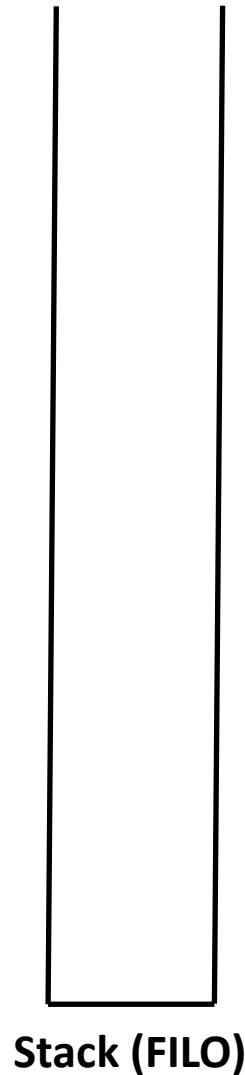
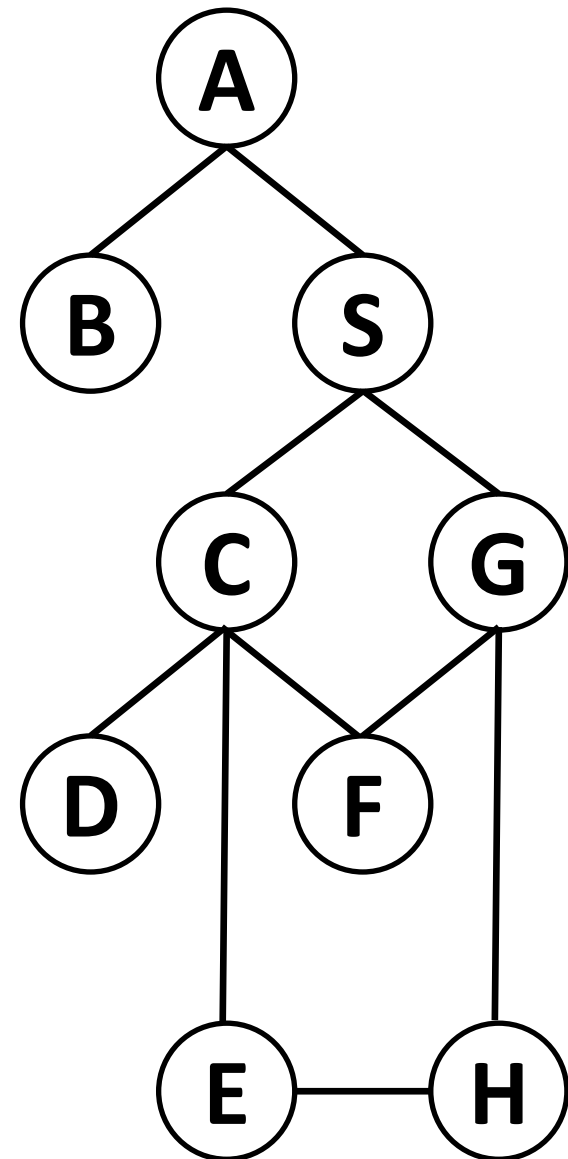


Uninformed (Blind) and Informed (Heuristic) Search

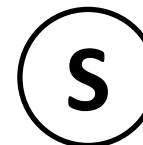
Boris Velichkov

Depth-First Search

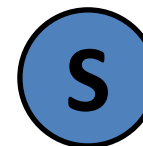


Visited Nodes:
{ }

Legend:



Node

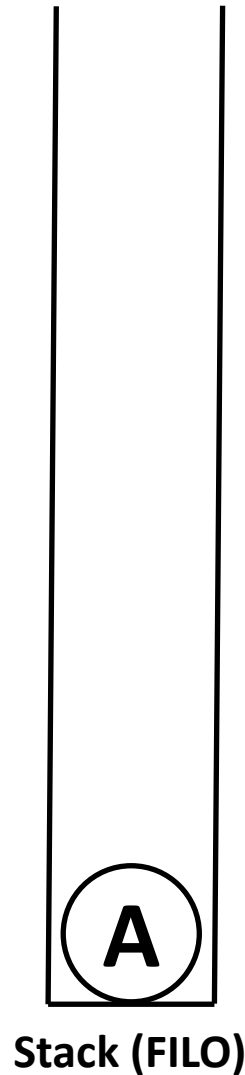
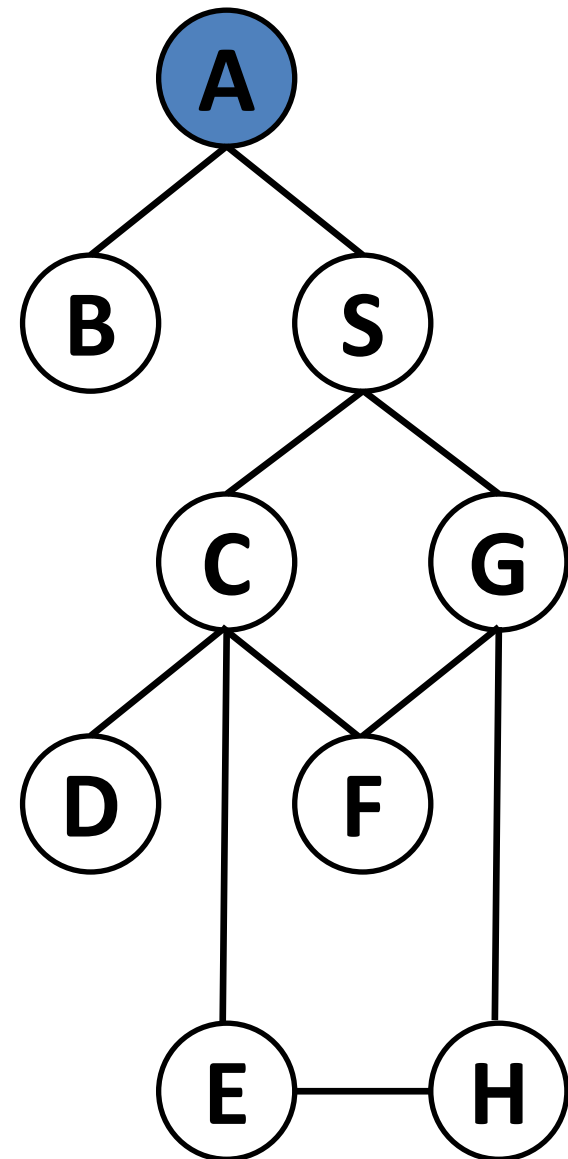


Visited Node



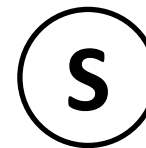
Expanded Node

Depth-First Search

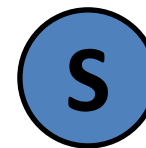


Visited Nodes:
 $\{A\}$

Legend:



Node

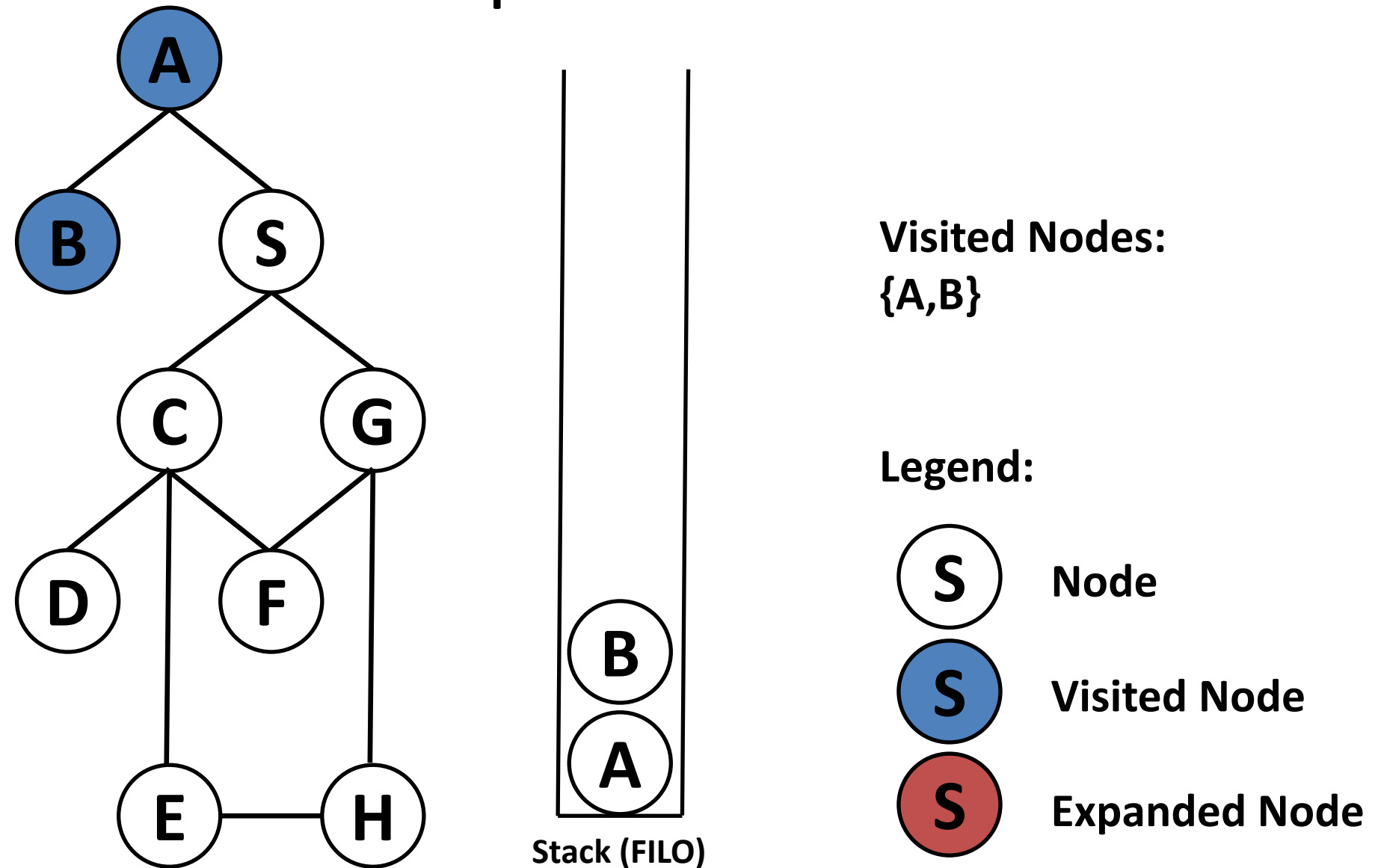


Visited Node

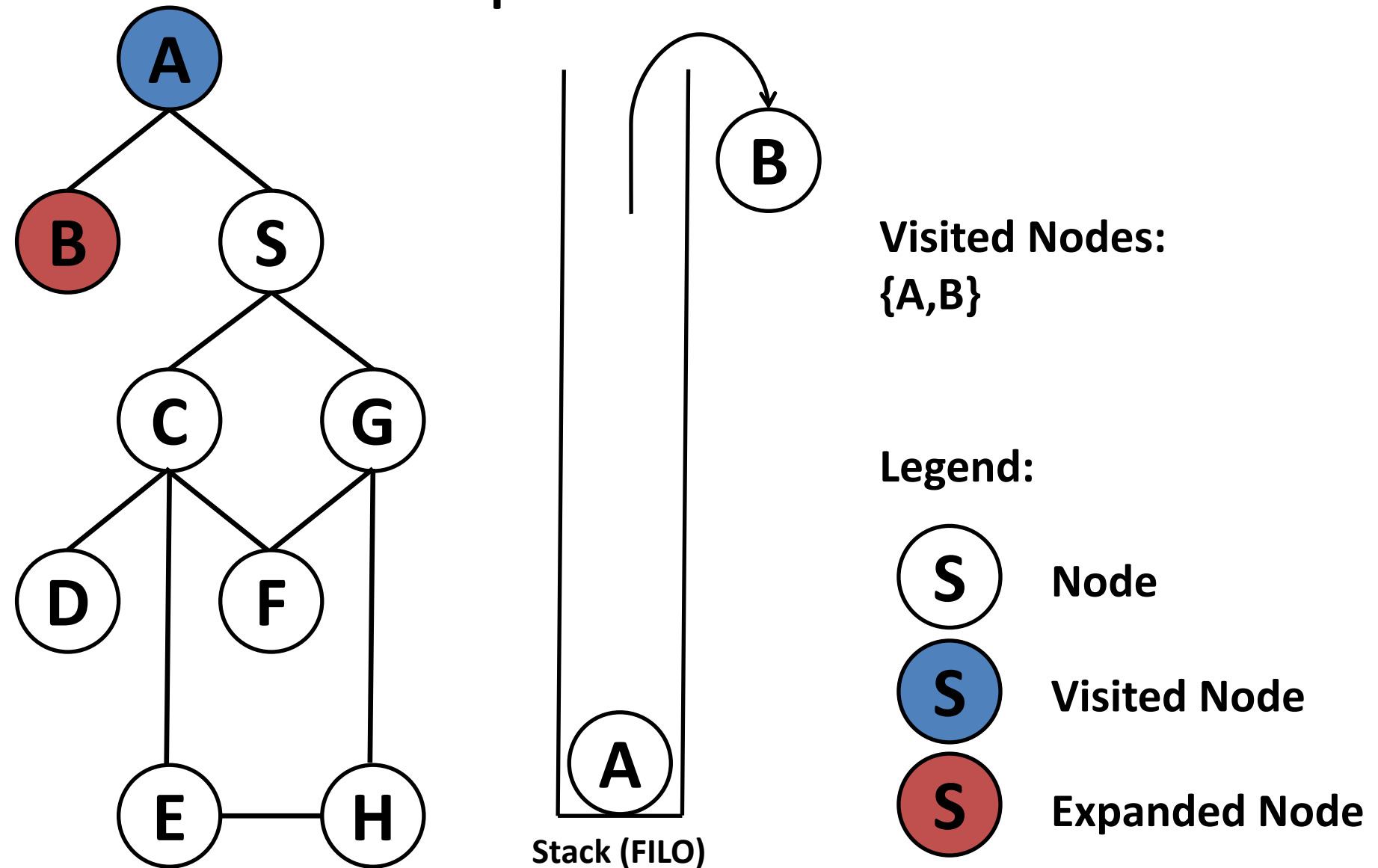


Expanded Node

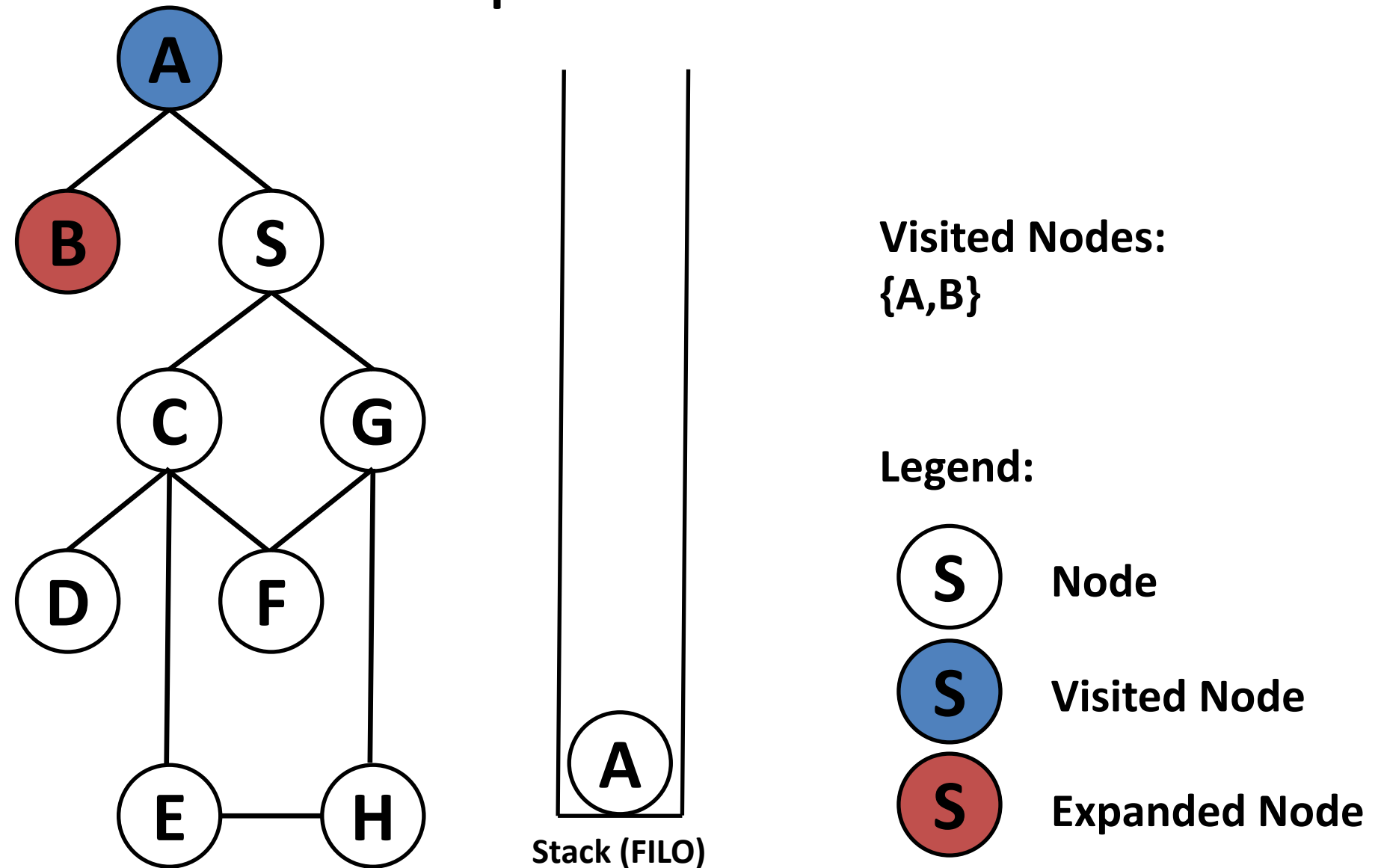
Depth-First Search



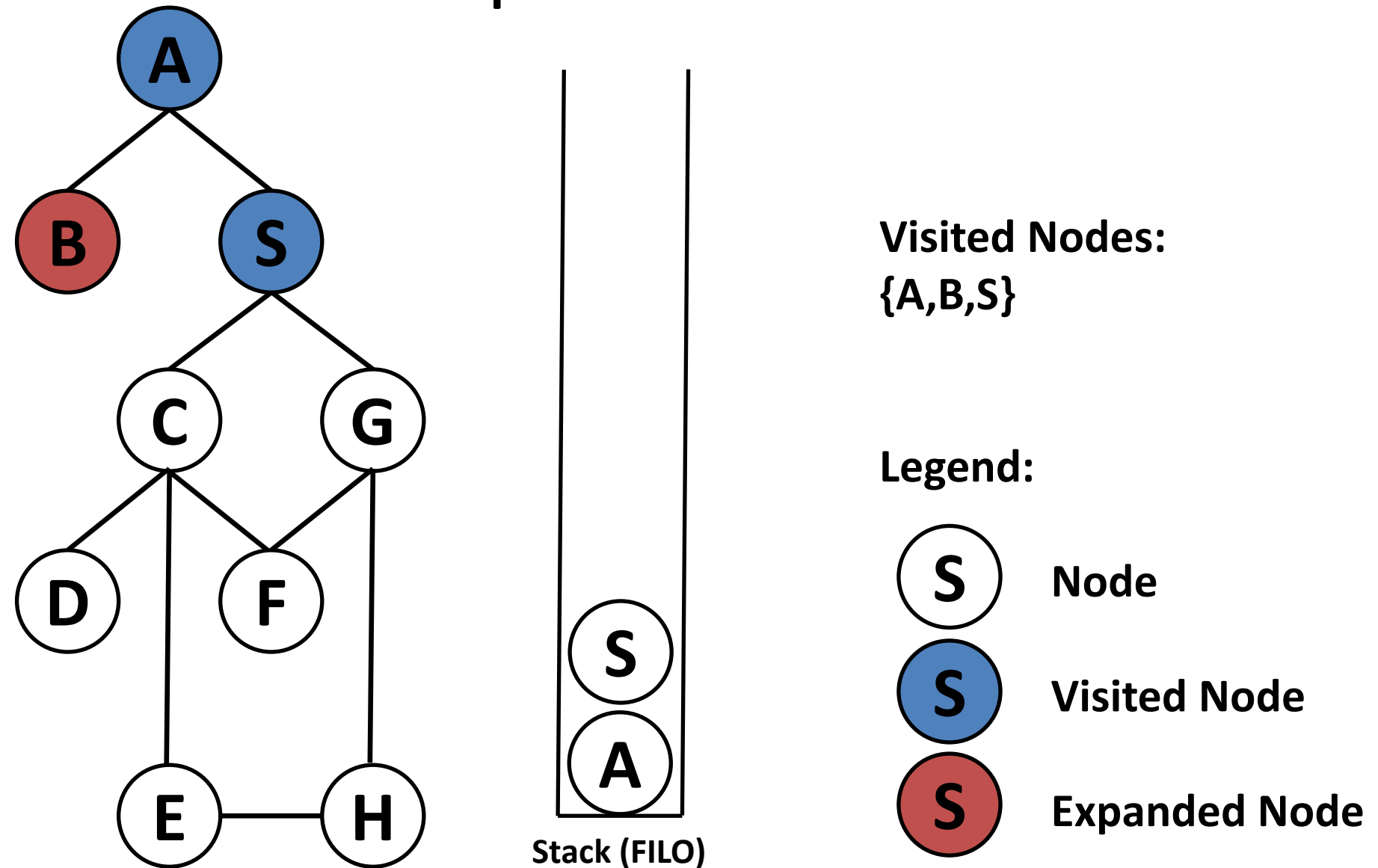
Depth-First Search



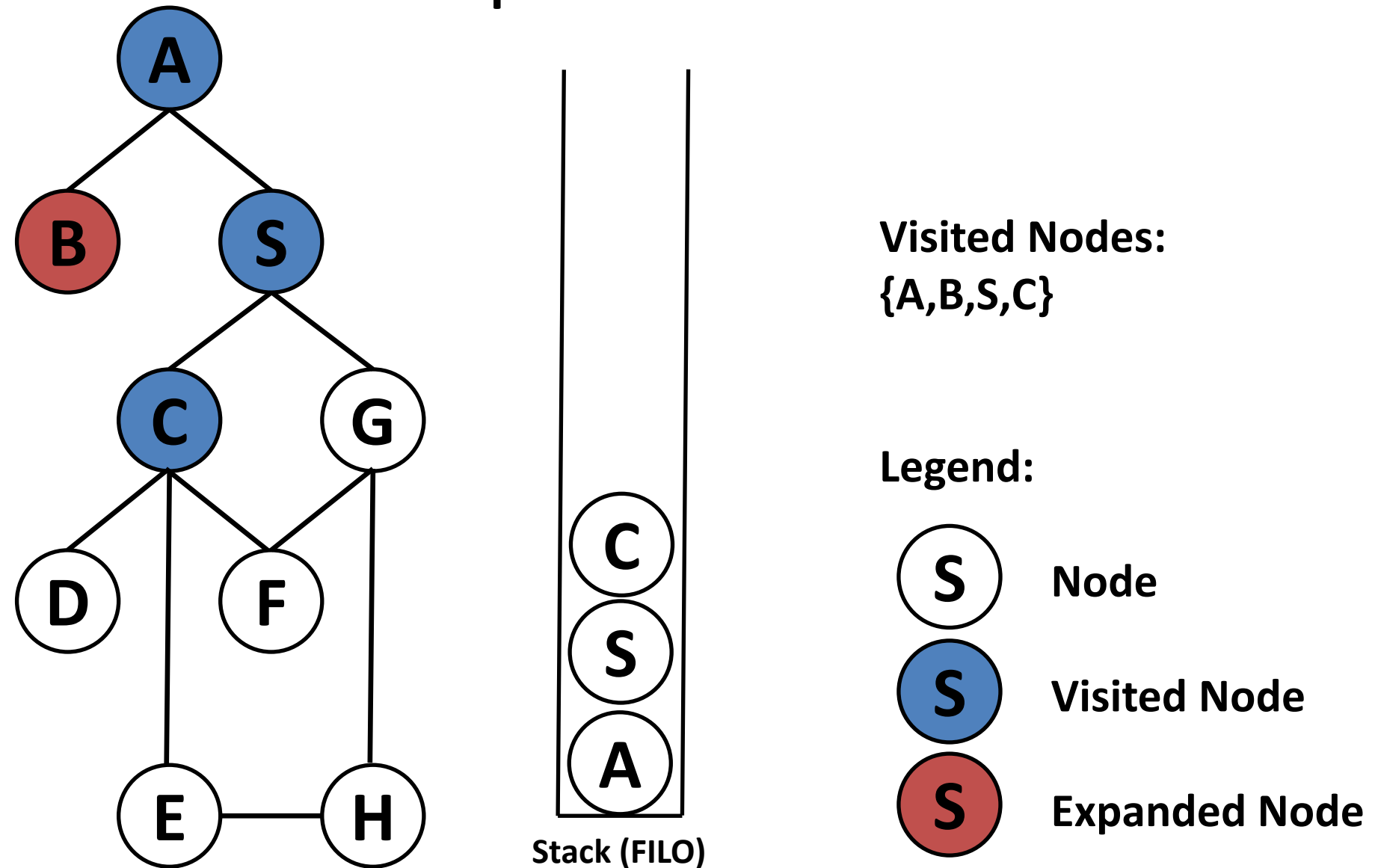
Depth-First Search



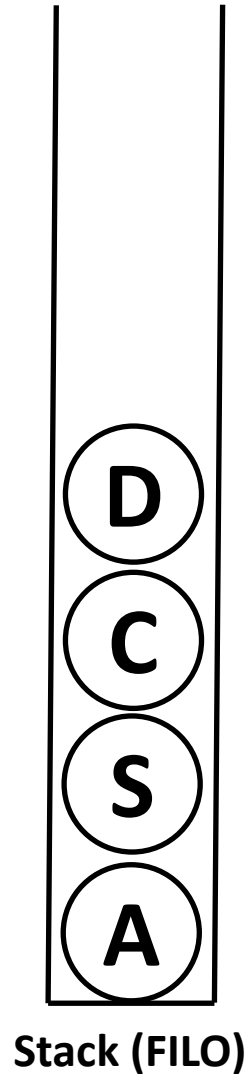
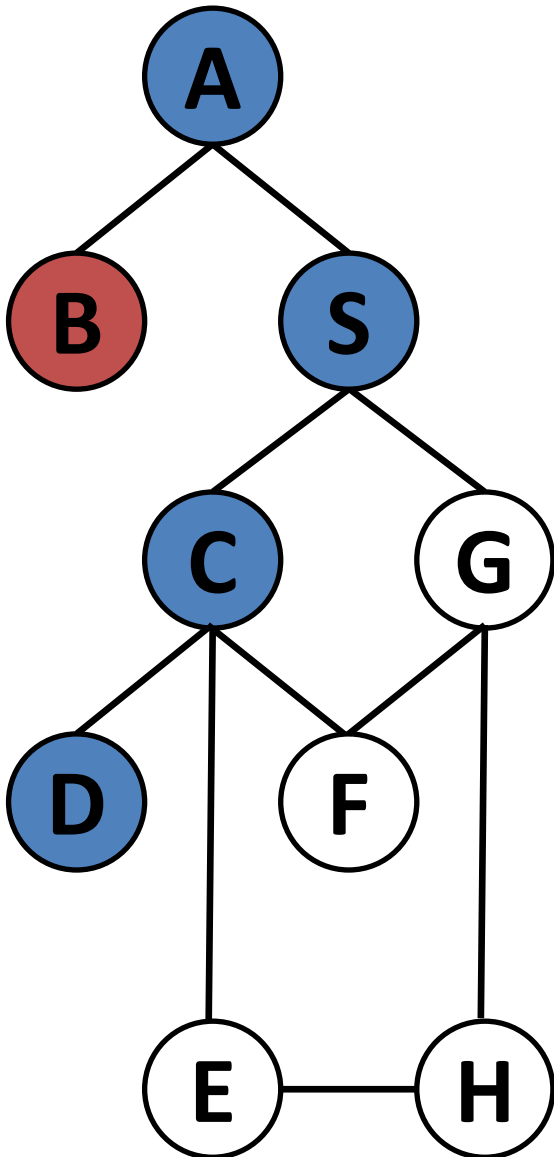
