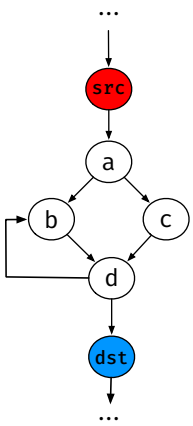
Why DFS?

- Efficient, linear time complexity, i.e., O(V+E), where V is nodes and E is edges.
- One of the most commonly used graph algorithms.

Assignment 1: C++ Coding Task

Graph Traversal

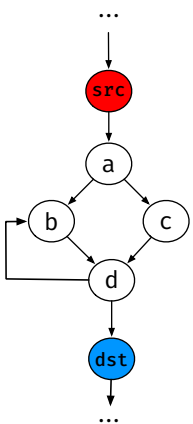


Given a source node `src` and a destination node `dst` on a graph

- (1) can `src` reach `dst`?
- (2) if so, what are the possible paths from `src` to `dst` along the graph?

Assignment 1: C++ Coding Task

Graph Traversal



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Answer:

- (1) Yes.

Assignment 1: C++ Coding Task

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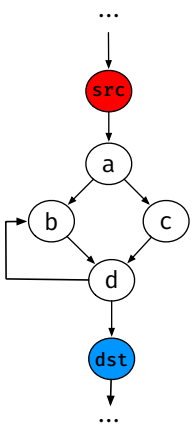

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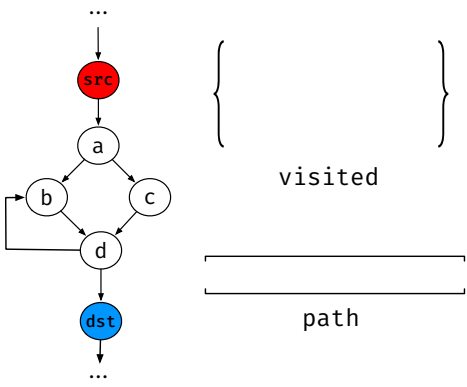
- (1) can `src` reach `dst`?
- (2) if so, what are the possible paths from `src` to `dst` along the graph?

Answer:

- (1) Yes.
- (2) All possible paths:
  - `src` → `a` → `b` → `d` → `dst`
  - `src` → `a` → `c` → `d` → `dst`
  - `src` → `a` → `b` → `d` → `b` → `d` → `dst`
  - `src` → `a` → `b` → `d` → `b` → `d` → `...dst`

Assignment 1: C++ Coding Task

DFS algorithm and an example

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visited: set<Node*>
//edge seq in the current path during traversal
path: vector<Edge*>

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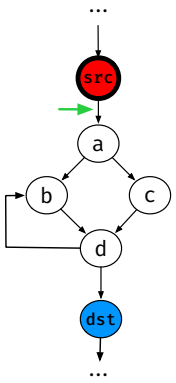

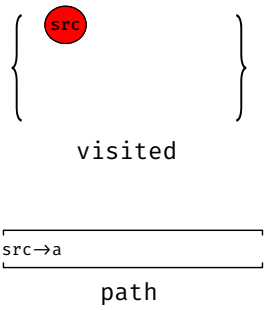


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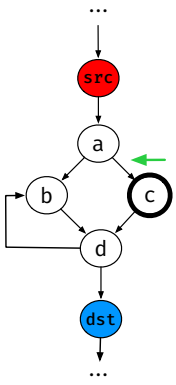

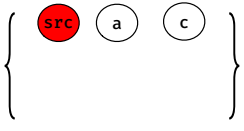

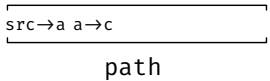


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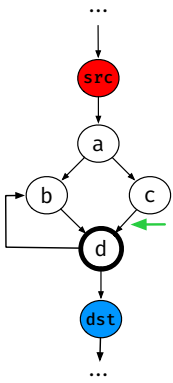

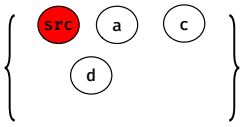

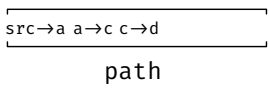


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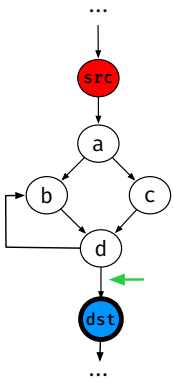

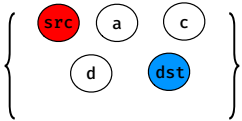

visited

src→a a→c c→d d→dst

path

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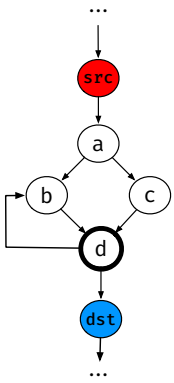

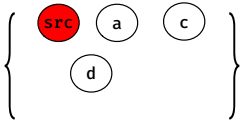

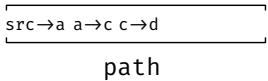


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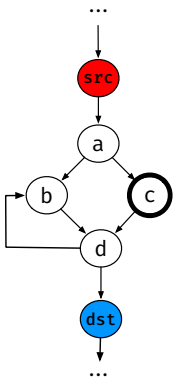

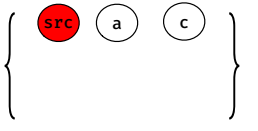

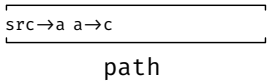


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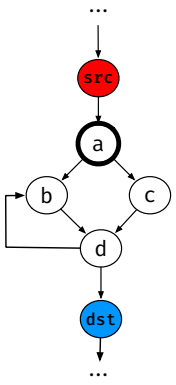

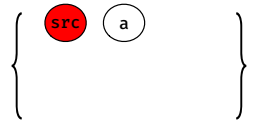

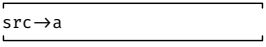


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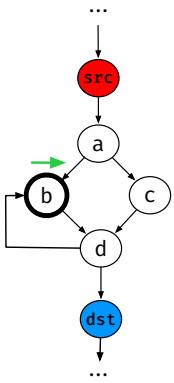
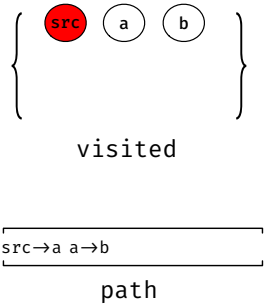
DFS algorithm



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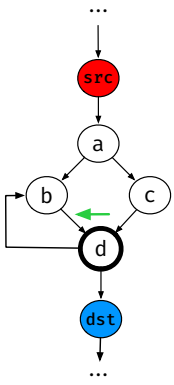

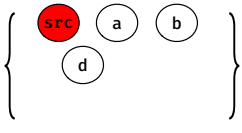

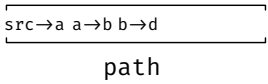


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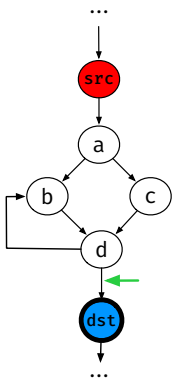

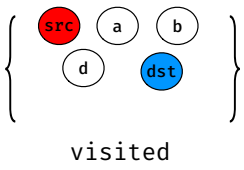

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4   if src == dst then
5     Print path; //Print node seq of current path
6   foreach edge e ∈ outEdges(src) do
7     nxtNode = e.getDst();
8     if (nxtNode ∉ visited)
9           DFS(visited, path, e, dst);
10  visited.erase(curNode);
11  path.pop_back();
```