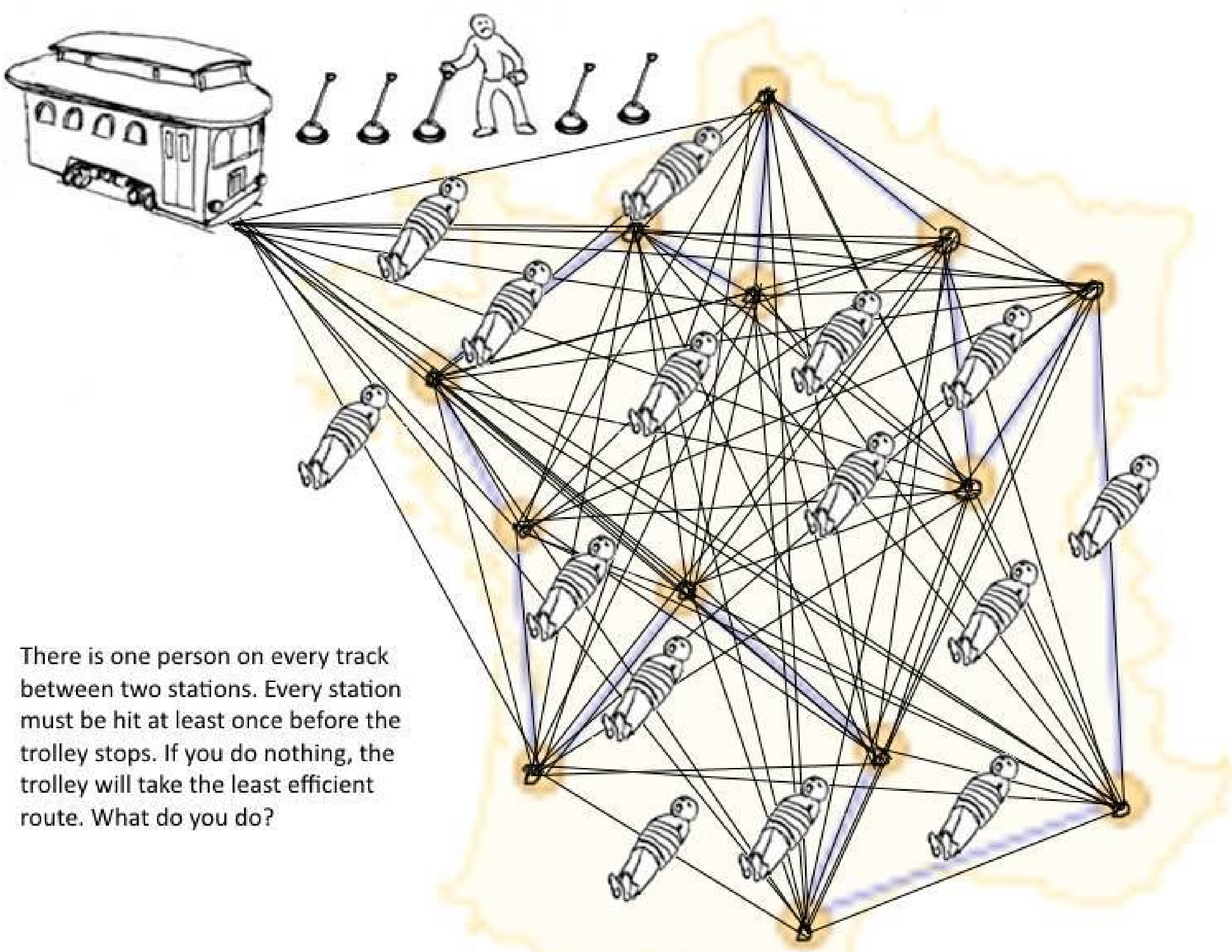
Graph Traversals

Why care about graph traversals ?



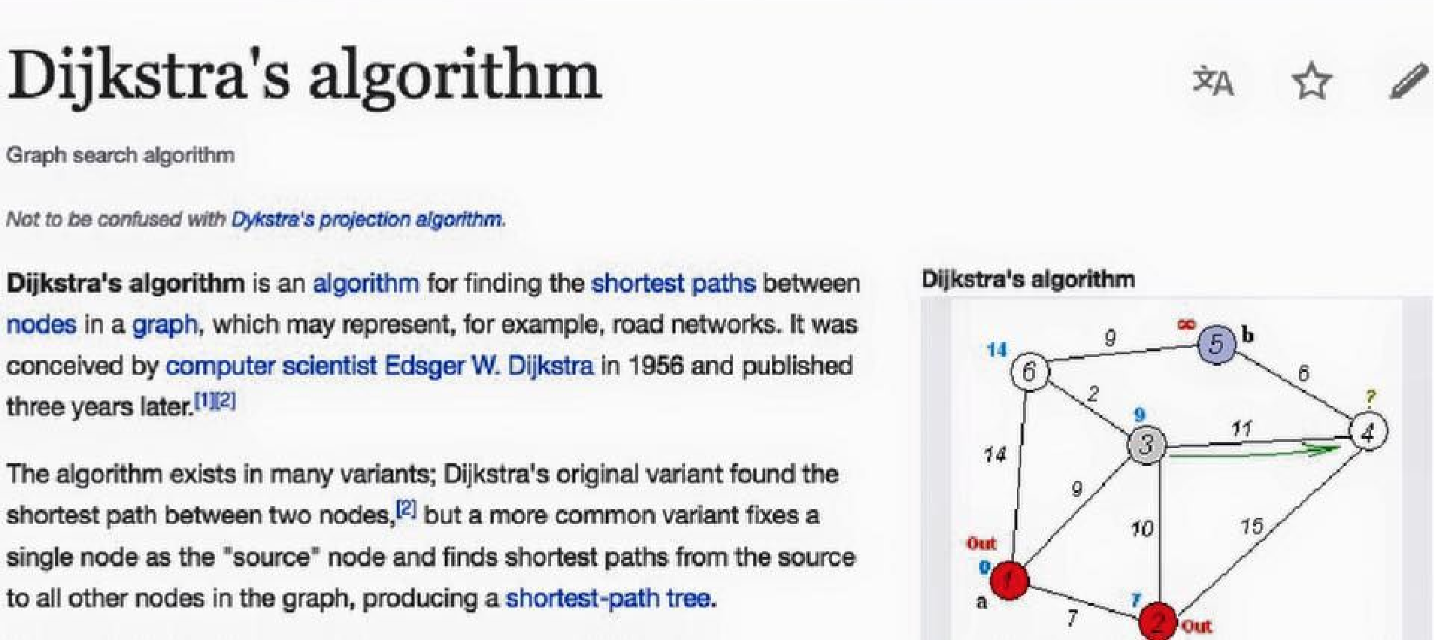
There is one person on every track between two stations. Every station must be hit at least once before the trolley stops. If you do nothing, the trolley will take the least efficient route. What do you do?

Bae: Come over

Dijkstra: But there are so many routes to take and I don't know which one's the fastest

Bae: My parents aren't home

Dijkstra:



Dijkstra's algorithm

Graph search algorithm

Not to be confused with Dykstra's projection algorithm.

Dijkstra's algorithm is an algorithm for finding the shortest paths between nodes in a graph, which may represent, for example, road networks. It was conceived by computer scientist Edsger W. Dijkstra in 1956 and published three years later.[1][2]

The algorithm exists in many variants; Dijkstra's original variant found the shortest path between two nodes,[2] but a more common variant fixes a single node as the "source" node and finds shortest paths from the source to all other nodes in the graph, producing a shortest-path tree.

Dijkstra's algorithm

Roadmap

- Memes
    - Breadth Search
    - Depth Search
    - Cycle Detection
    - Applications
    - Animations
    - Visualizations

search algorithms

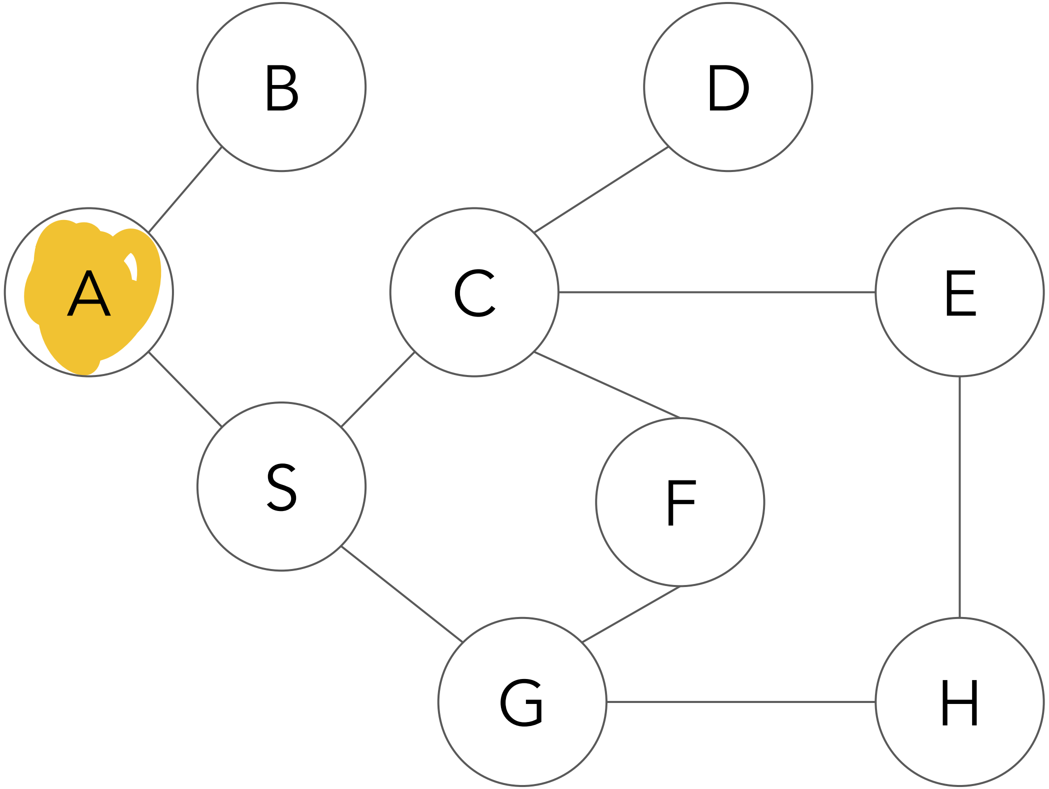
- α–β
- A*
- B*
- Backtracking
- Beam
- Bellman–Ford
- Best-first
- Bidirectional
- Borůvka
- Branch & bound
- BFS
- British Museum
- D*
- DFS
- Dijkstra
- Edmonds
- Floyd–Warshall
- Fringe search
- Hill climbing
- IDA*
- Iterative deepening
- Johnson
- Jump point
- Kruskal
- Lexicographic BFS
- Prim
- SMA*

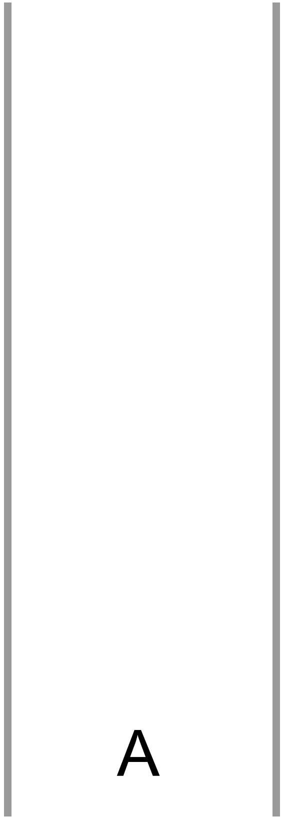
BREADTH-FIRST SEARCH
DEPTH-FIRST SEARCH
MARVEL
CAPTAIN AMERICA
CIVIL WAR
MAY 6, 2016