Depth-First Search



Depth-First Search

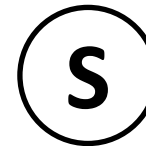


Depth-First Search



Visited Nodes:
 $\{A, B, S, C, D\}$

Legend:



Node

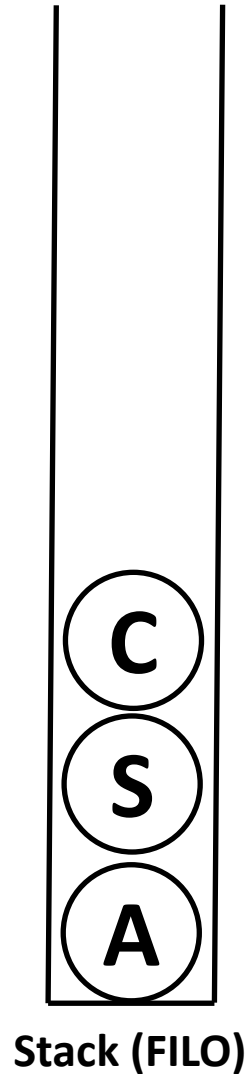
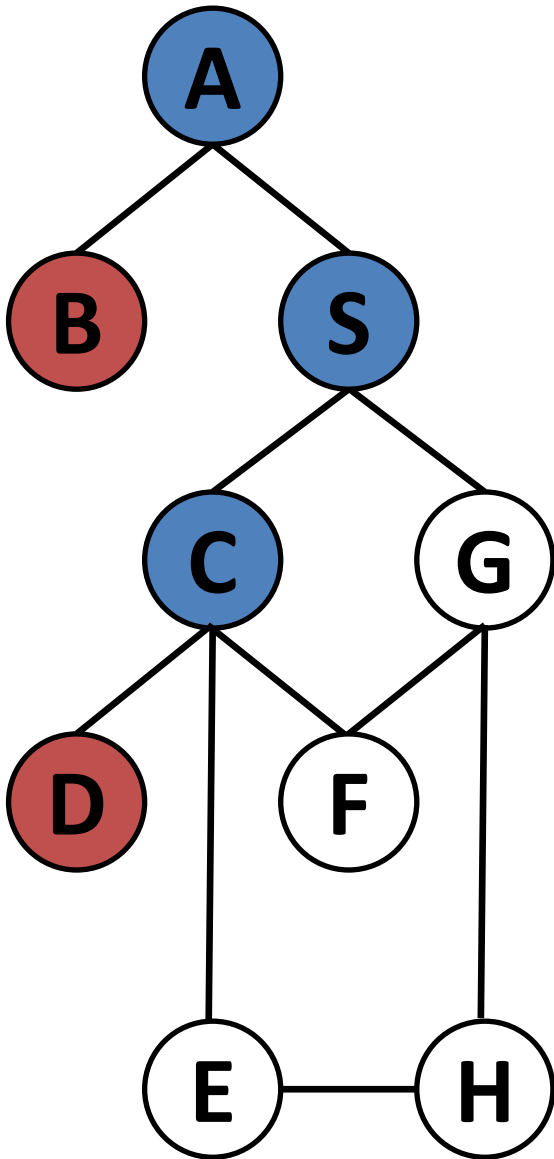


Visited Node



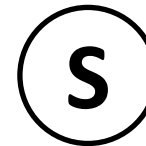
Expanded Node

Depth-First Search



Visited Nodes:
 $\{A, B, S, C, D\}$

Legend:



Node

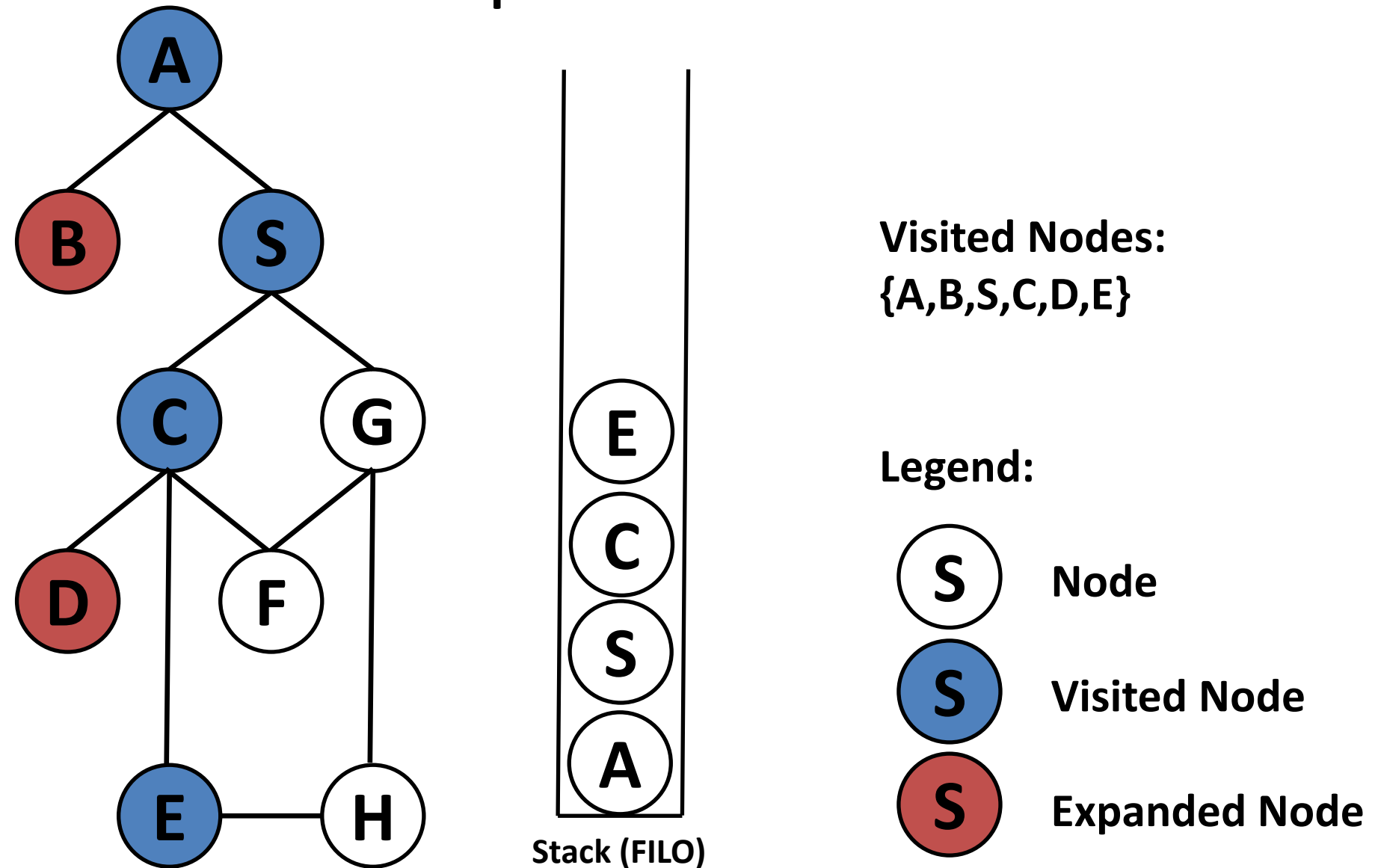


Visited Node

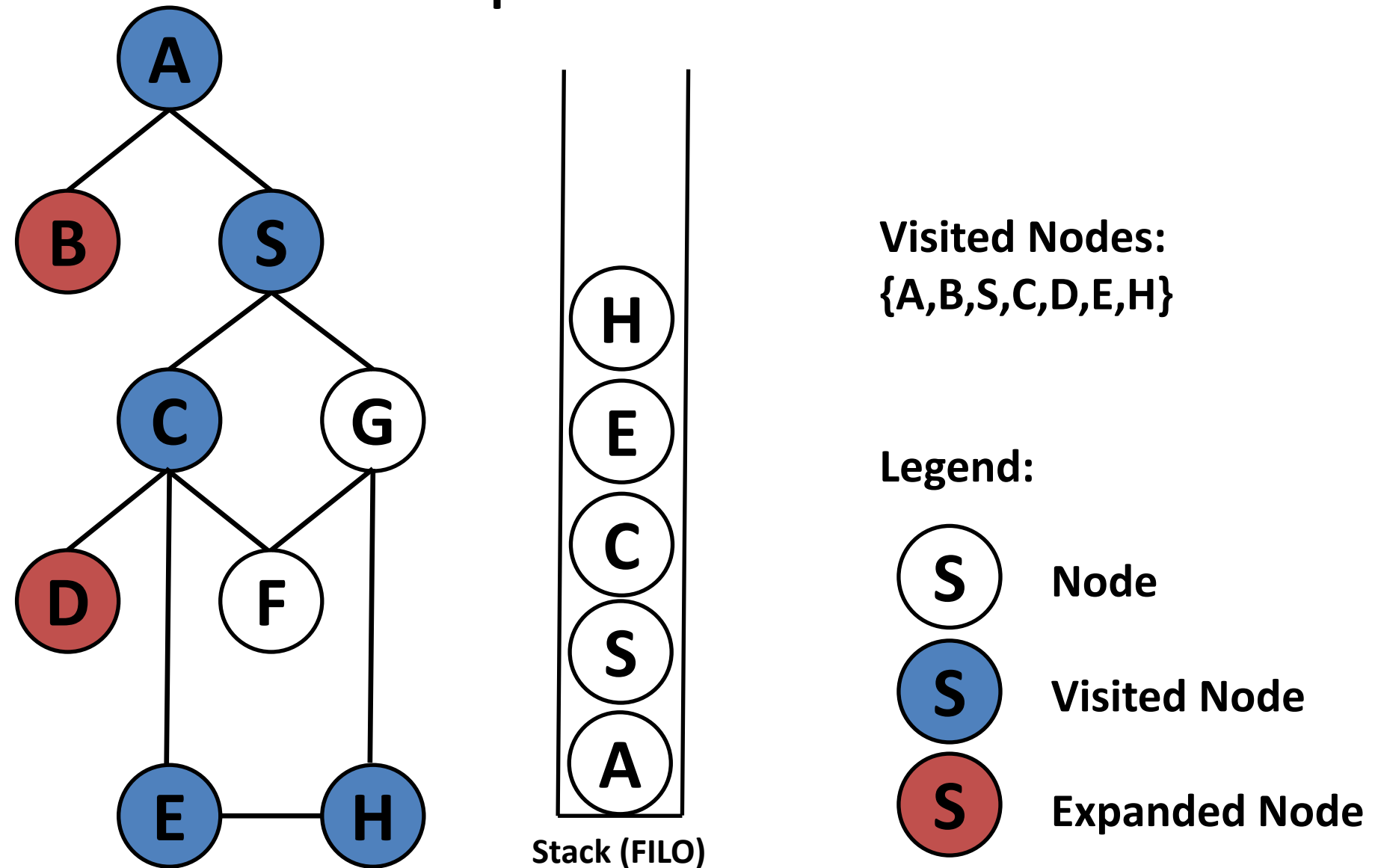


Expanded Node

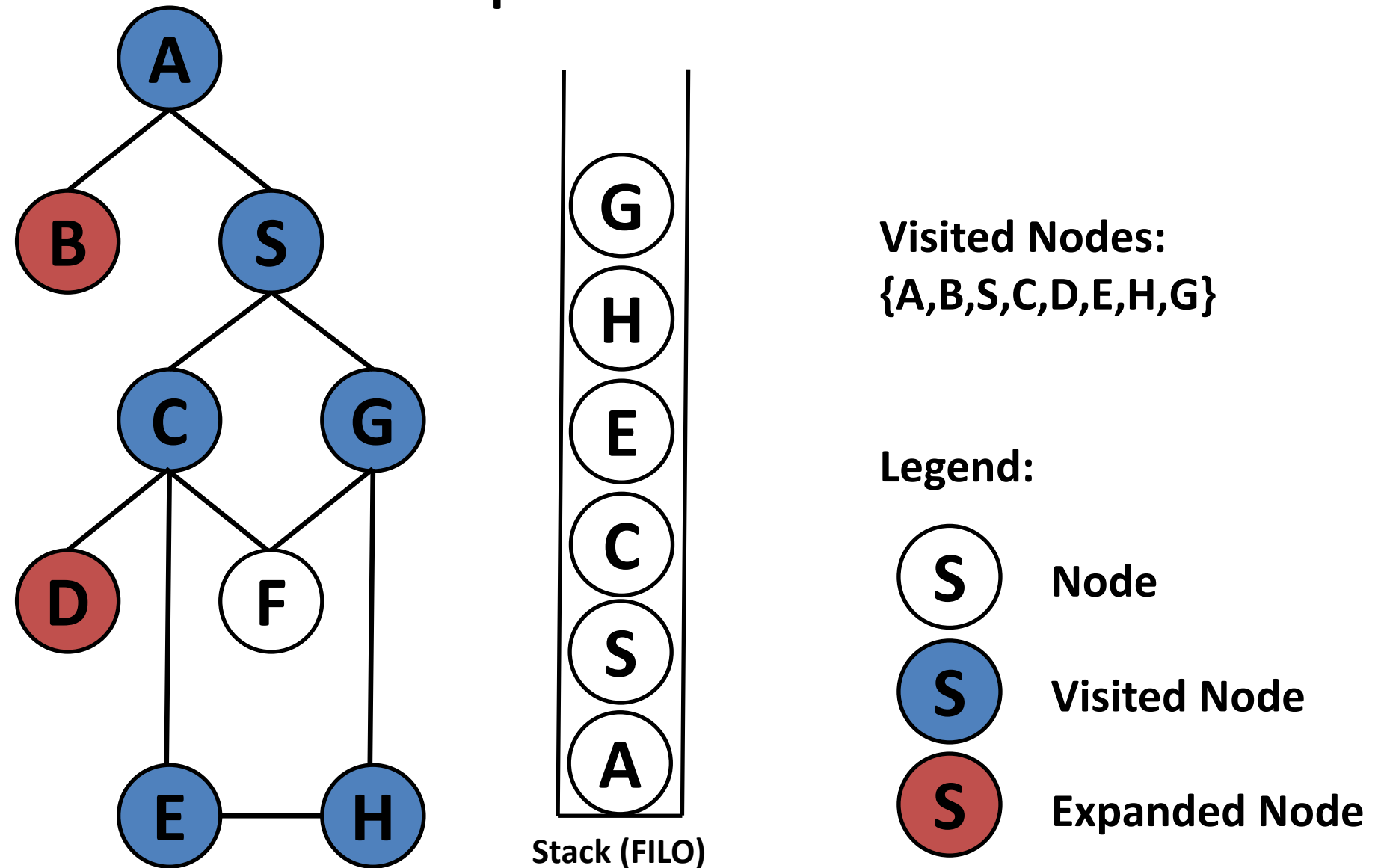
Depth-First Search



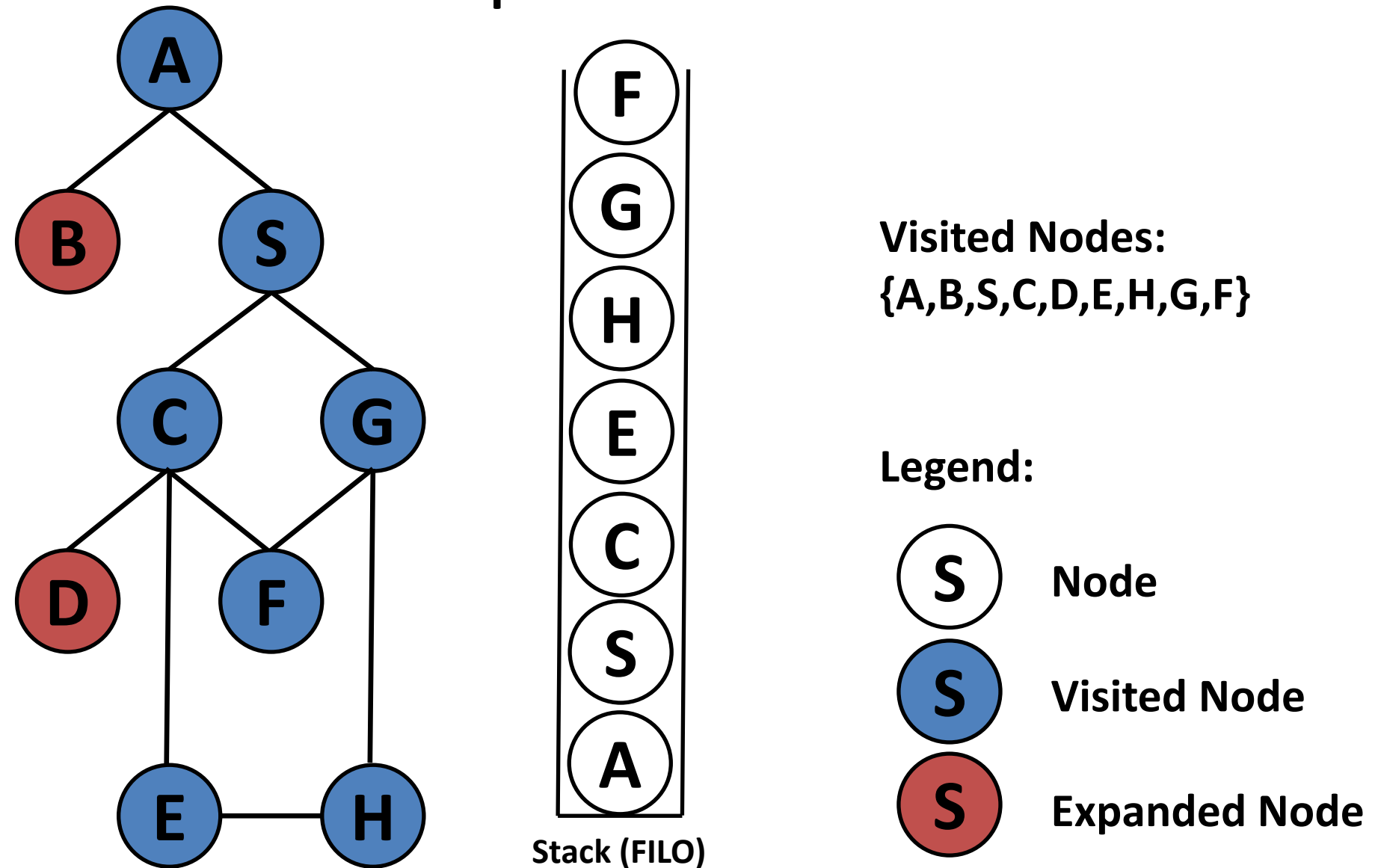
Depth-First Search



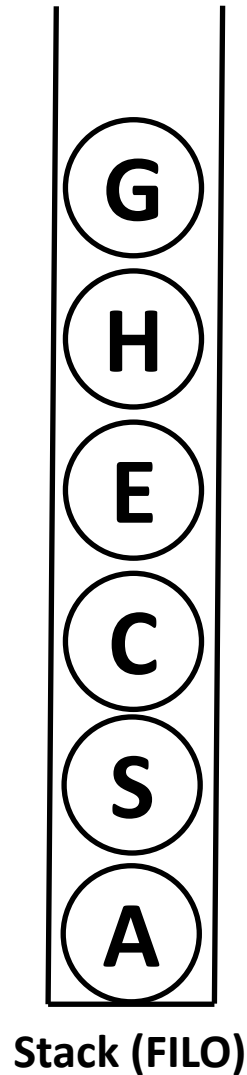
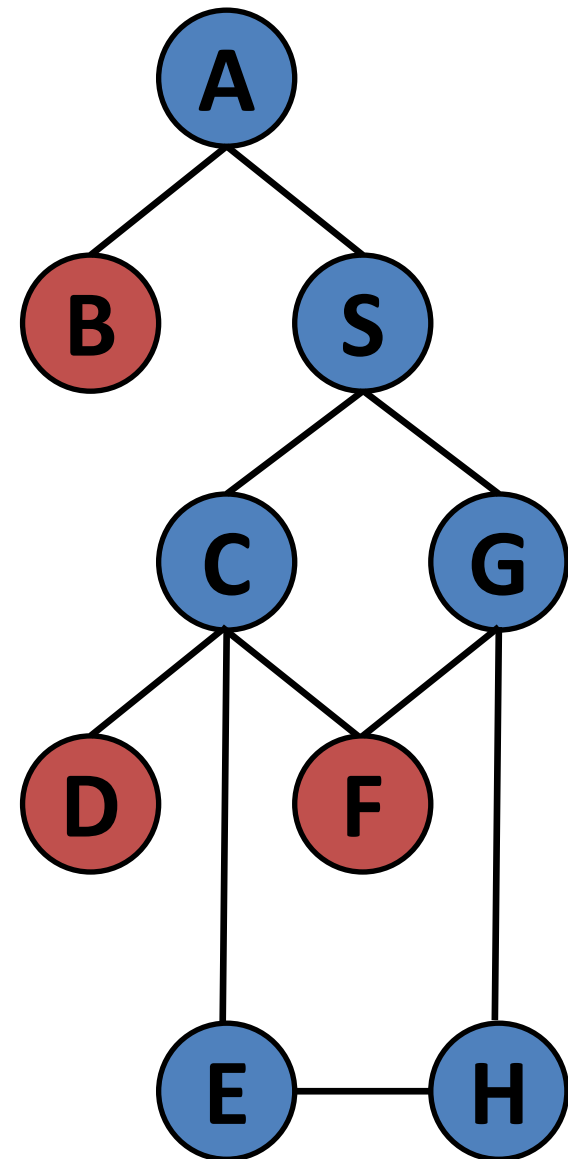
Depth-First Search



Depth-First Search

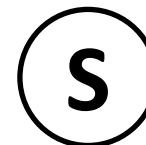


Depth-First Search



Visited Nodes:
 $\{A, B, S, C, D, E, H, G, F\}$

Legend:



Node

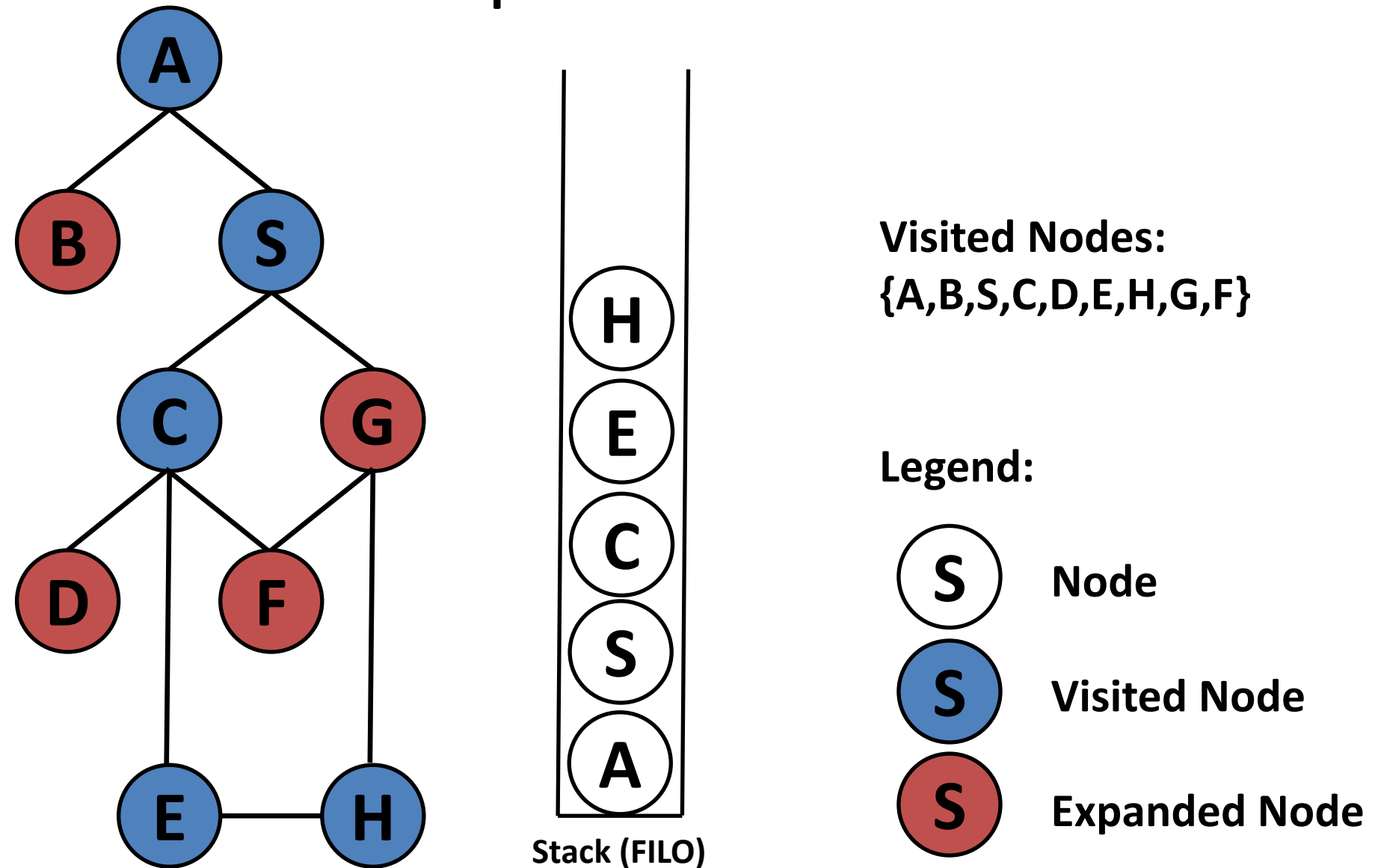


Visited Node

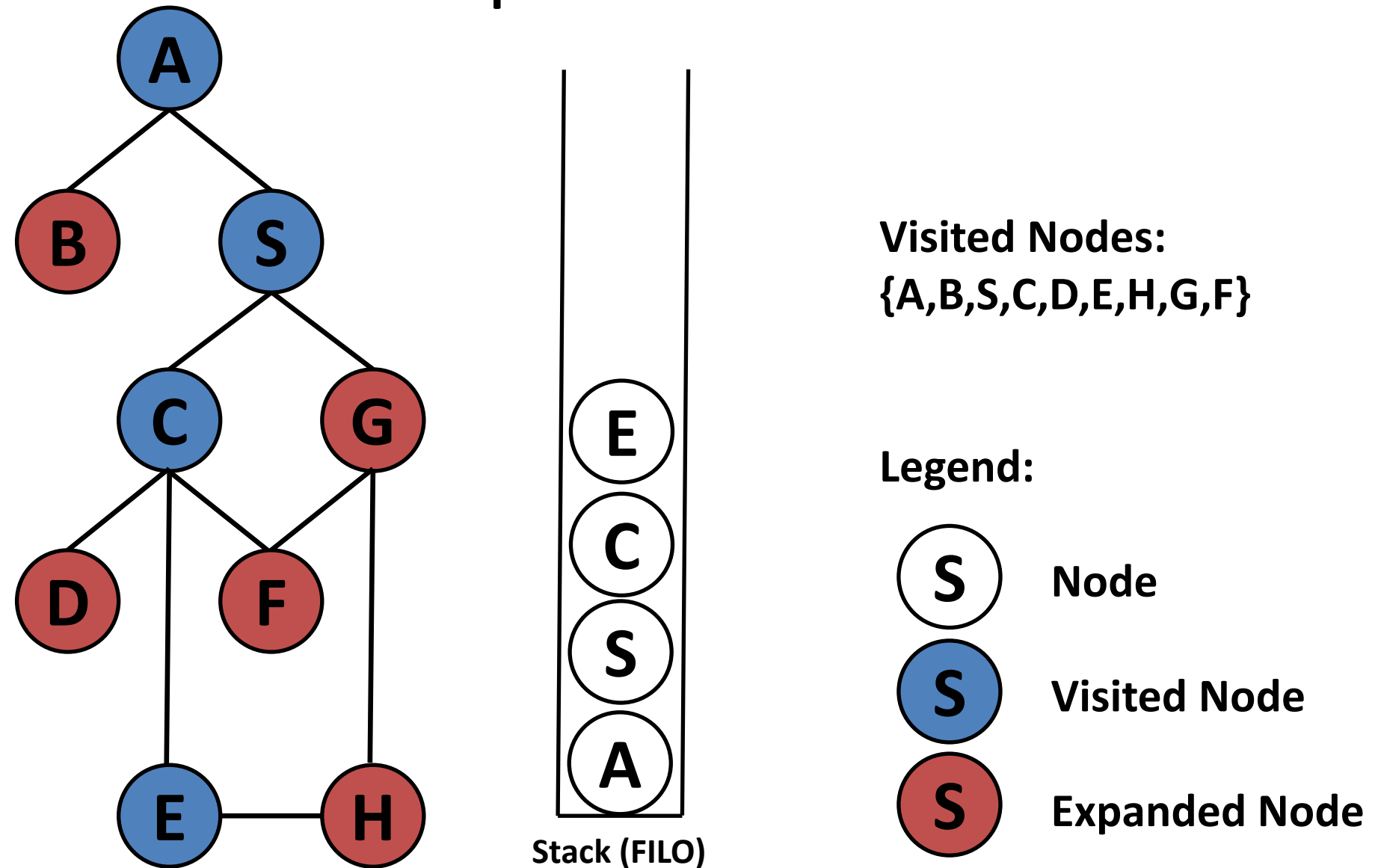


Expanded Node

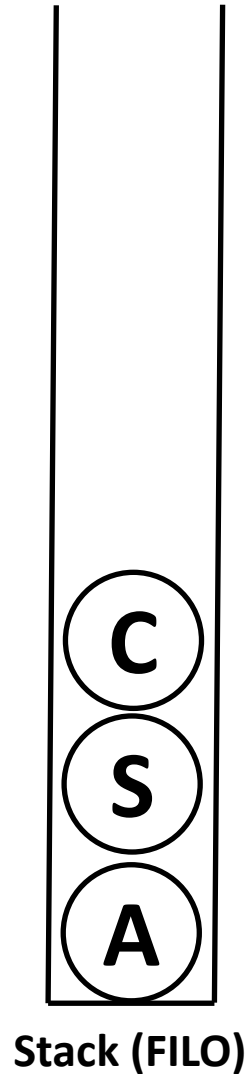
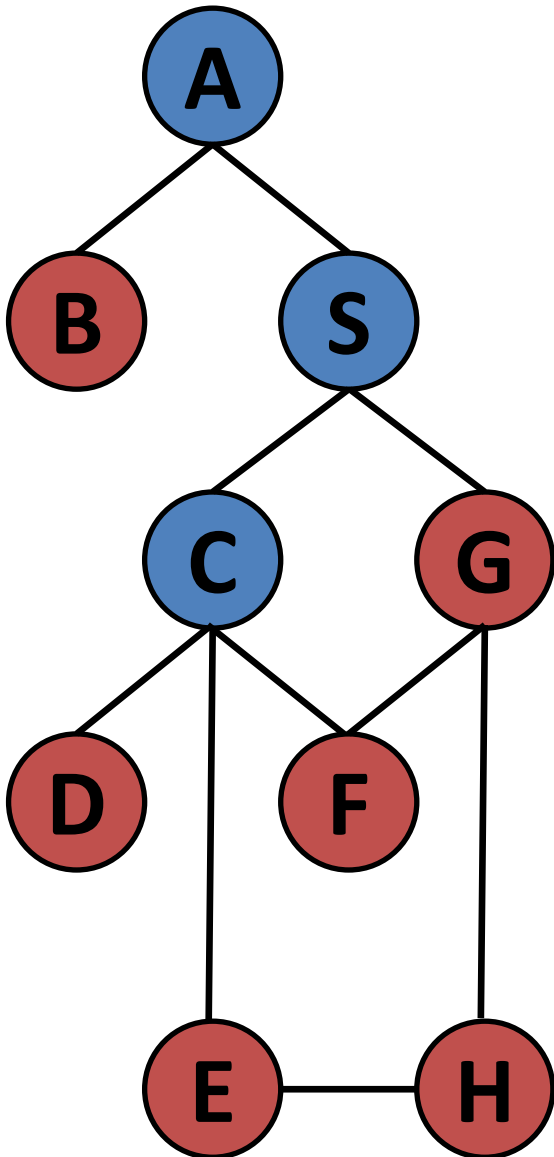
Depth-First Search



Depth-First Search

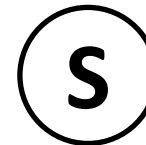


Depth-First Search



Visited Nodes:
 $\{A, B, S, C, D, E, H, G, F\}$

Legend:



Node

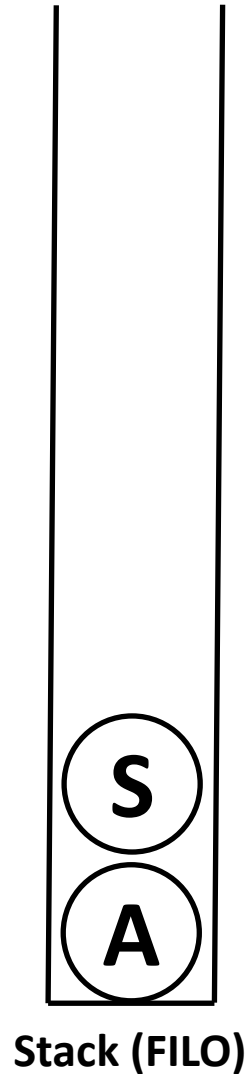
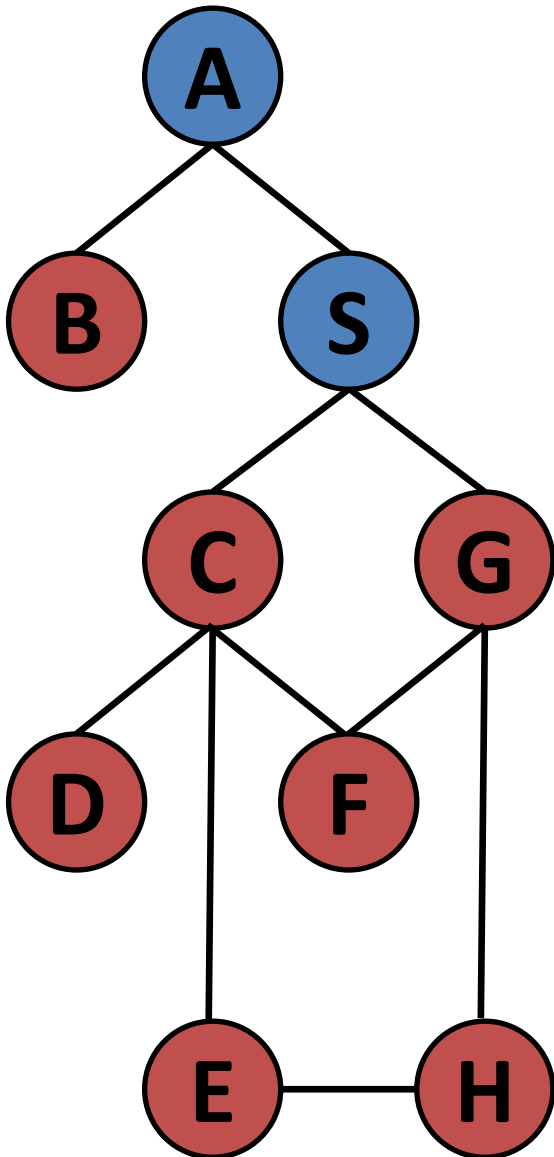