Depth-First Search

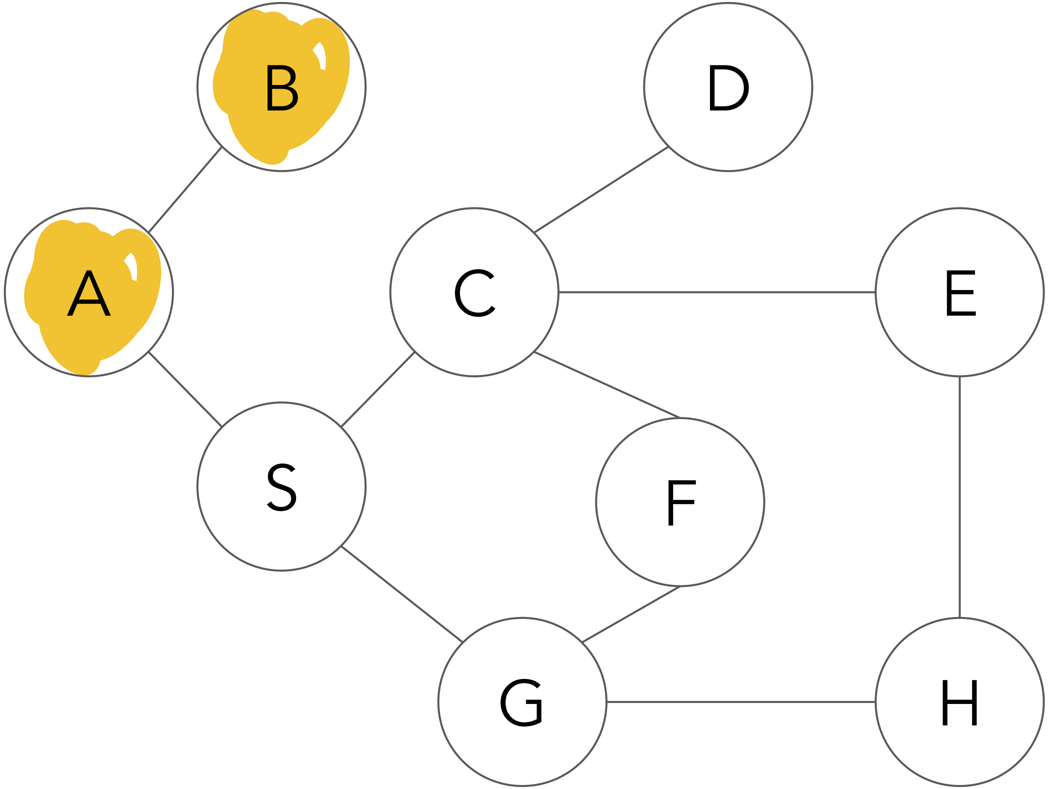
Using a stack 💸

Stack Status





Output: A

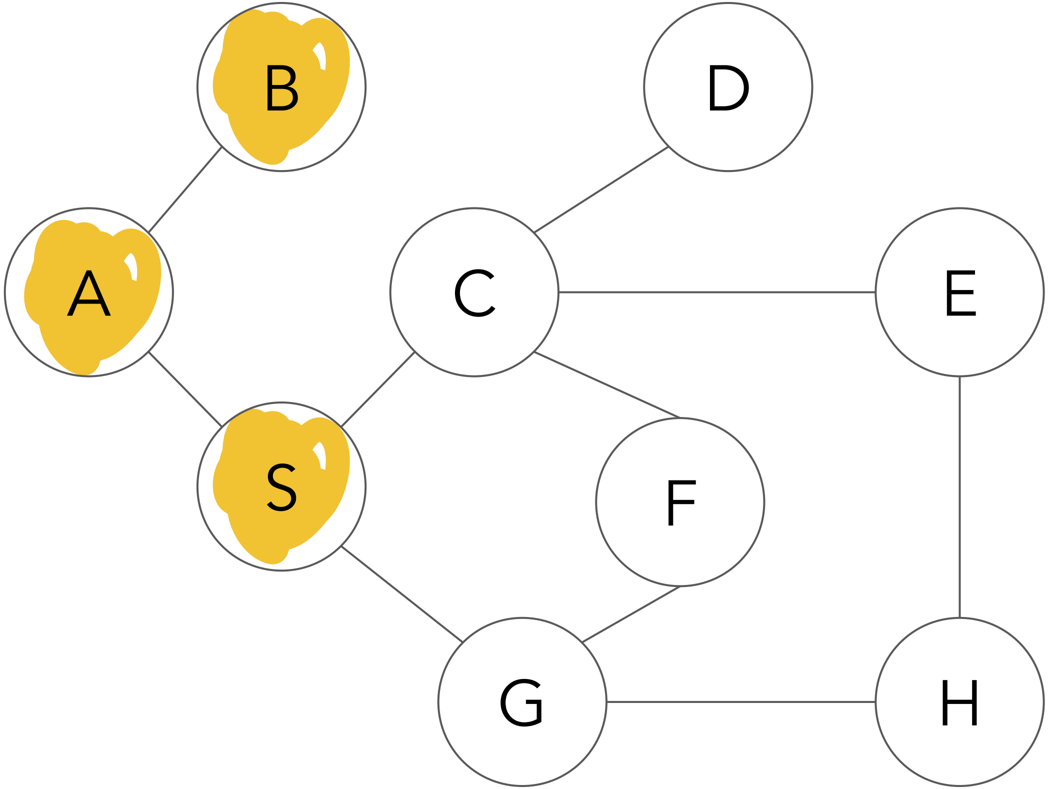


Stack Status

B

A

Output: A B



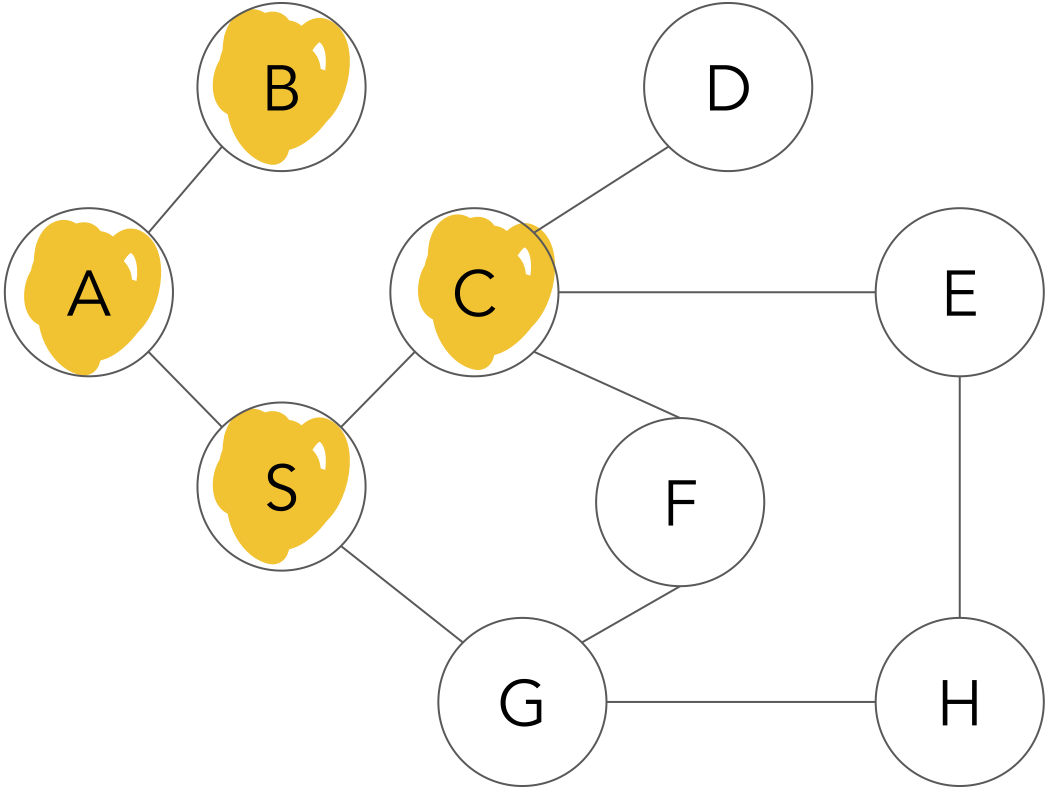
Stack Status

S

A

Output: A B S

Stack Status



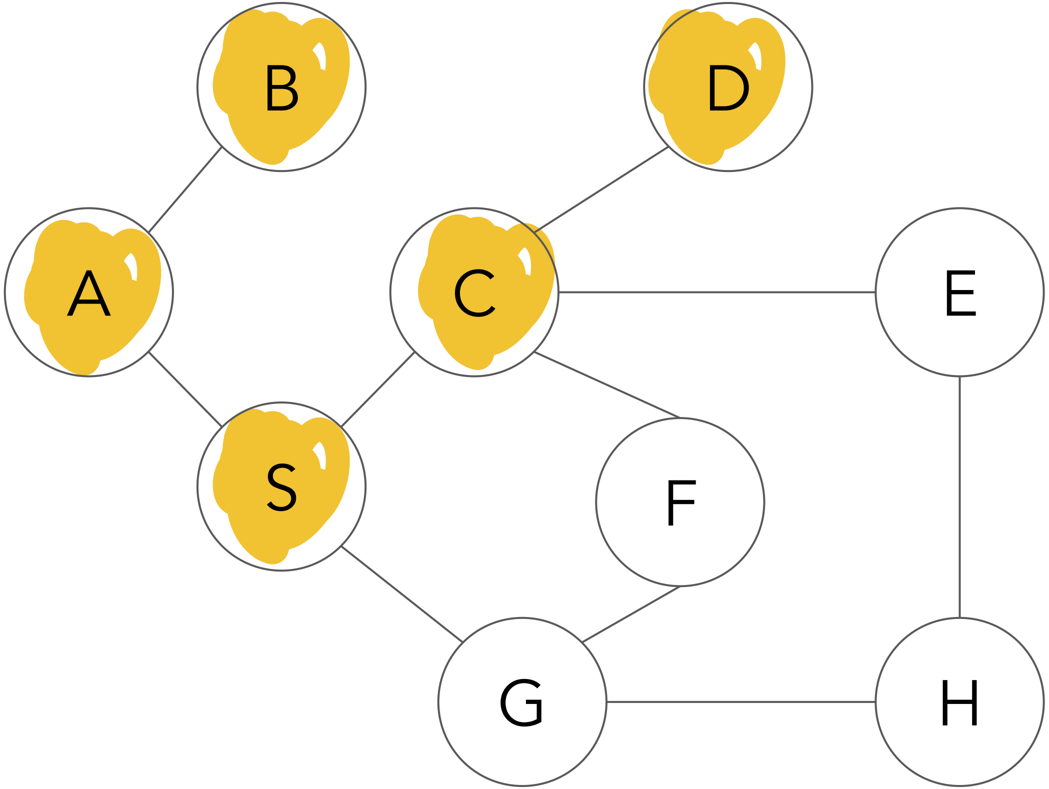
C

S

A

Output: A B S C

Stack Status



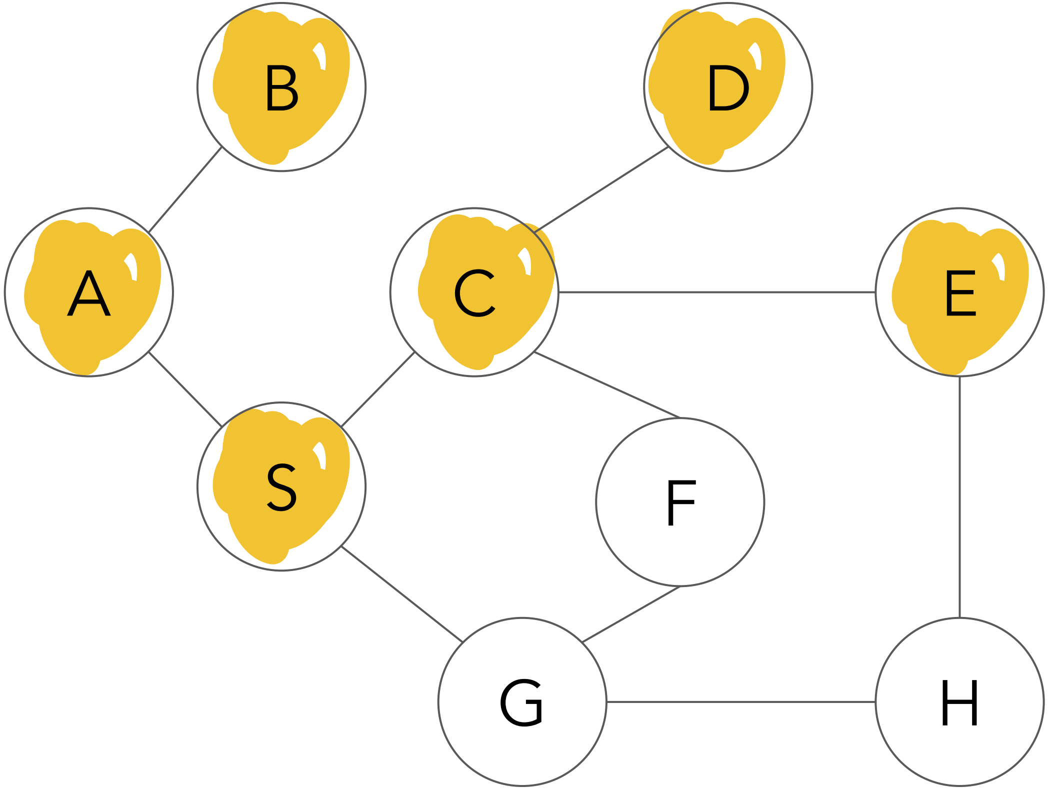
D

C

S

A

Output: A B S C D



Stack Status

E

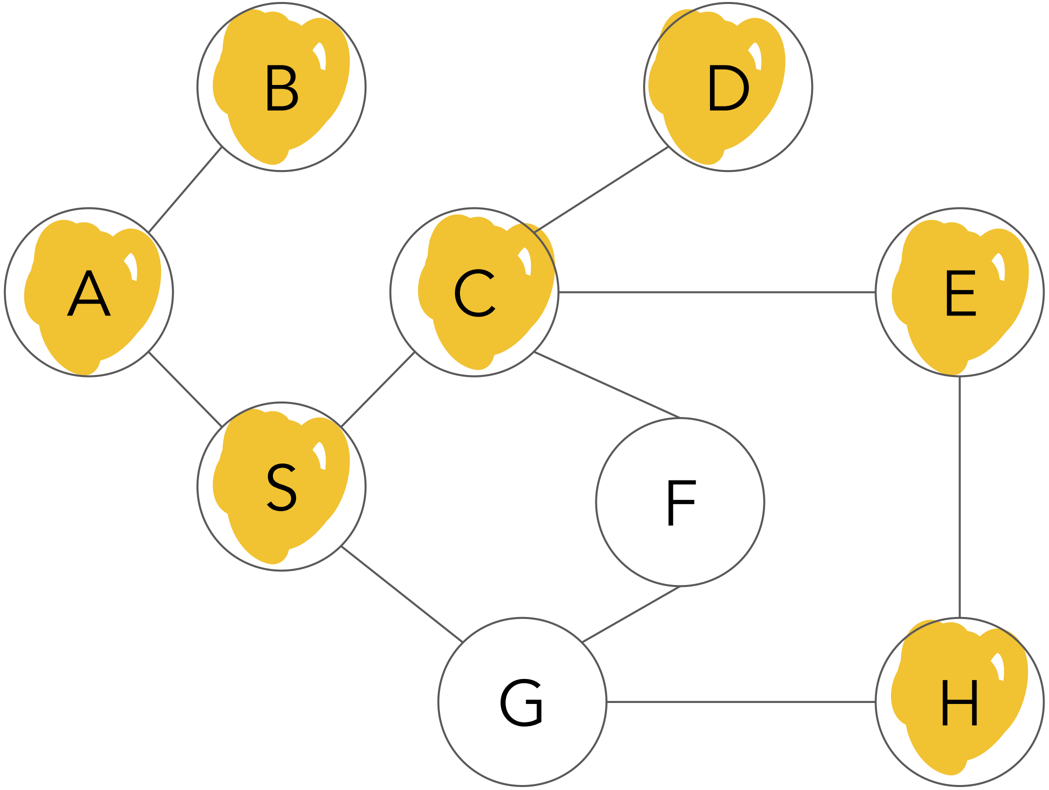
C

S

A

Output: A B S C D E

Stack Status



H

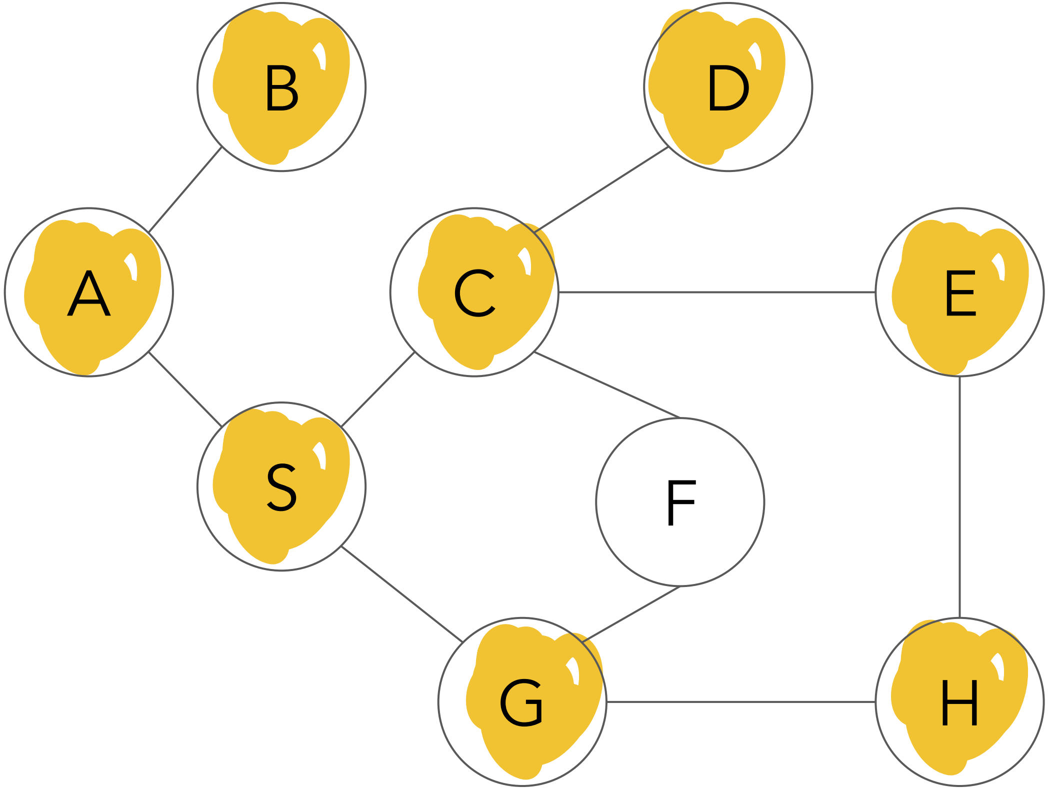
E

C

S

A

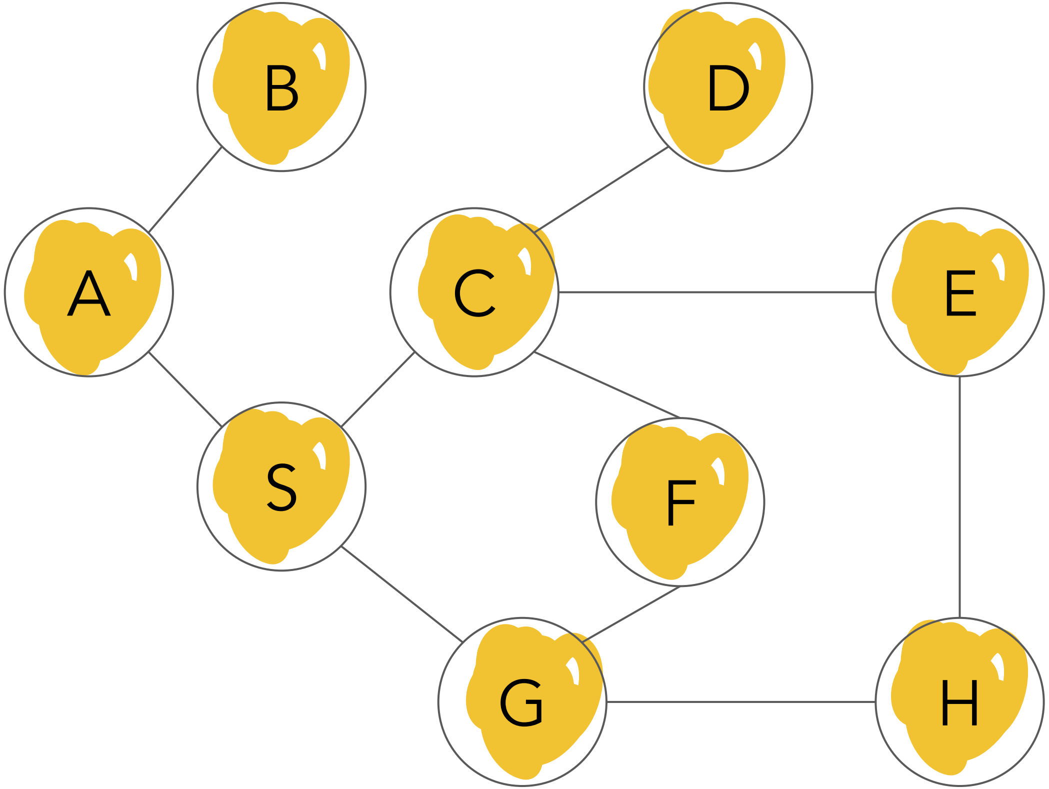
Output: A B S C D E H



Output: A B S C D E H G

Stack Status

G
H
E
C
S
A



Stack Status

F

G

H

E

C

S

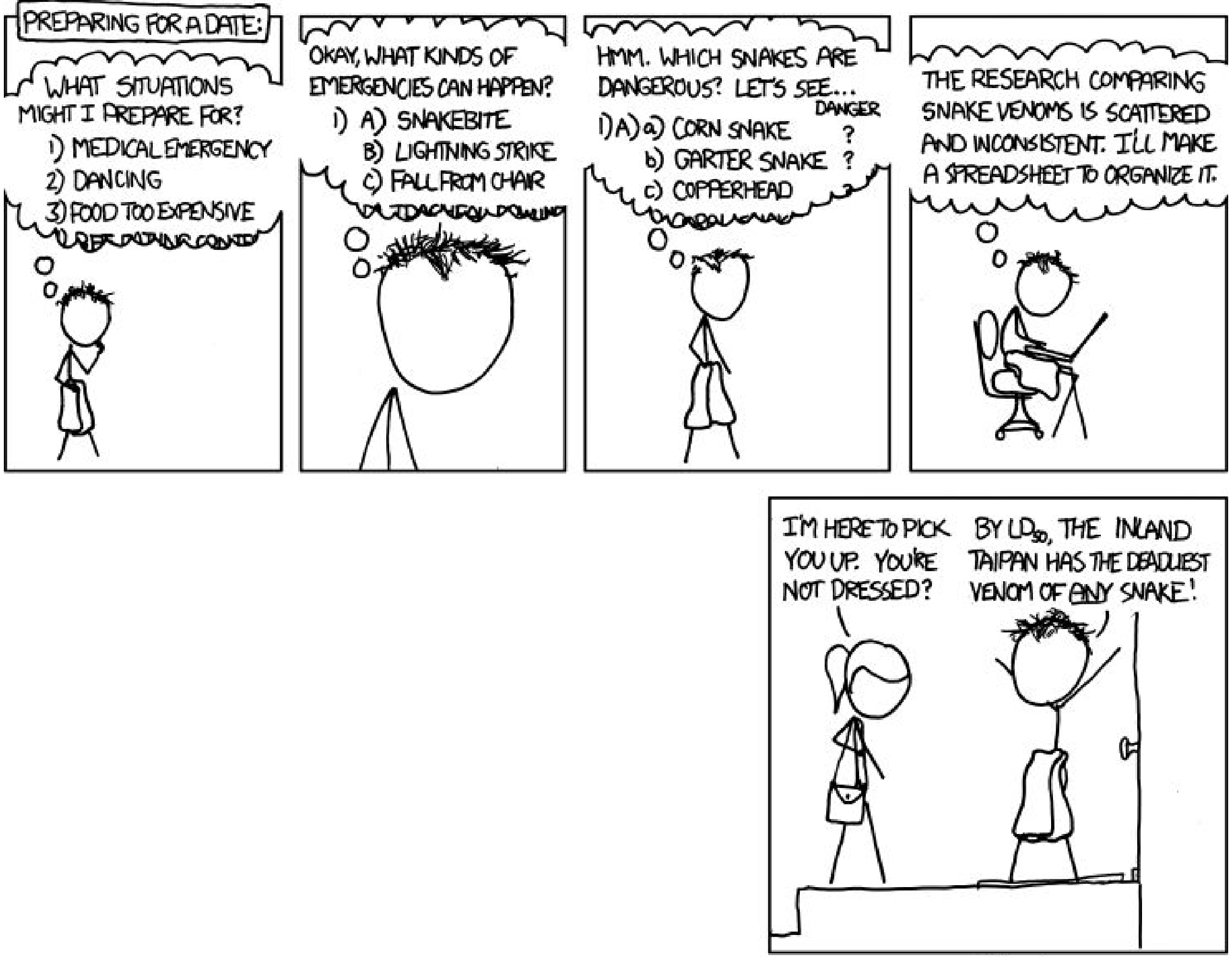
A

Output: A B S C D E H G F

Applications

Algorithms that use depth-first search as a building block include:

- Filesystem search
- Maze generation may use a randomized depth-first search.
- AI
- Finding connected components.
- Topological sorting.
- Finding 2-(edge or vertex)-connected components.
- Finding 3-(edge or vertex)-connected components.
- Finding the bridges of a graph.
- Generating words in order to plot the Limit Set of a Group.
- Finding strongly connected components.
- Planarity testing[7][8]
- Solving puzzles with only one solution, such as mazes. (DFS can be adapted to find all solutions to a maze by only including nodes on the current path in the visited set.)
- Finding biconnectivity in graphs.


PREPARING FOR A DATE:
WHAT SITUATIONS MIGHT I PREPARE FOR?
1) MEDICAL EMERGENCY
2) DANCING
3) FOOD TOO EXPENSIVE
OKAY, WHAT KINDS OF EMERGENCIES CAN HAPPEN?
1) A) SNAKEBITE
B) LIGHTNING STRIKE
C) FALL FROM CHAIR
HMM. WHICH SNAKES ARE DANGEROUS? LET'S SEE...
DANGER
1) A) a) CORN SNAKE ?
b) GARTER SNAKE ?
c) COPPERHEAD ?
THE RESEARCH COMPARING SNAKE VENOMS IS SCATTERED AND INCONSISTENT. I'LL MAKE A SPREADSHEET TO ORGANIZE IT.
I'M HERE TO PICK YOU UP. YOU'RE NOT DRESSED?
BY LD50, THE INLAND TAIPAN HAS THE DEADLIEST VENOM OF ANY SNAKE!