Visited Node



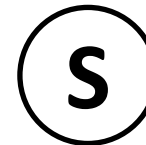
Expanded Node

Depth-First Search

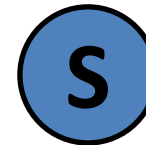


Visited Nodes:
 $\{A, B, S, C, D, E, H, G, F\}$

Legend:



Node

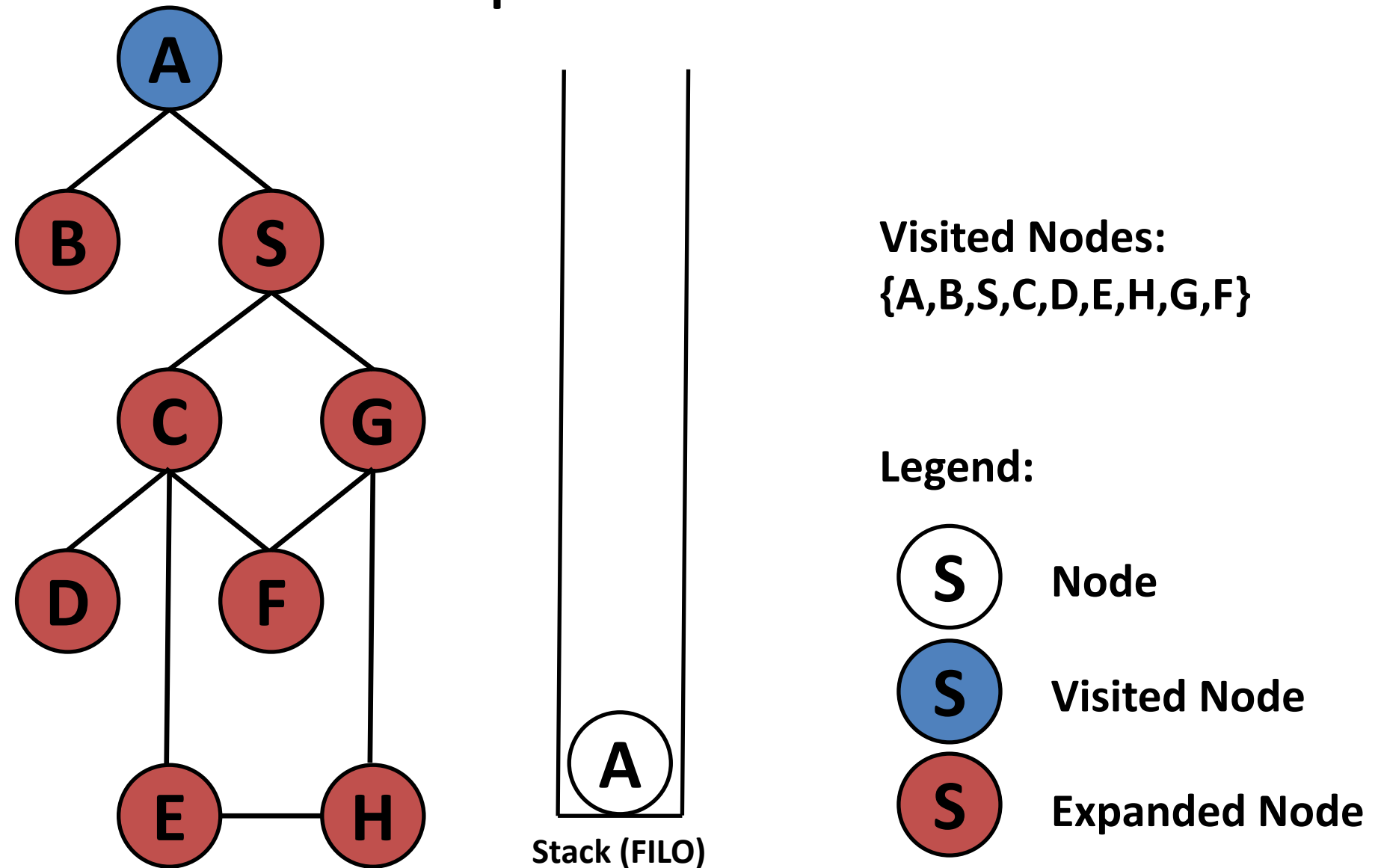


Visited Node

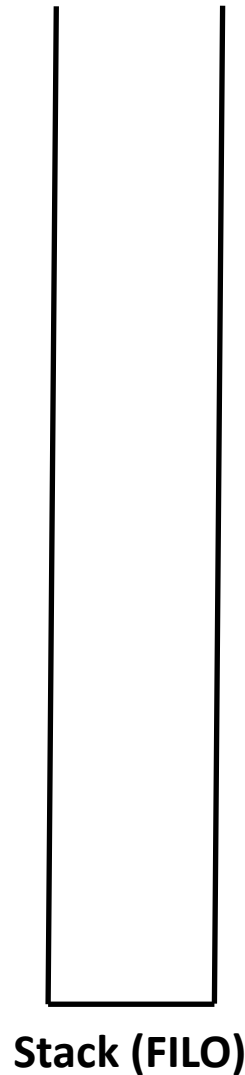
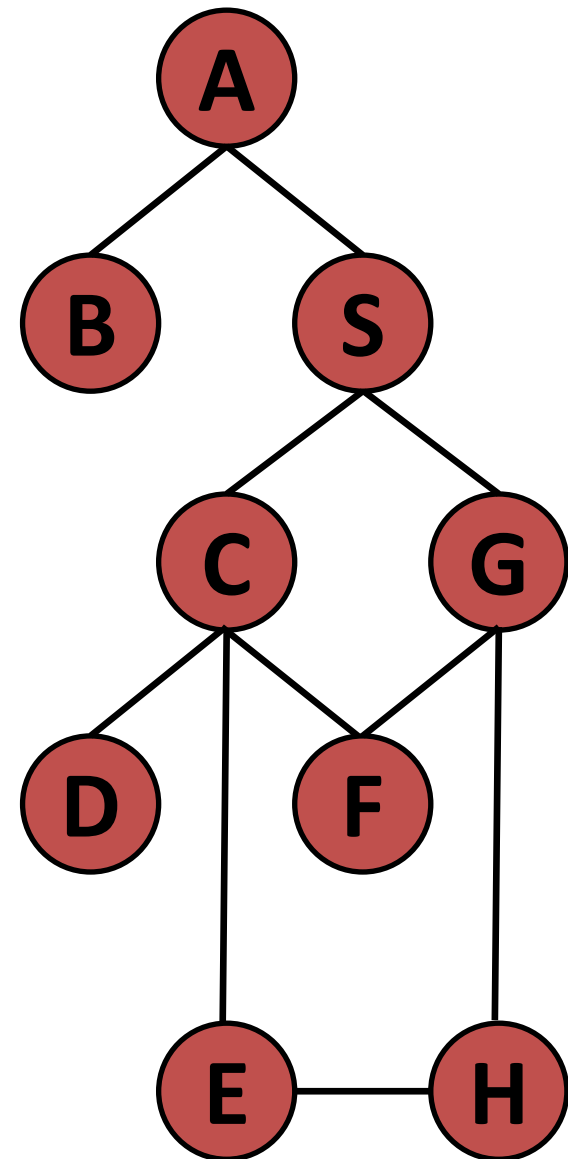


Expanded Node

Depth-First Search

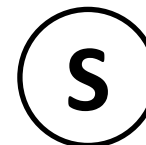


Depth-First Search



Visited Nodes:
 $\{A, B, S, C, D, E, H, G, F\}$

Legend:



Node

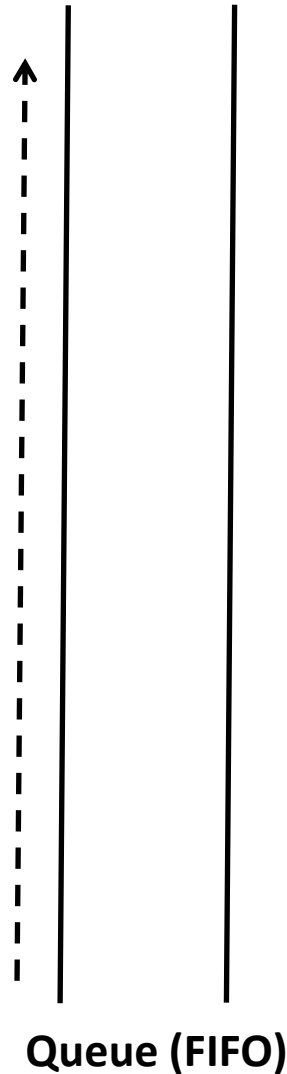
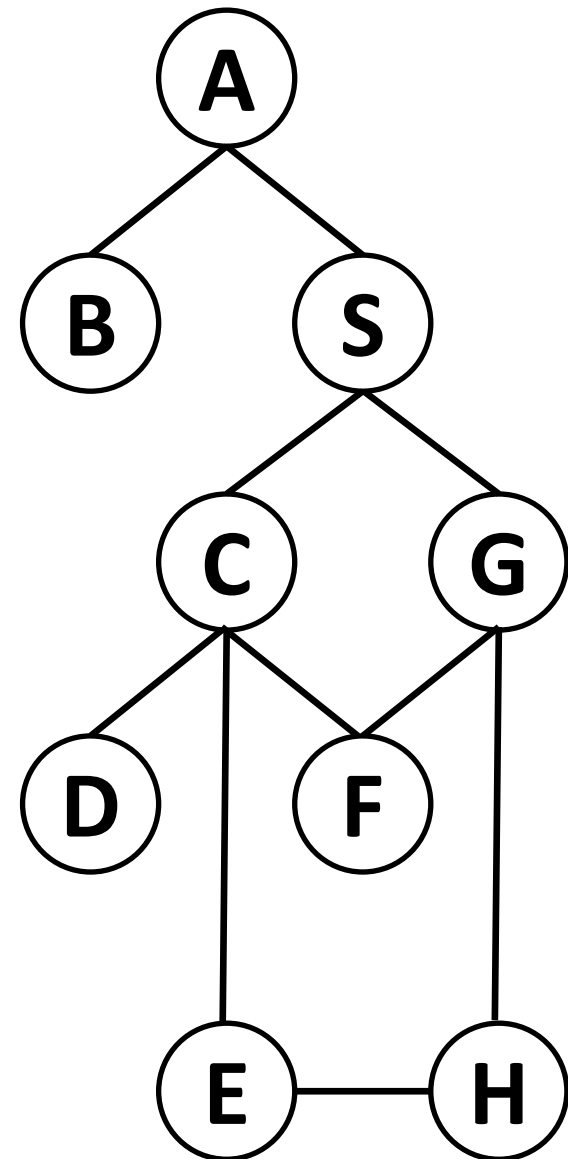


Visited Node



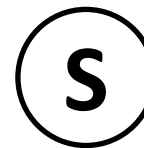
Expanded Node

Breadth-First Search

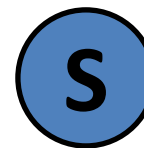


Visited Nodes:
{ }

Legend:



Node

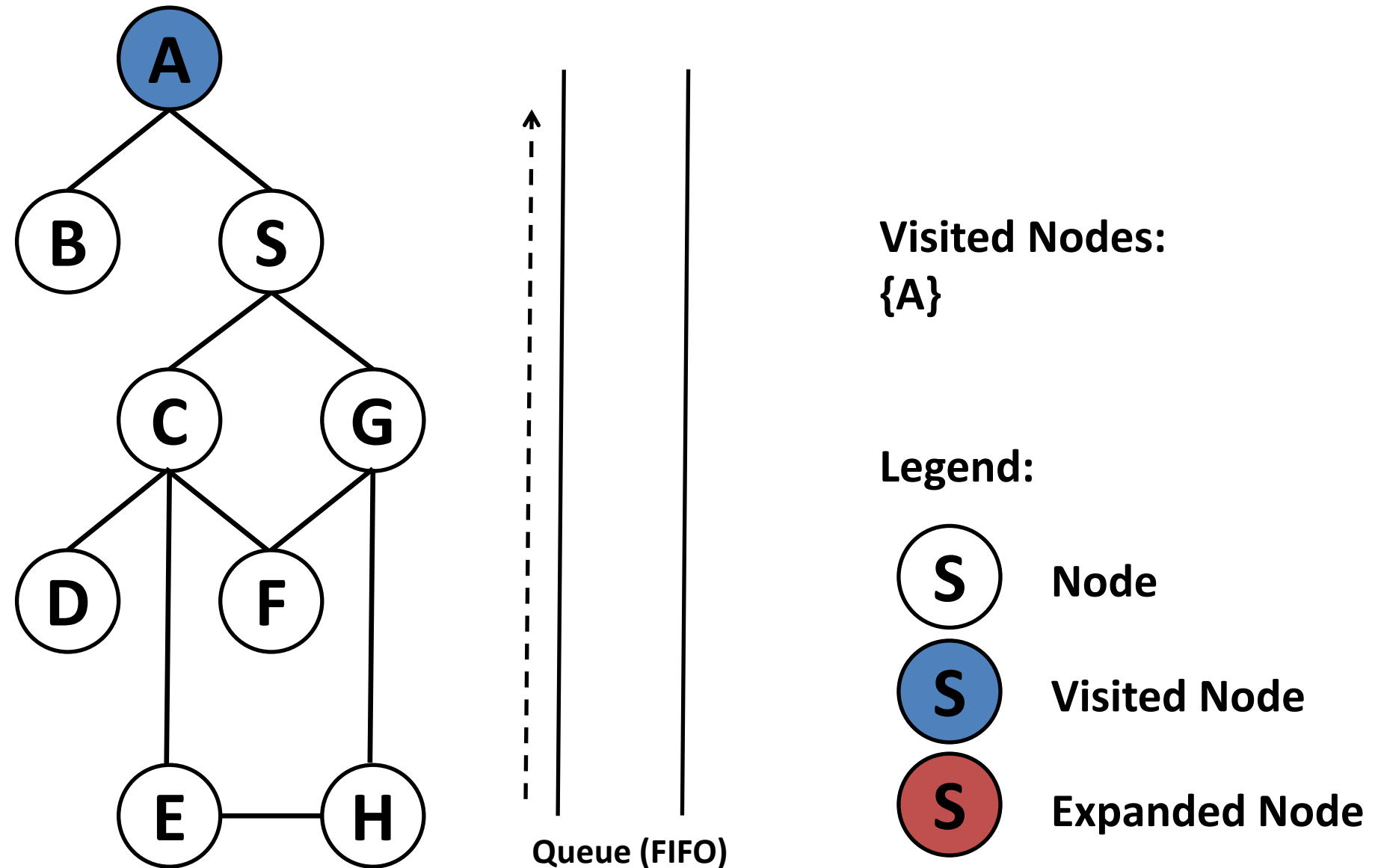


Visited Node

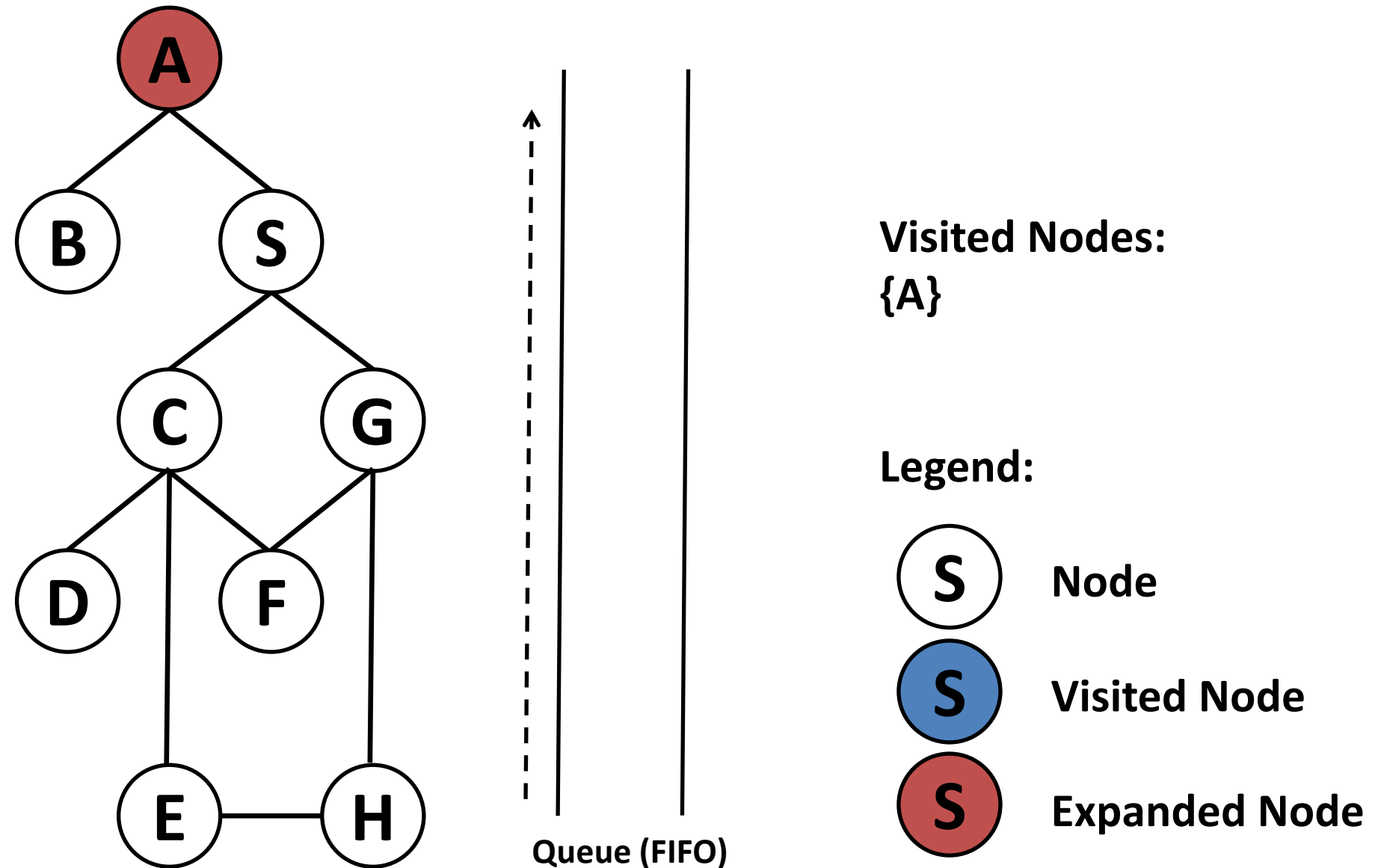


Expanded Node

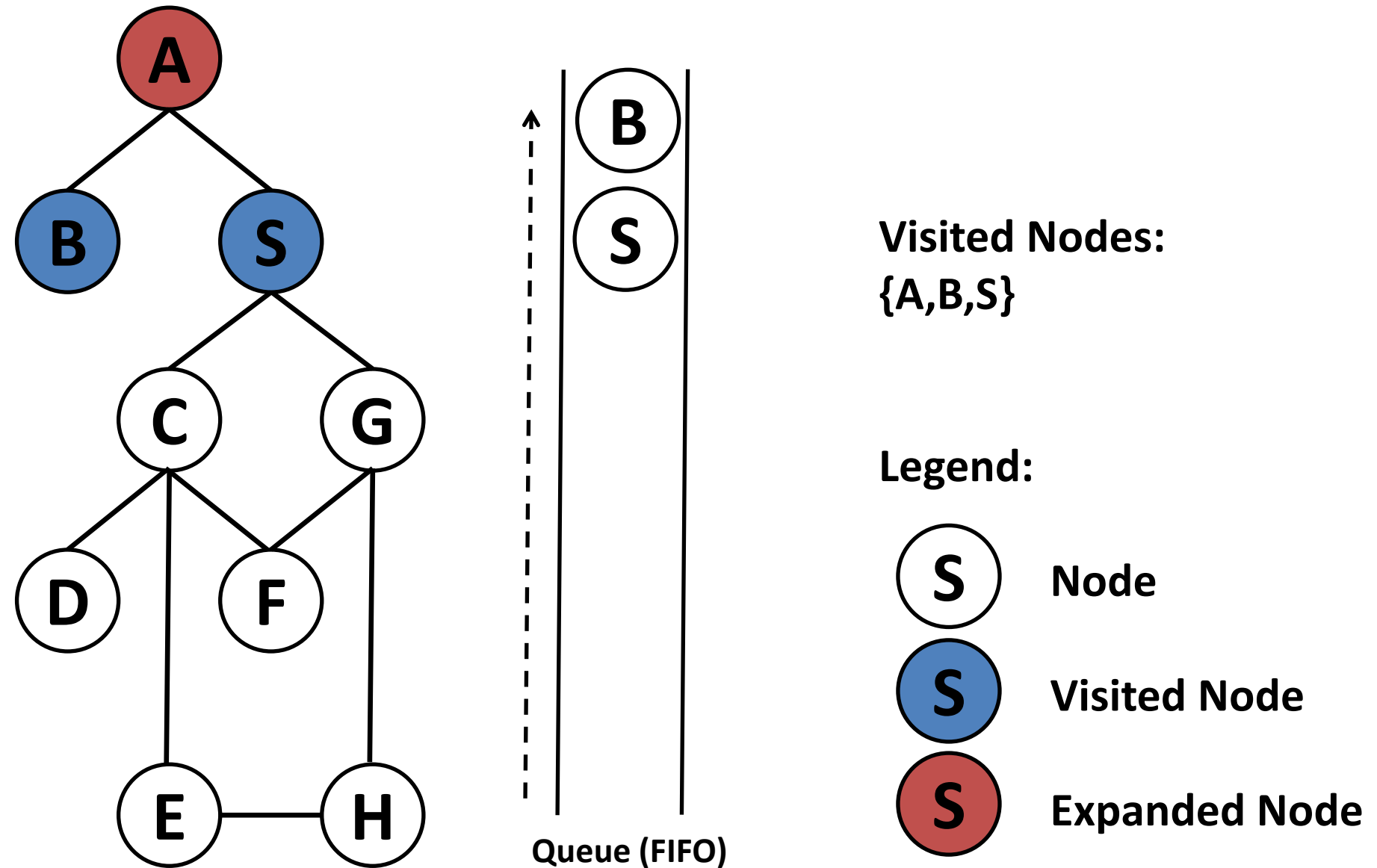
Breadth-First Search



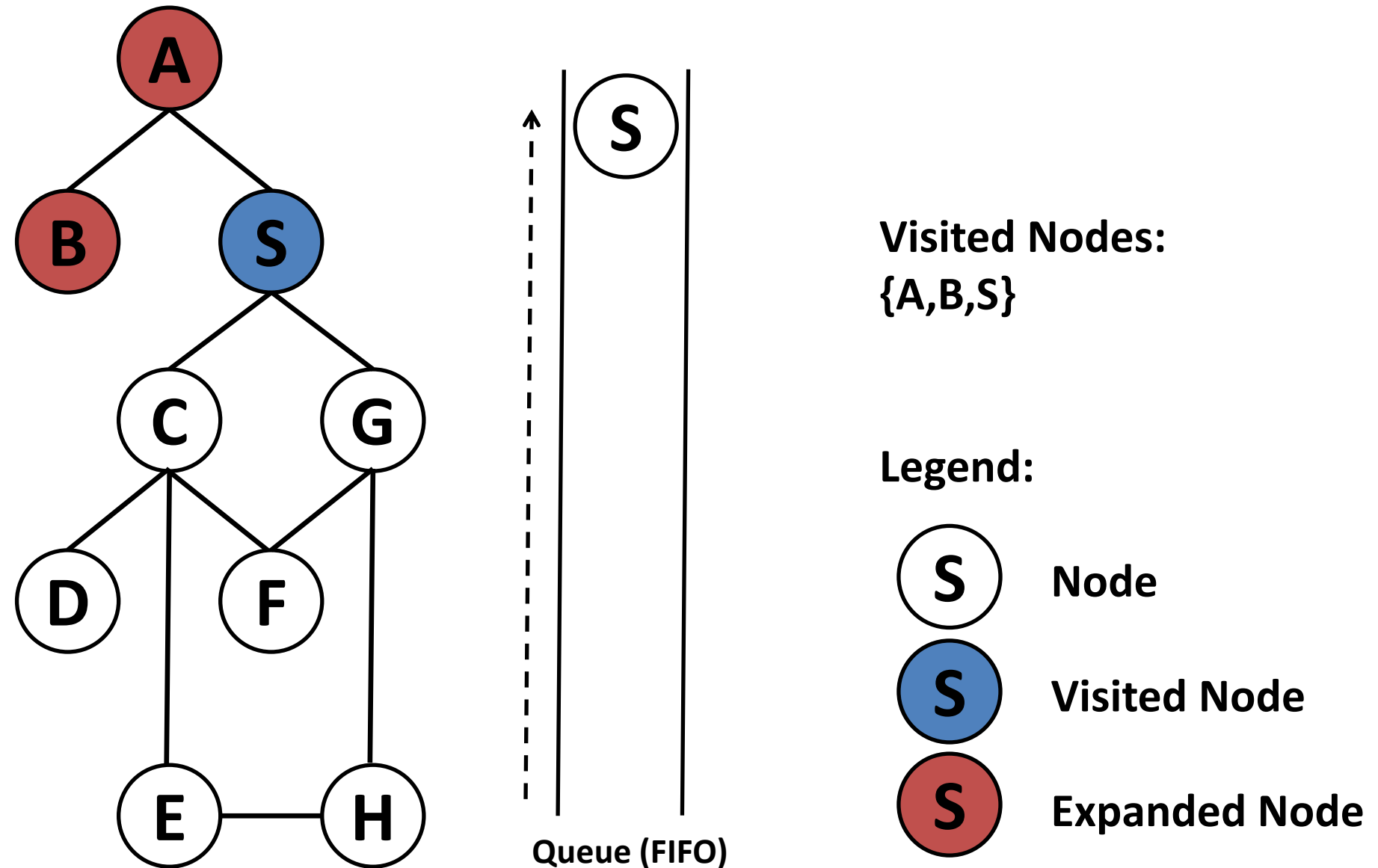