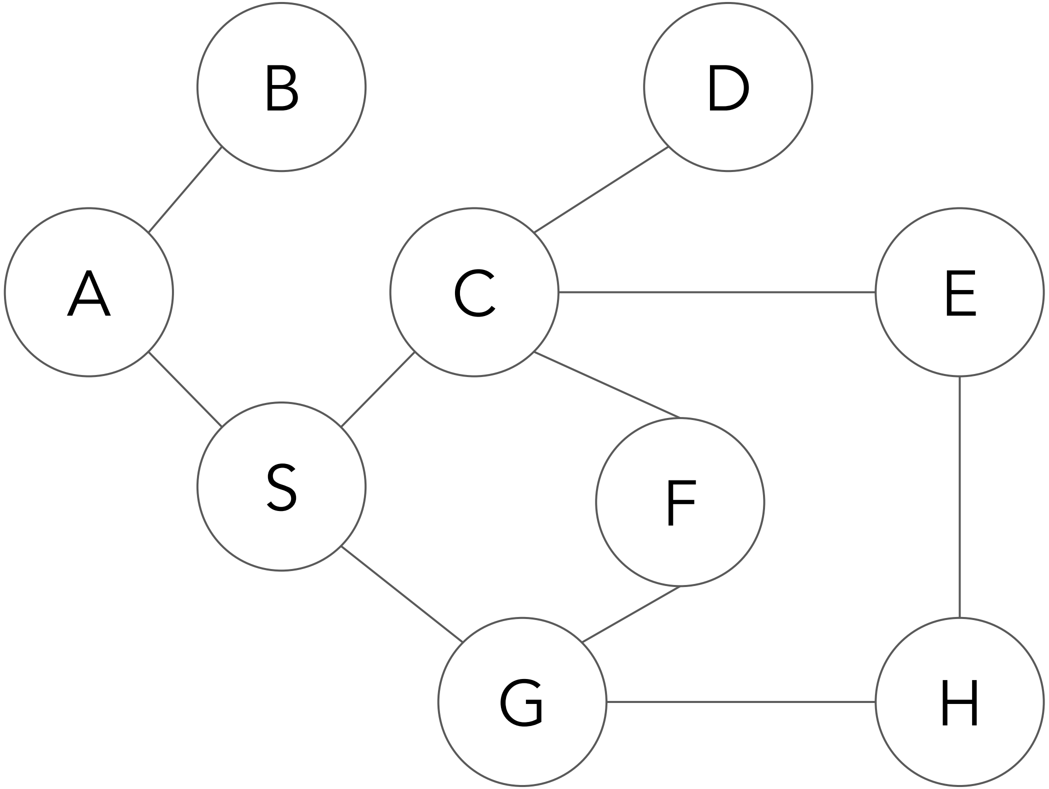
I REALLY NEED TO STOP
USING DEPTH-FIRST SEARCHES.

Breadth-First Search

Using a queue □□□□

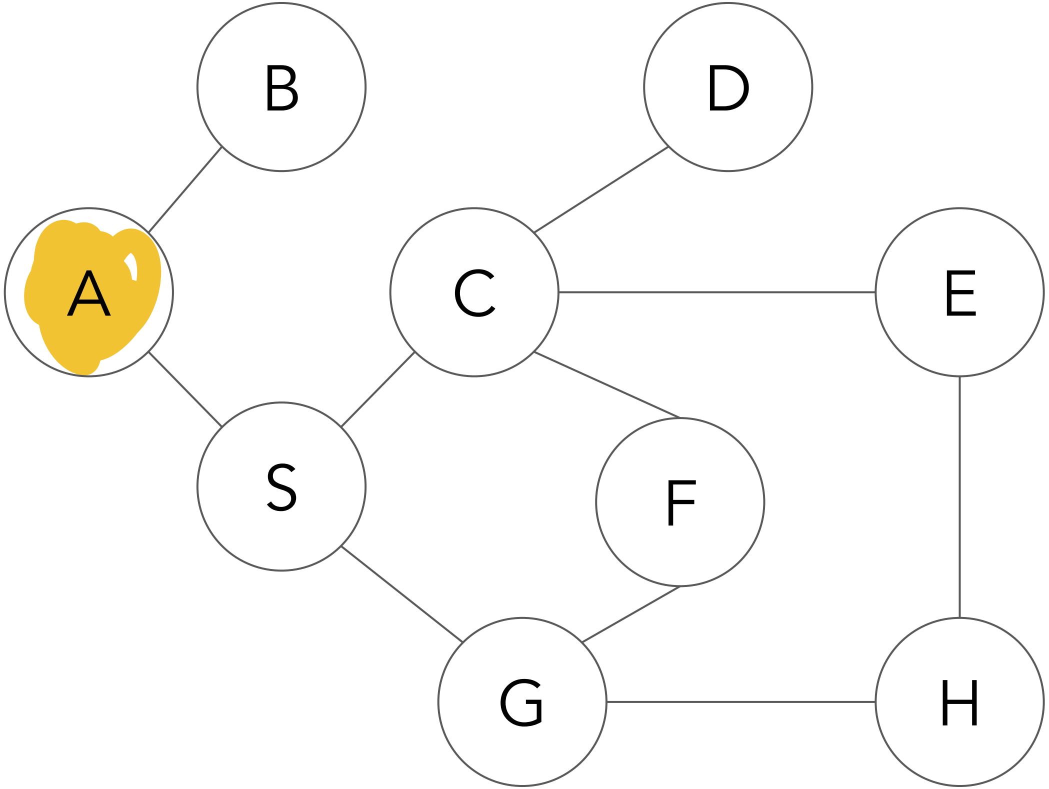
🍞 🔎

Queue Status



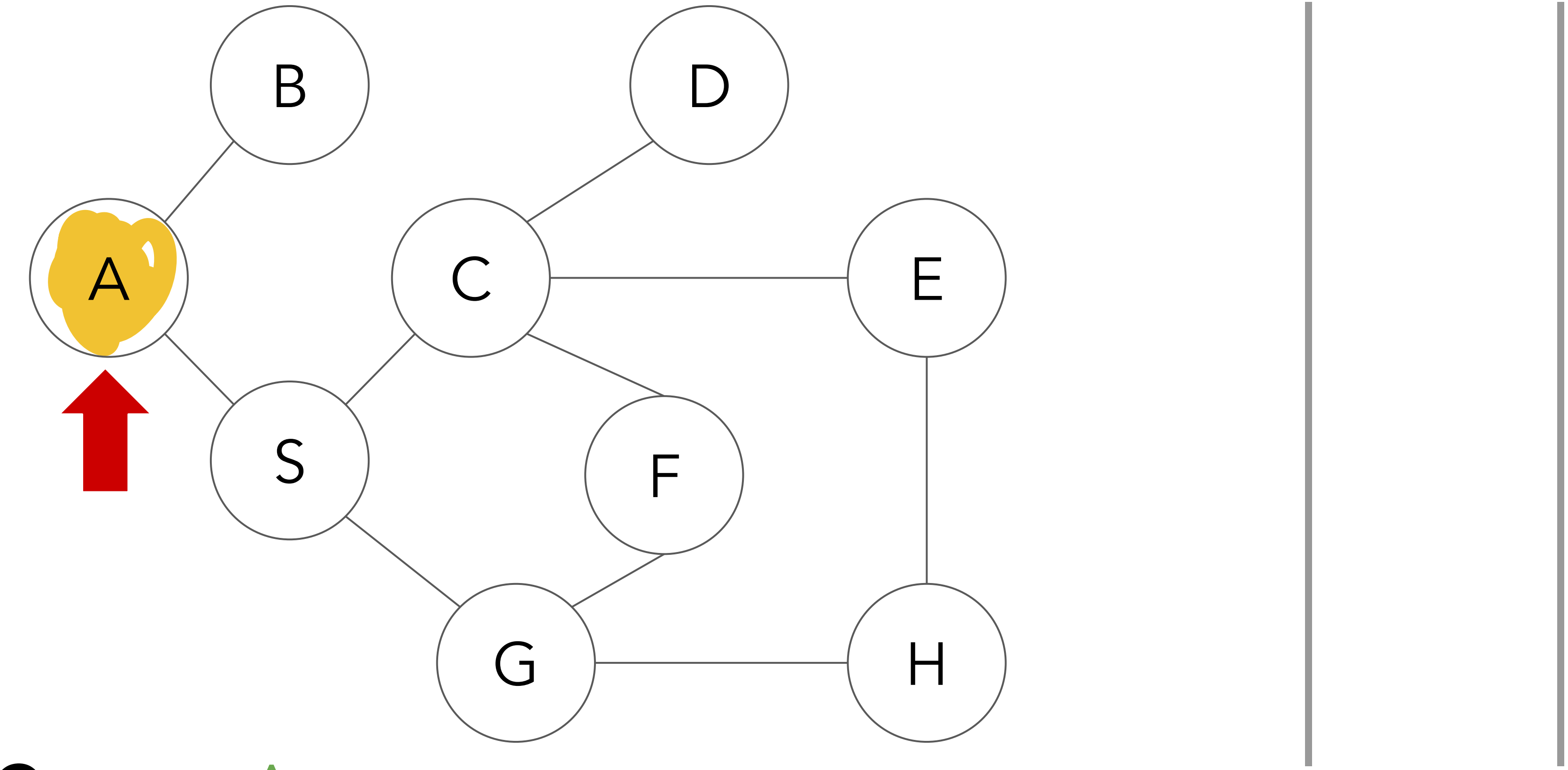
Output:

Queue Status

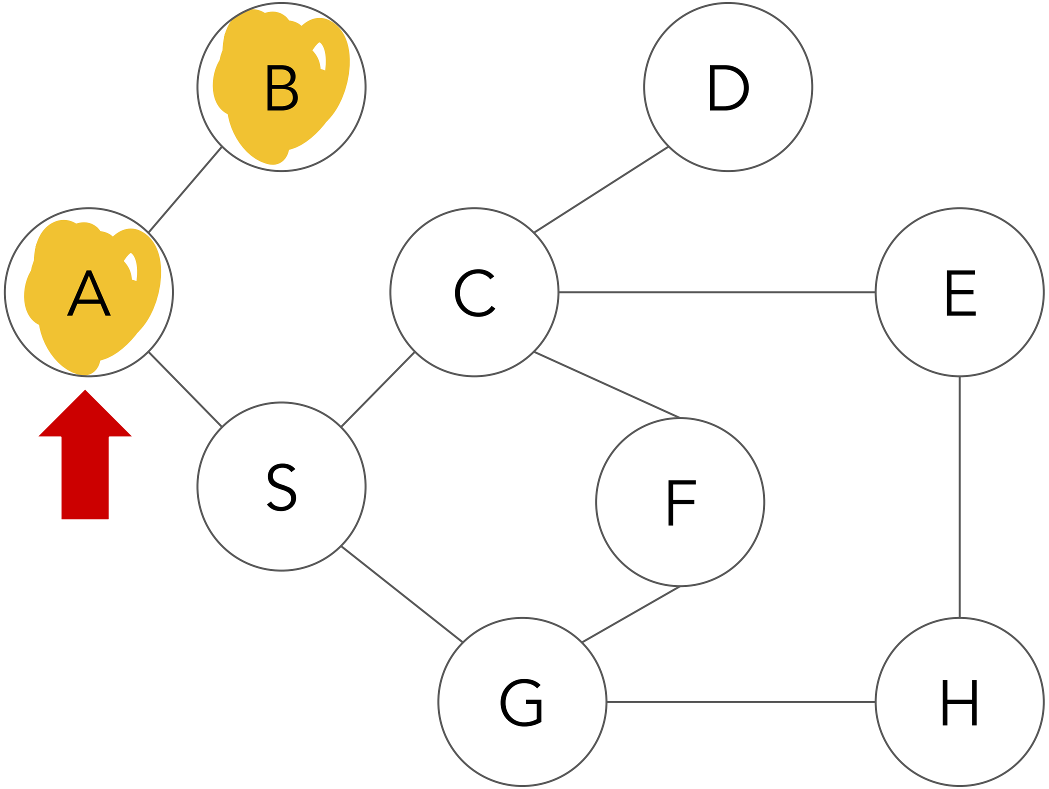


Output: A

Queue Status



Output: A

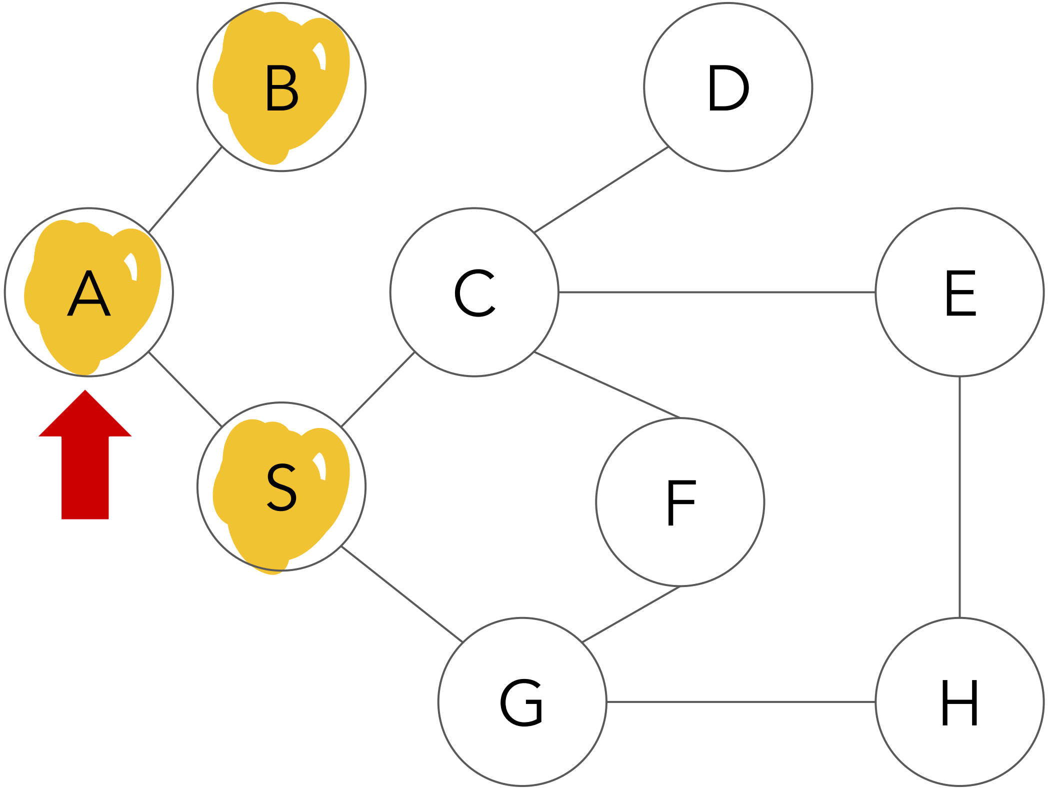


Queue Status

B

Output: A B

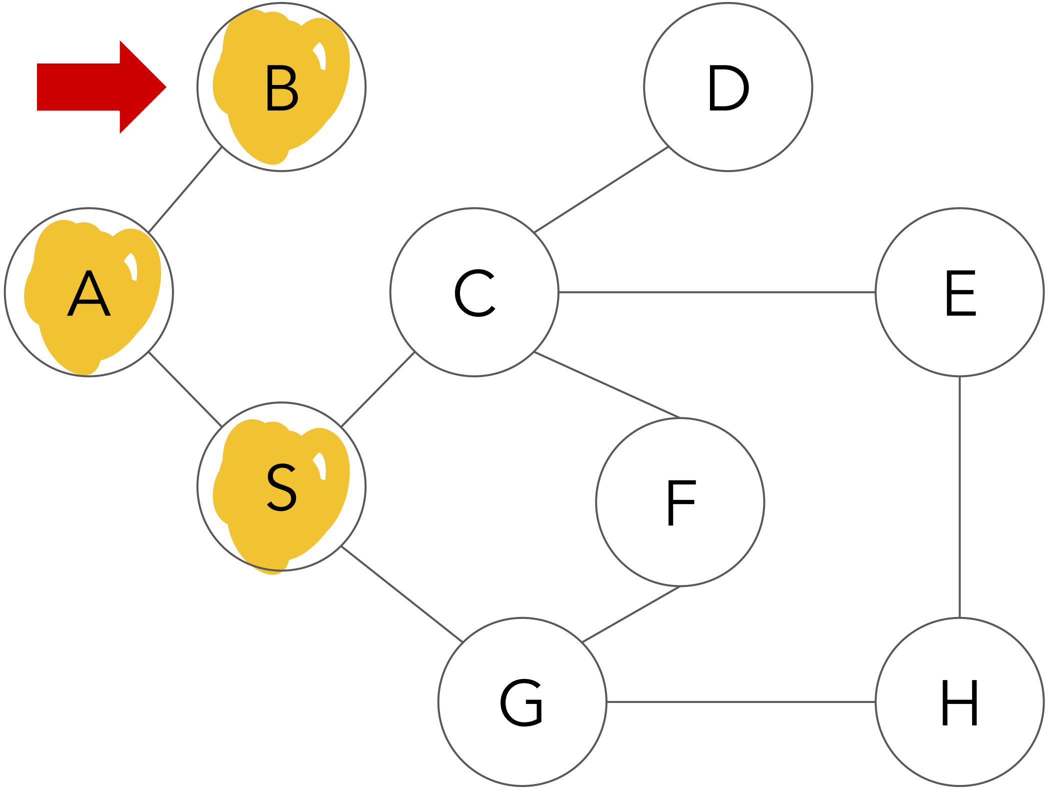
Queue Status



B
S

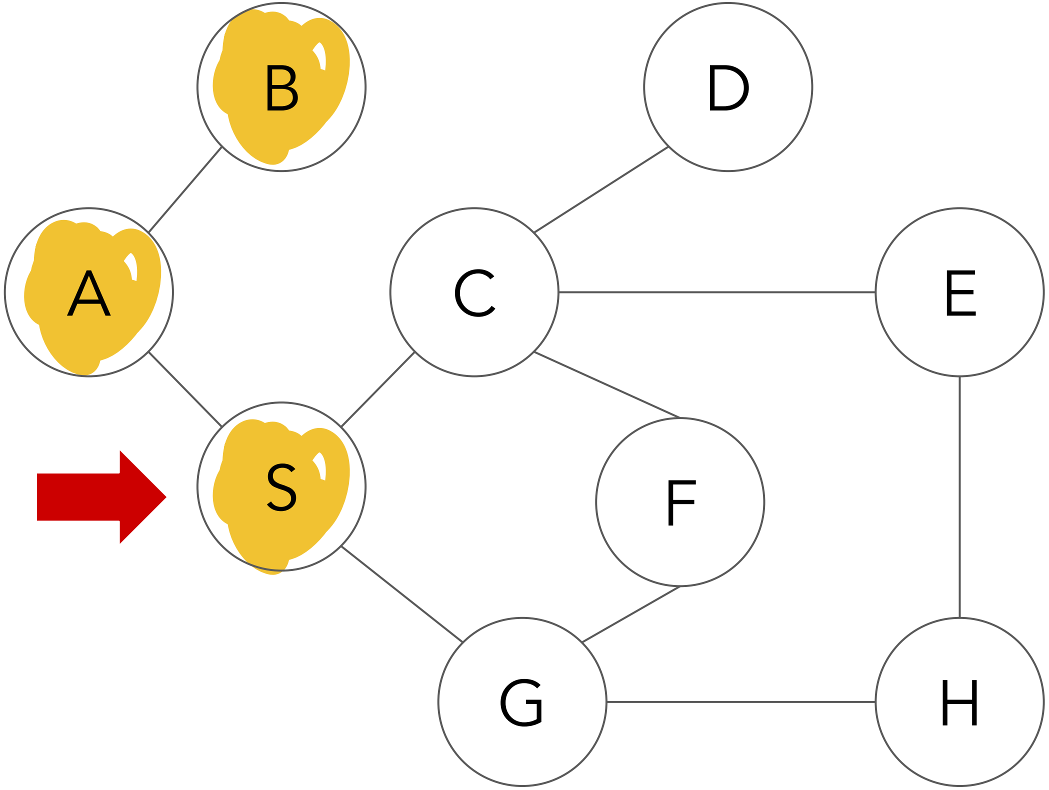
Output: A B S

Queue Status

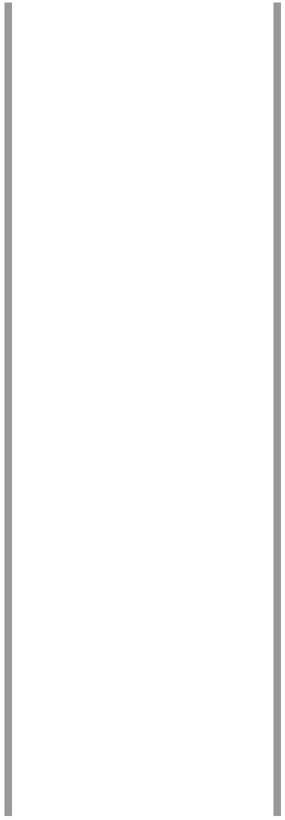


S

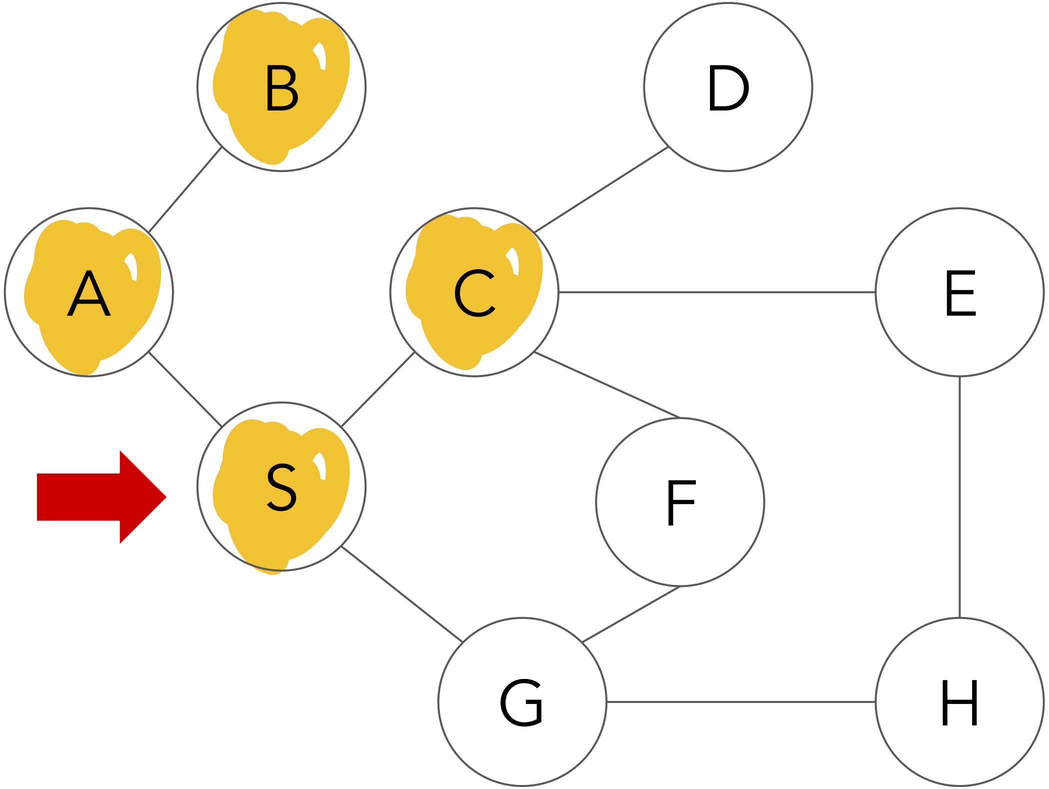
Output: A B S



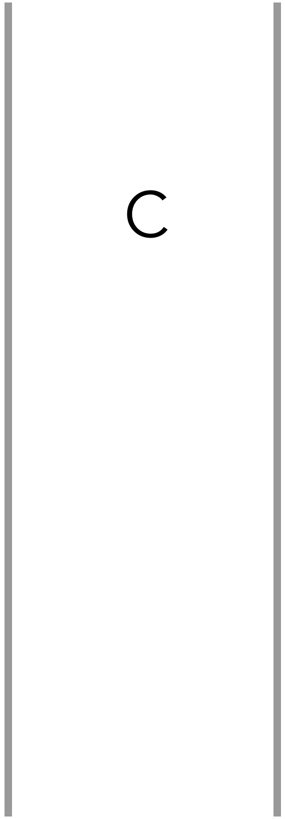
Queue Status



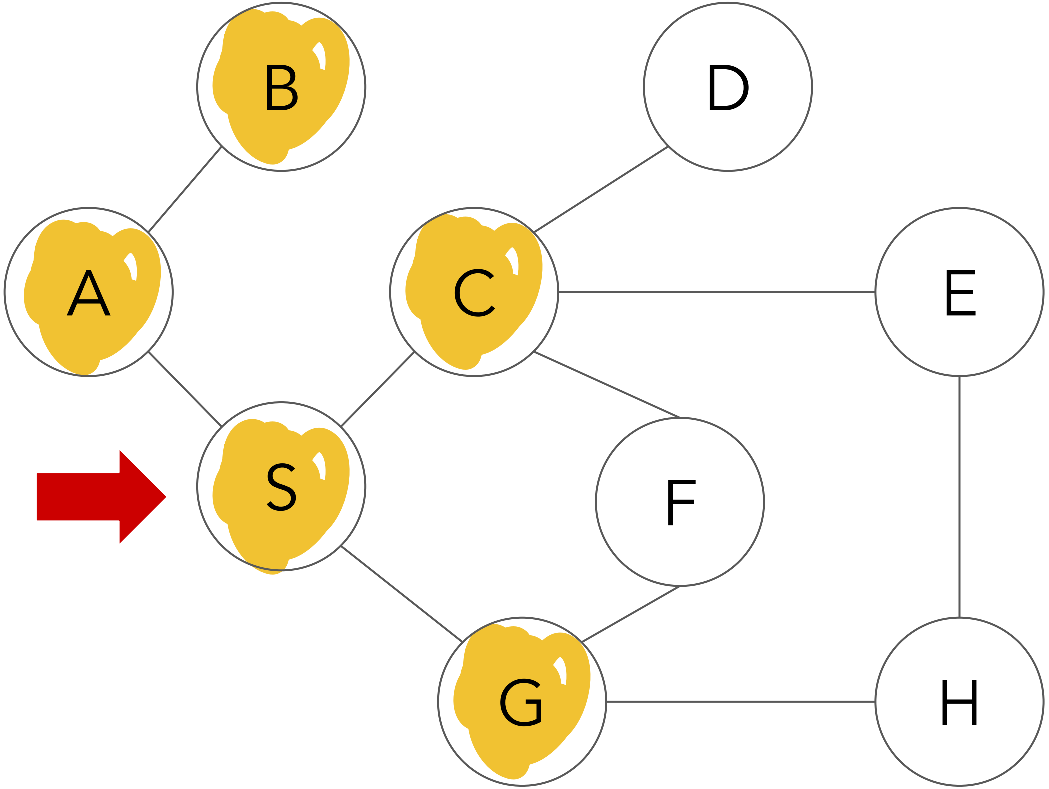
Output: A B S



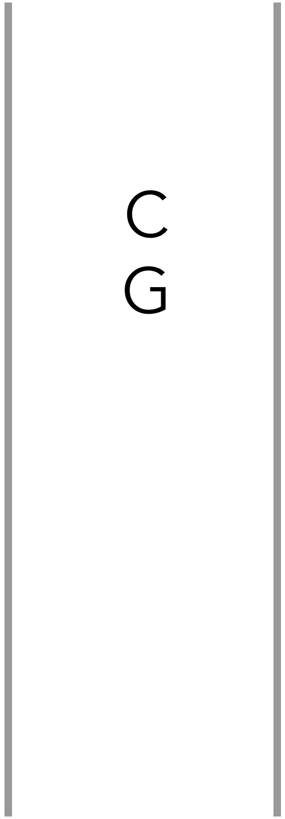
Queue Status



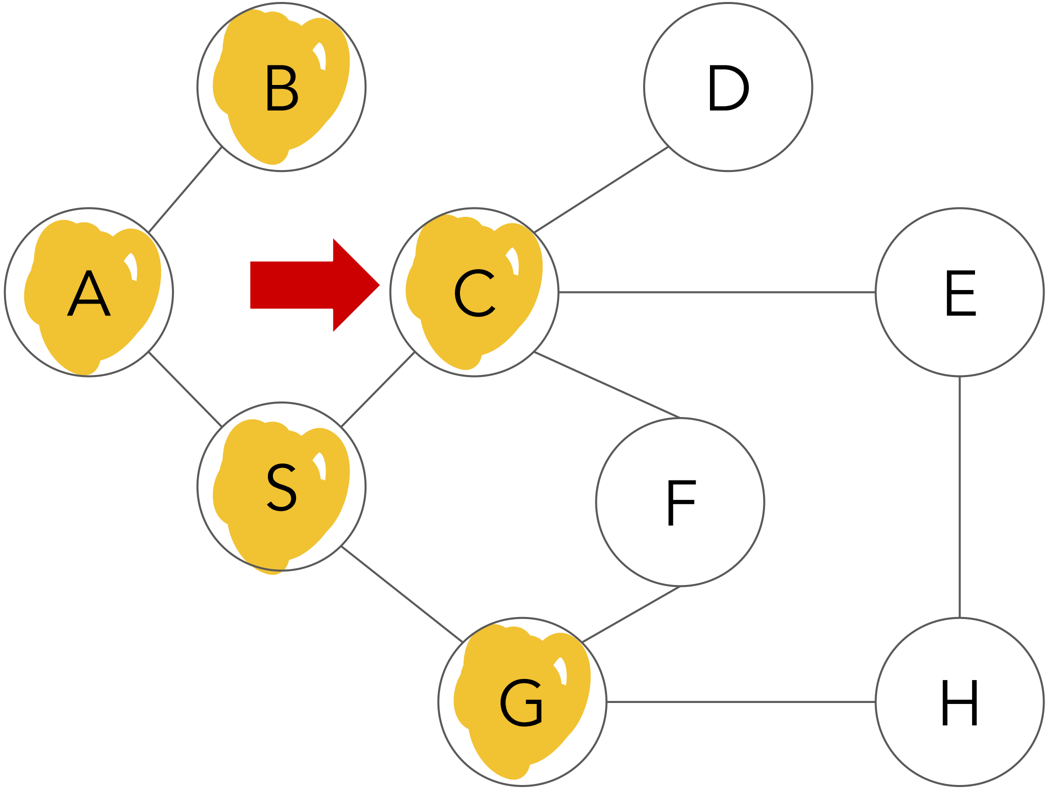
Output: A B S C



Queue Status



Output: A B S C G

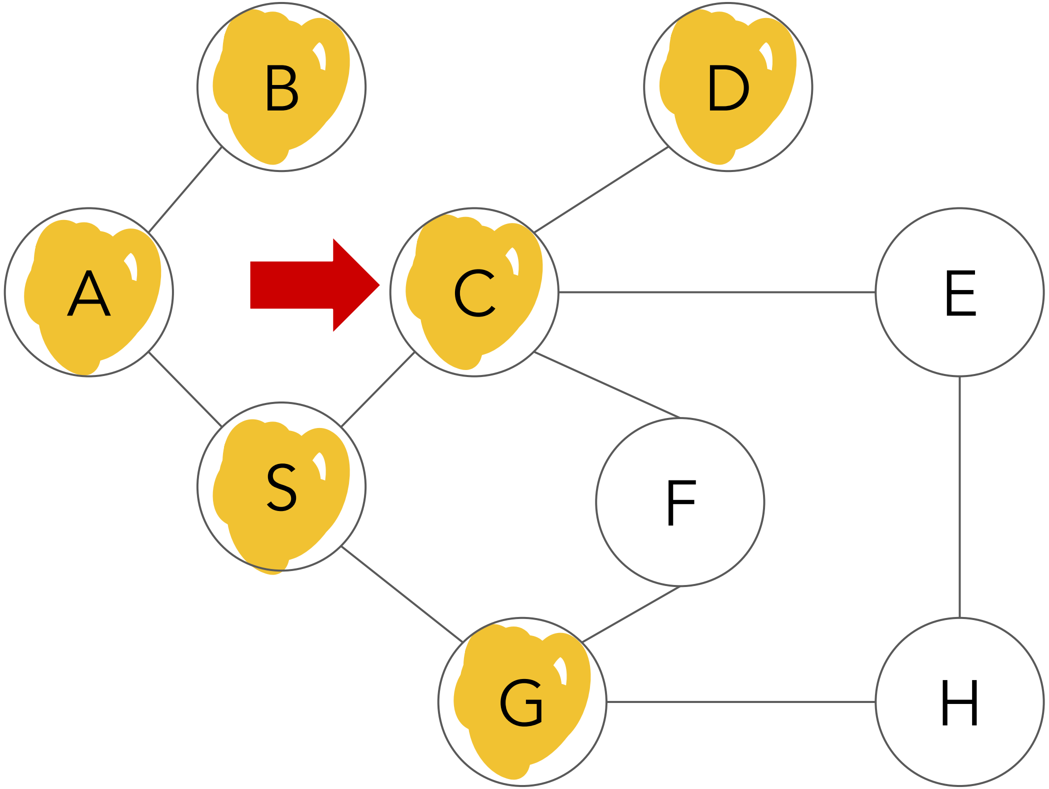


Queue Status

G

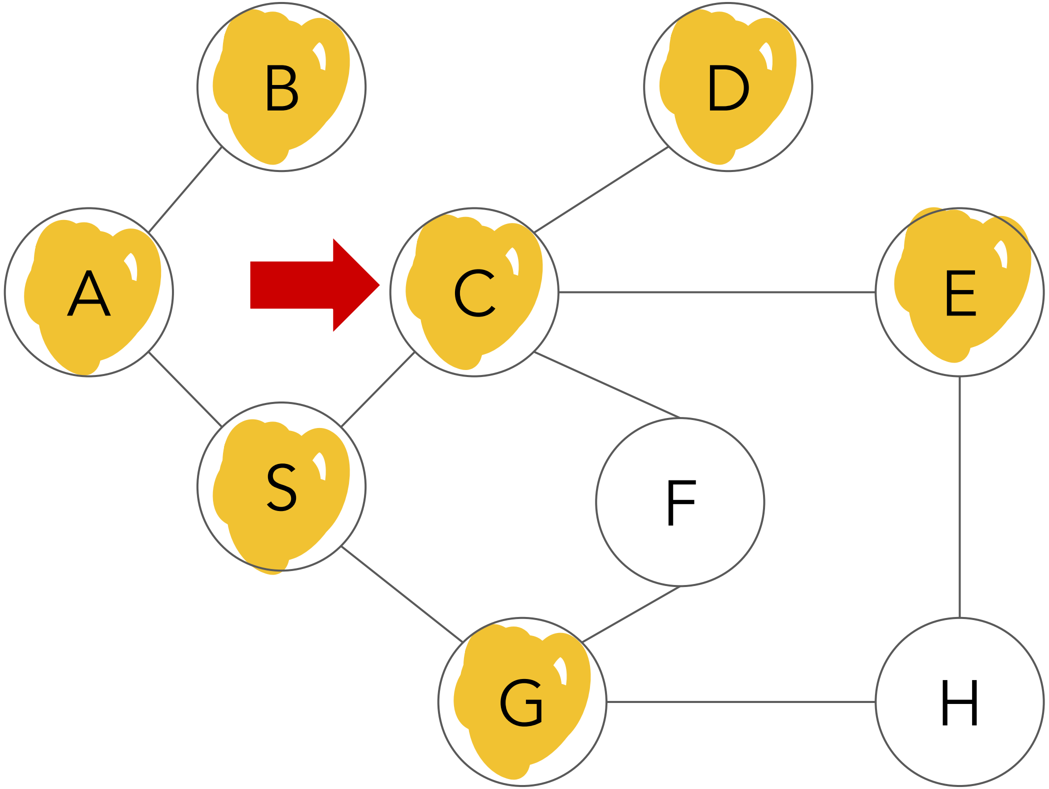
Output: A B S C G

Queue Status



G
D

Output: A B S C G D



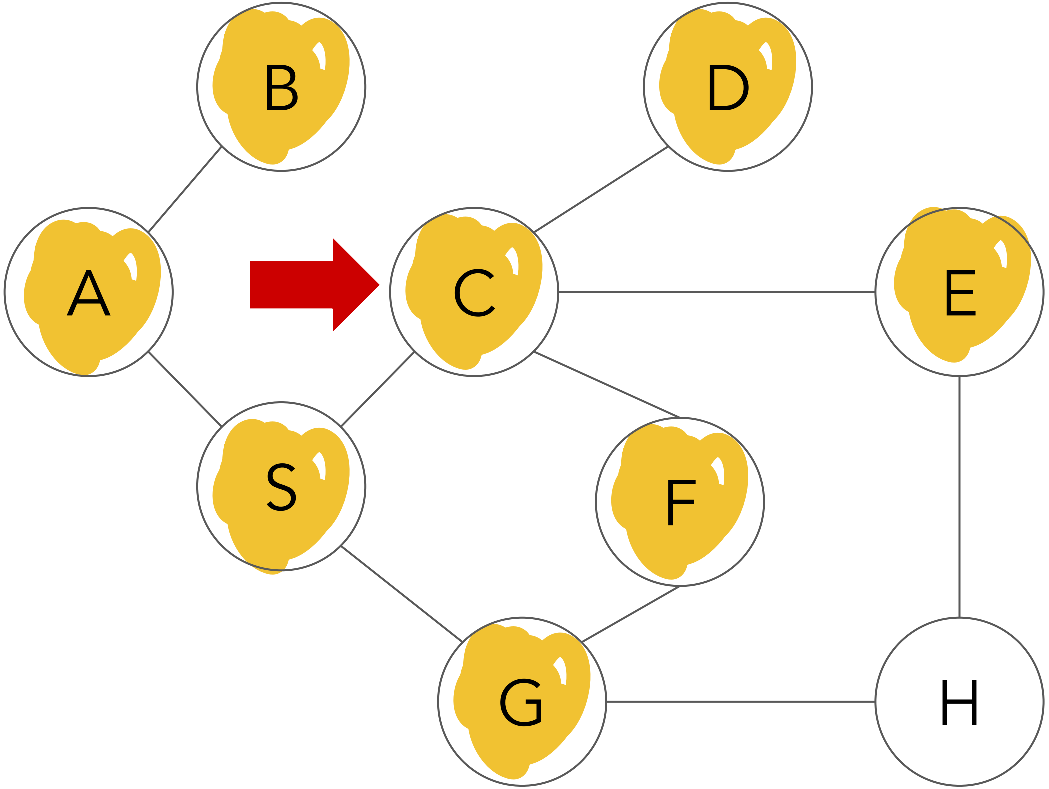
Queue Status

G

D

E

Output: A B S C G D E

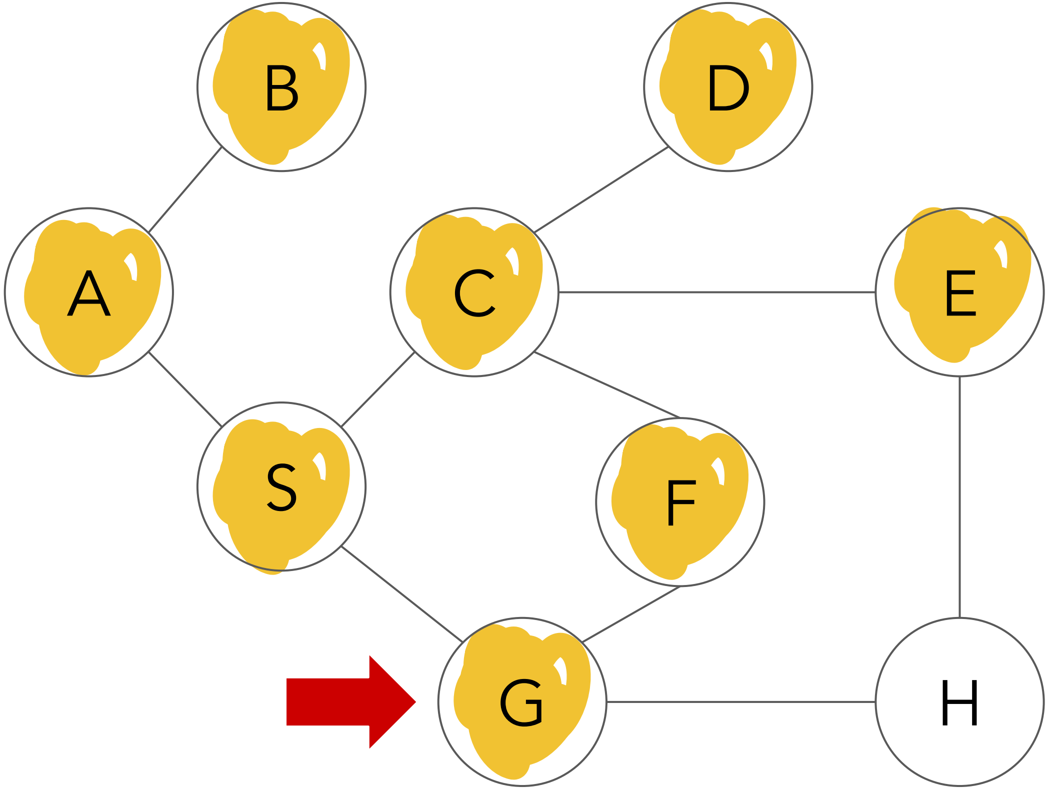


Queue Status

G
D
E
F

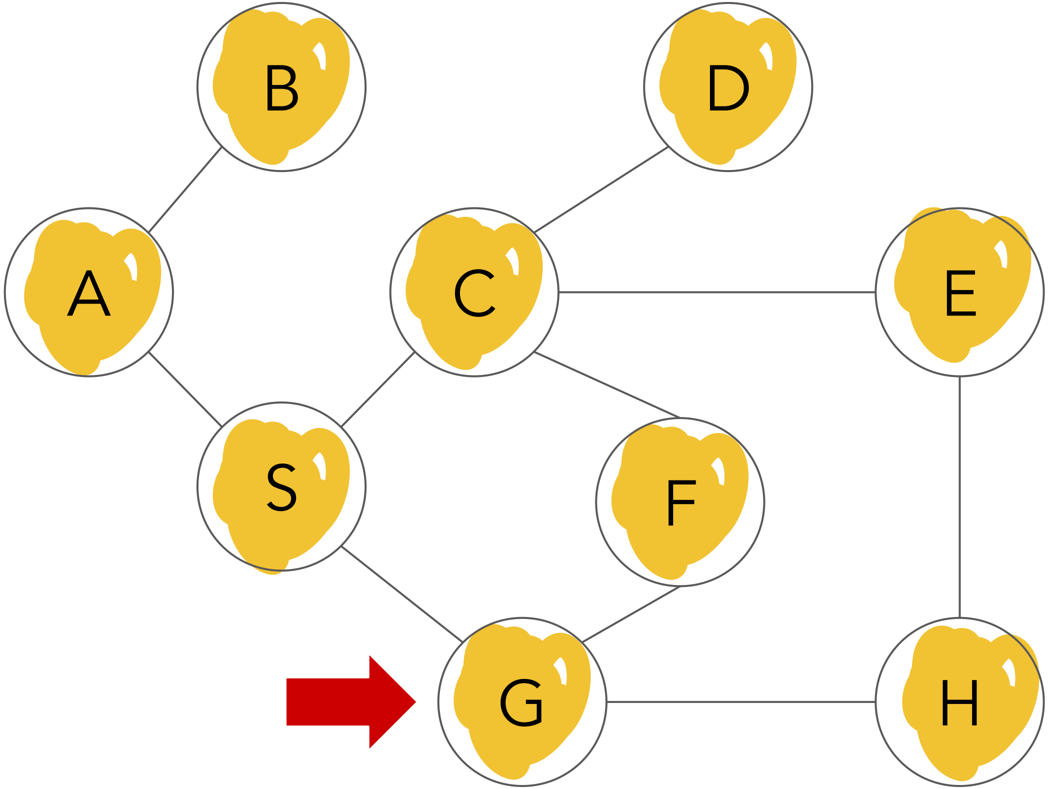
Output: A B S C G D E F

Queue Status



D
E
F

Output: A B S C G D E F

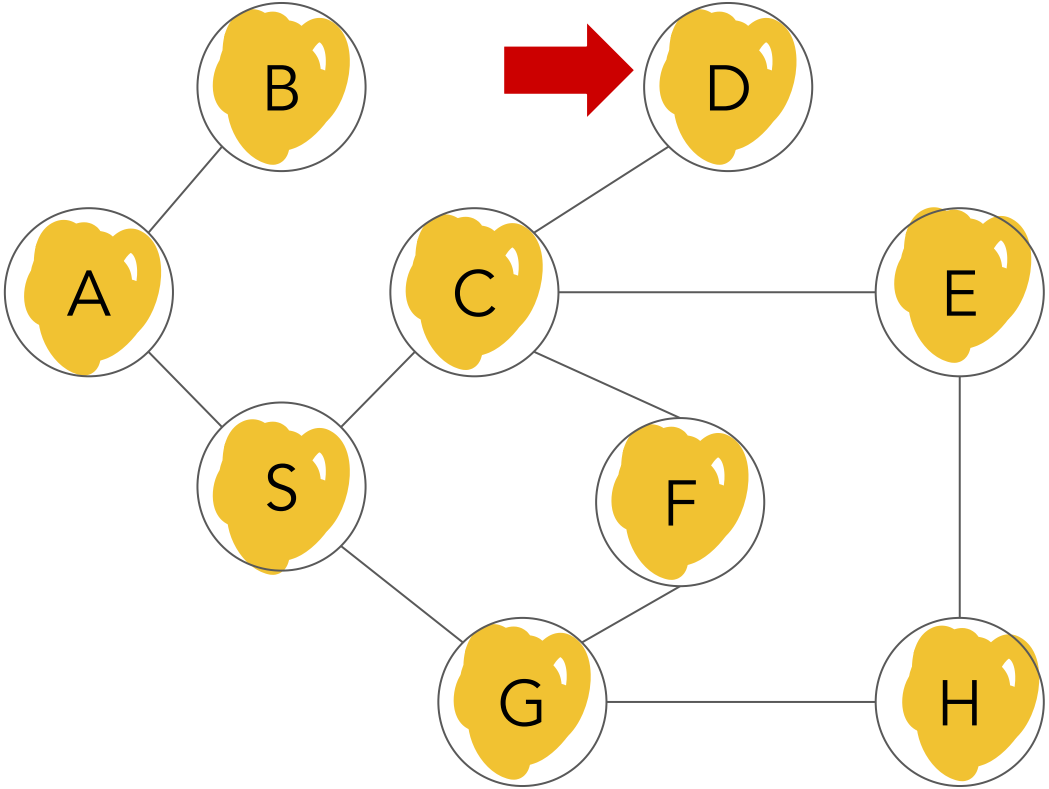


Queue Status

D
E
F
H

Output: A B S C G D E F H

Queue Status



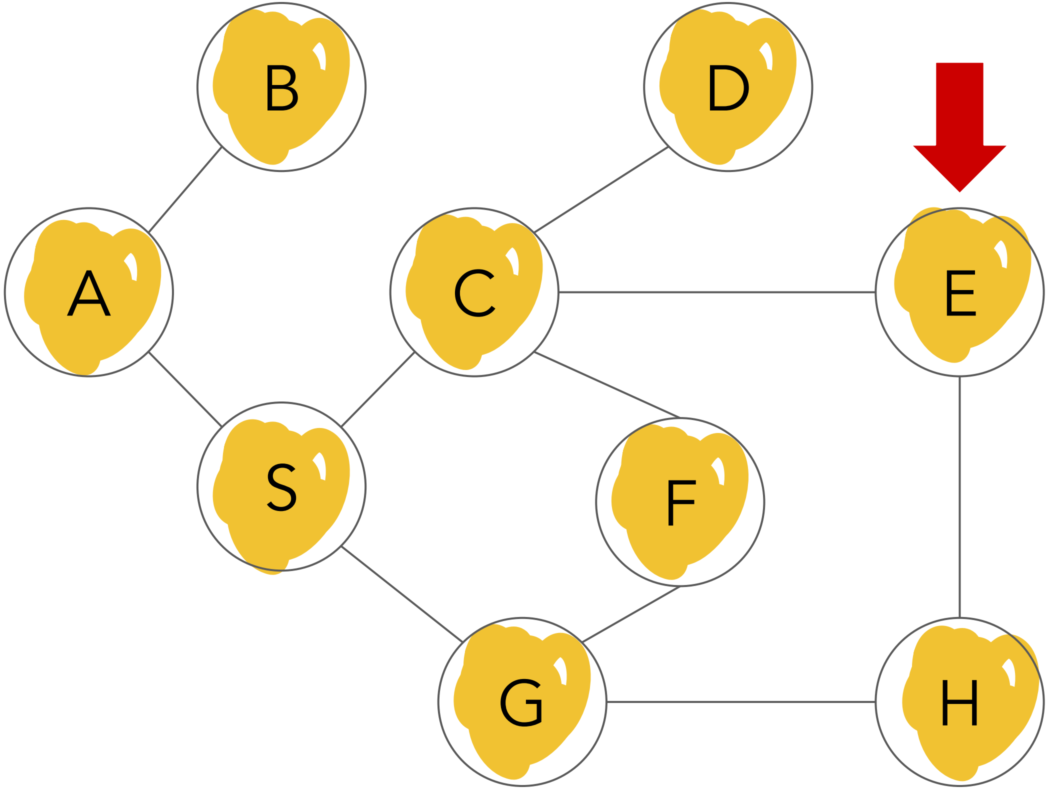
E

F

H

Output: A B S C G D E F H

Queue Status

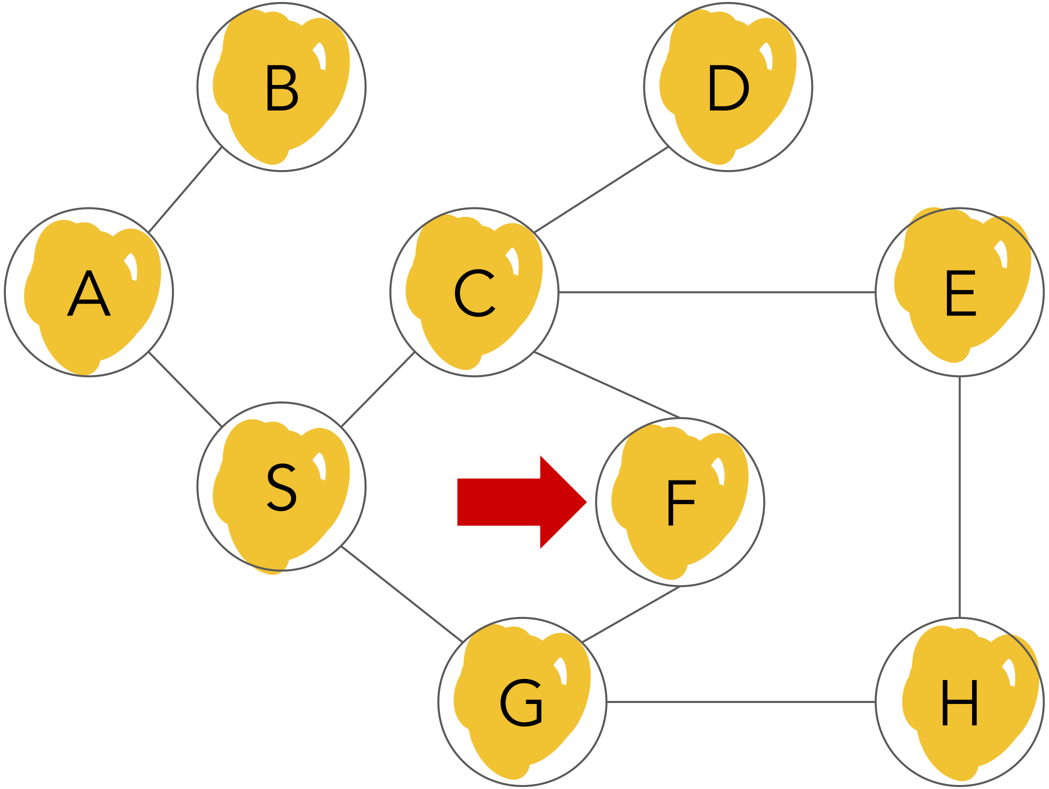


F

H

Output: A B S C G D E F H

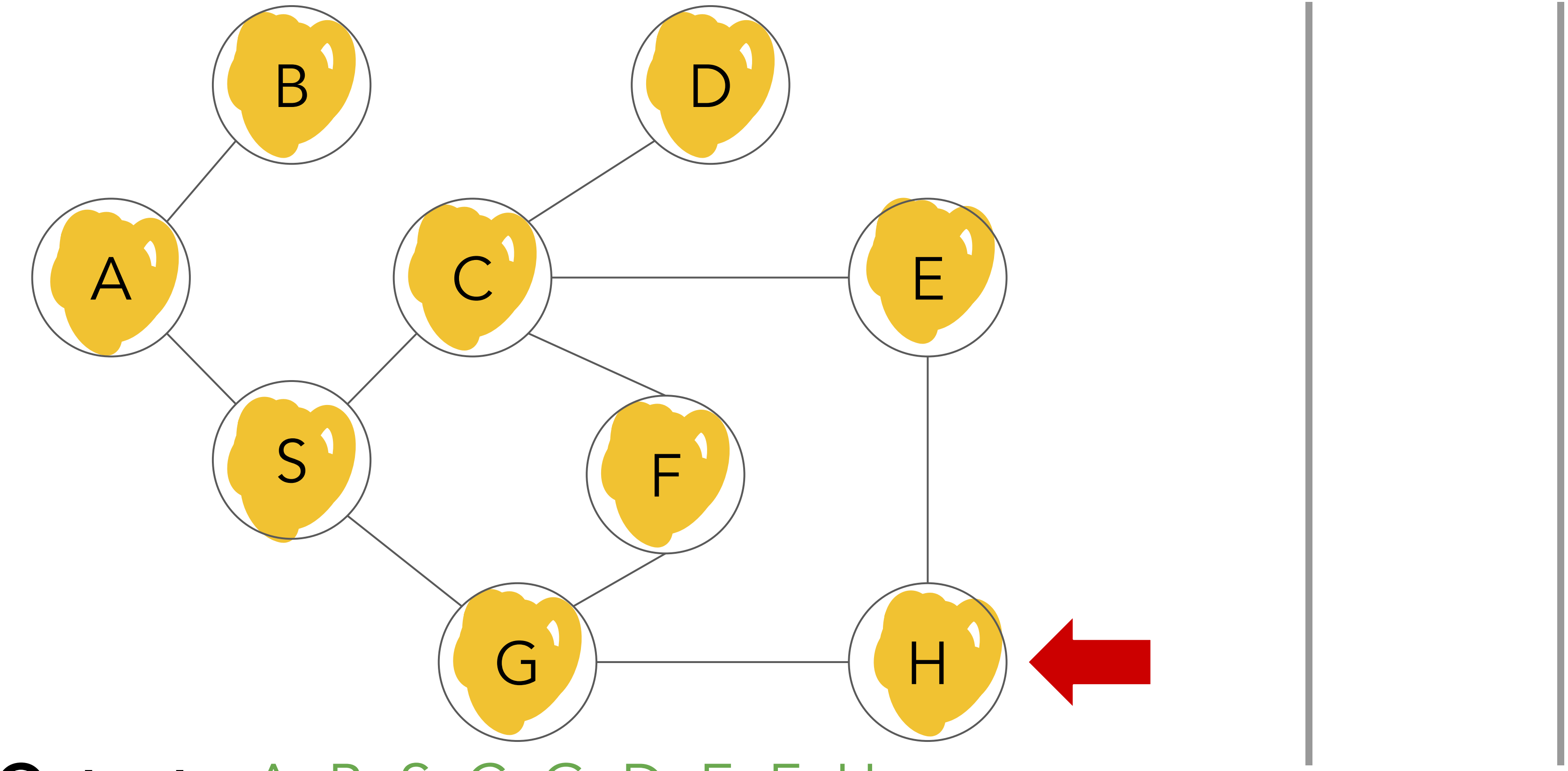
Queue Status



H

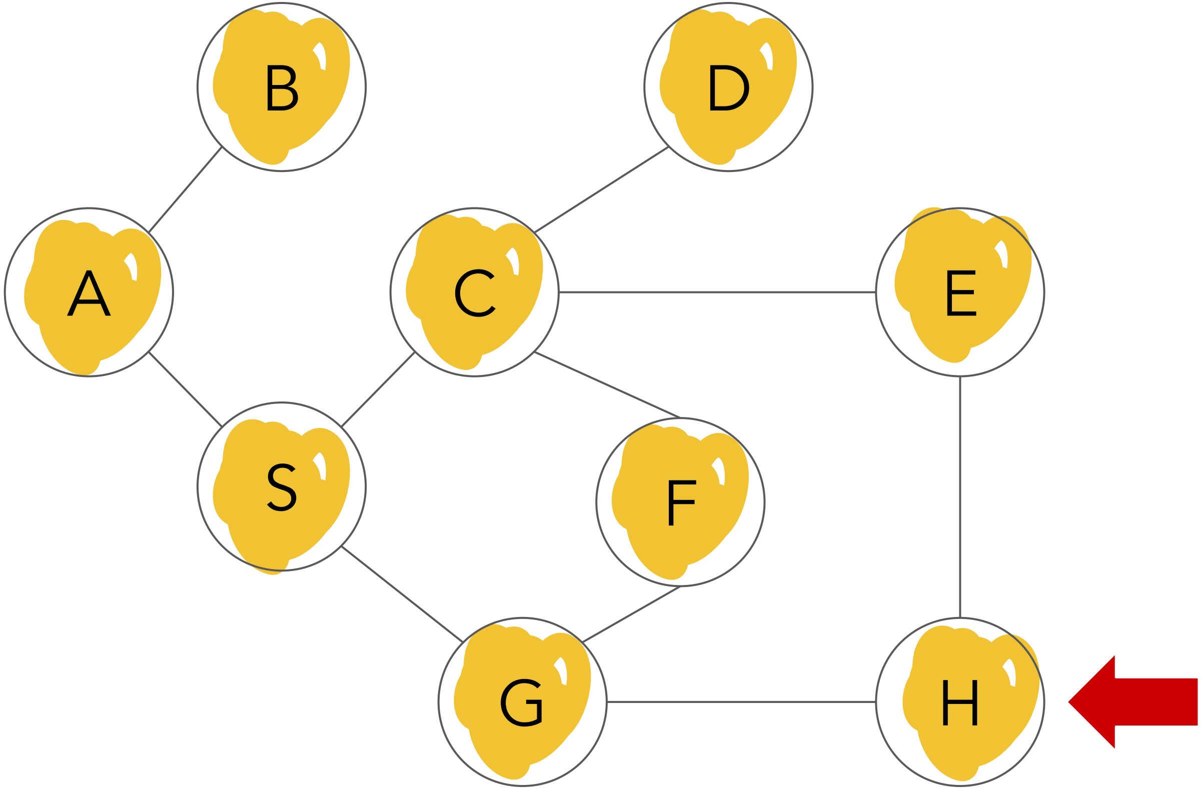
Output: A B S C G D E F H

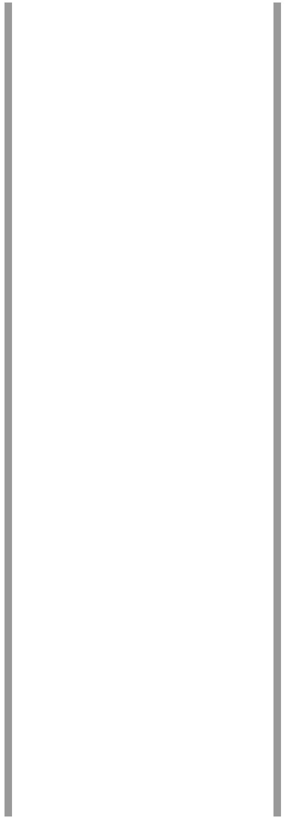
Queue Status



Output: A B S C G D E F H

Queue Status





Output: A B S C G D E F H

Empty Queue

ATTEMPTS TO IMPLEMENT A BREADTH-FIRST SEARCH
USES STACK INSTEAD OF QUEUE
memegenerator.net

Applications

Finding all vertices within one connected component

Finding the shortest path between two vertices (GPS navigation)

Maze generation algorithms

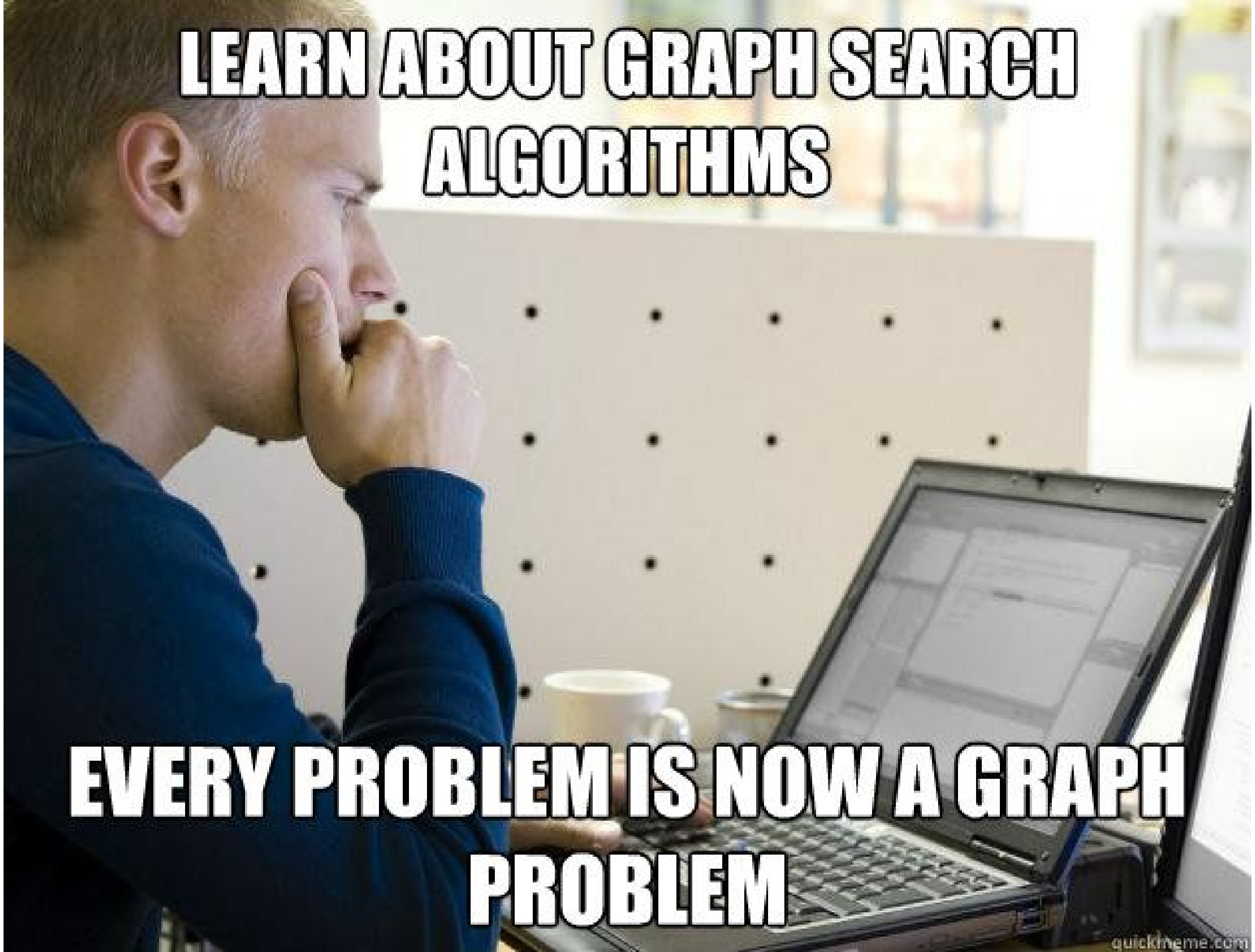
Analysis of networks and relationships

Finding closest neighbors (Friend suggestions)

P2P networks

Web crawlers

Filesystem search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