Breadth-First Search



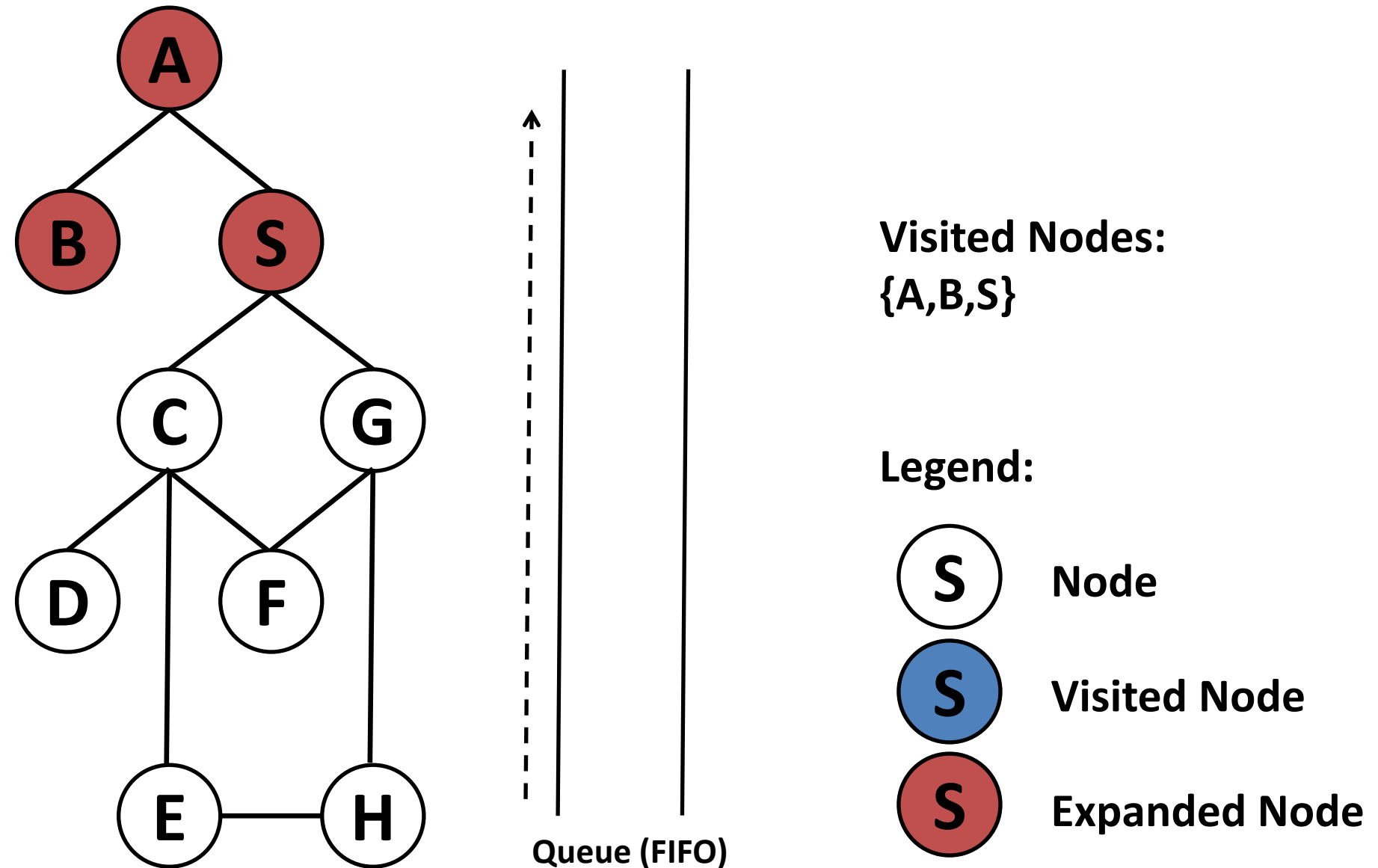
Breadth-First Search



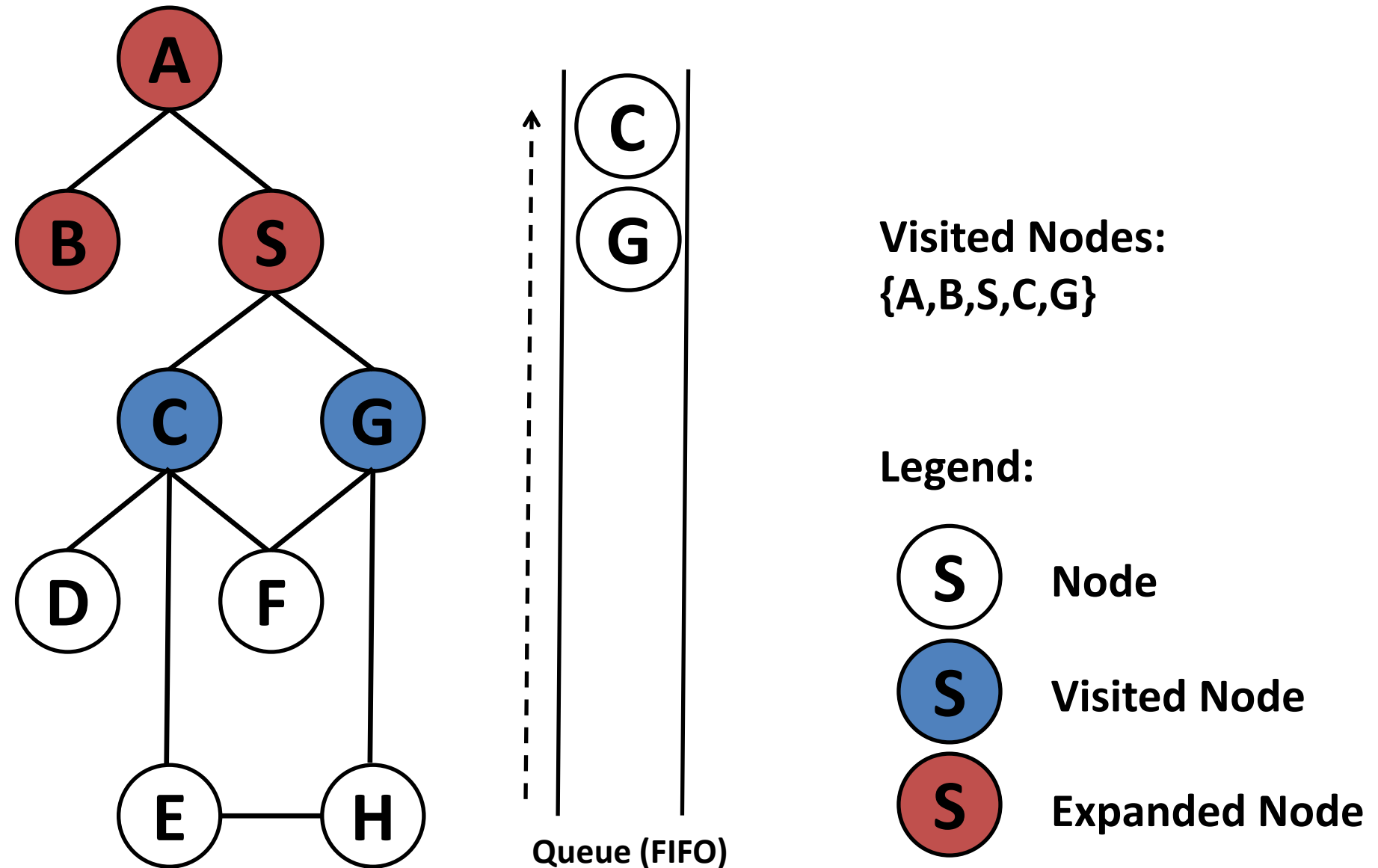
Breadth-First Search



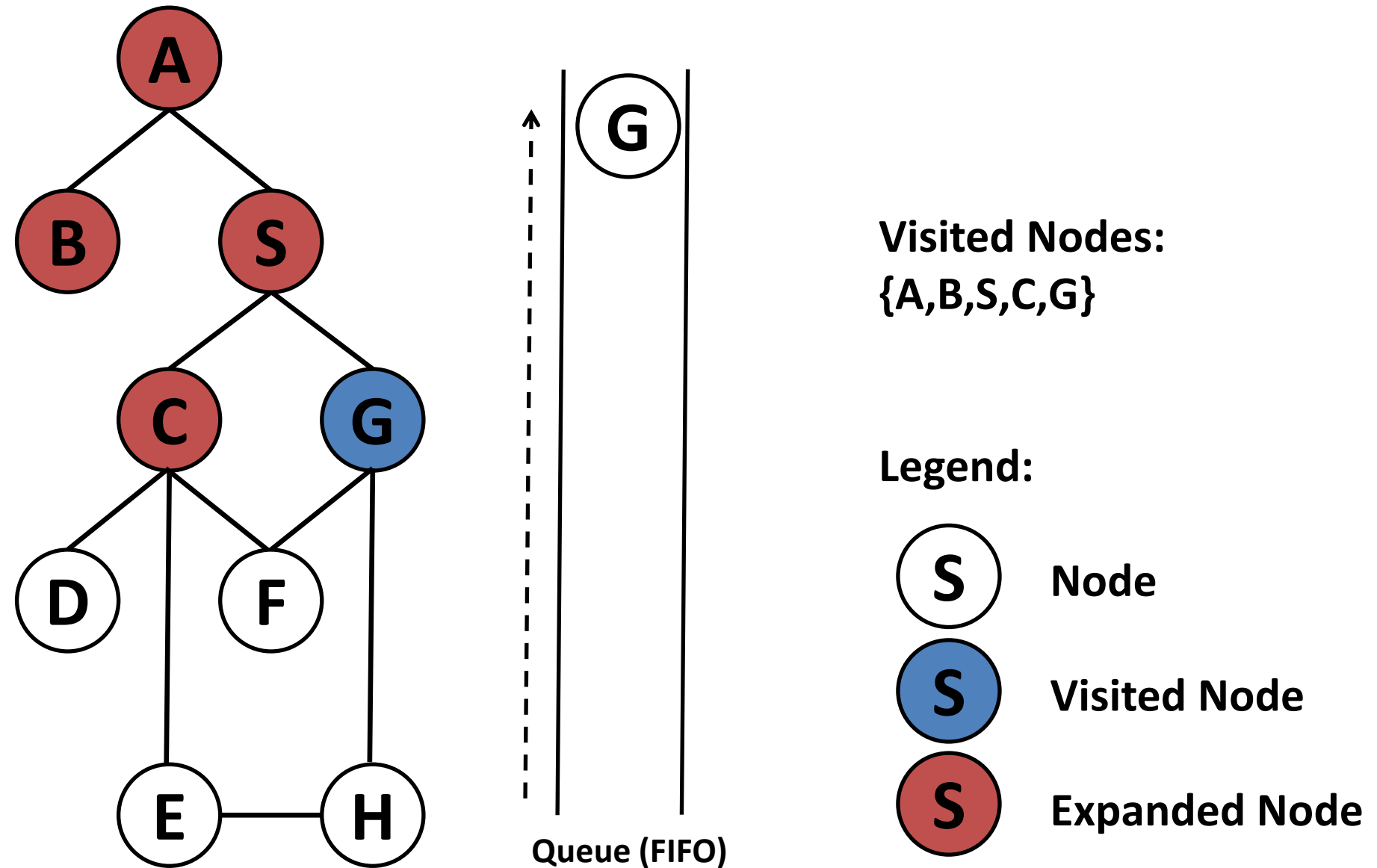
Breadth-First Search



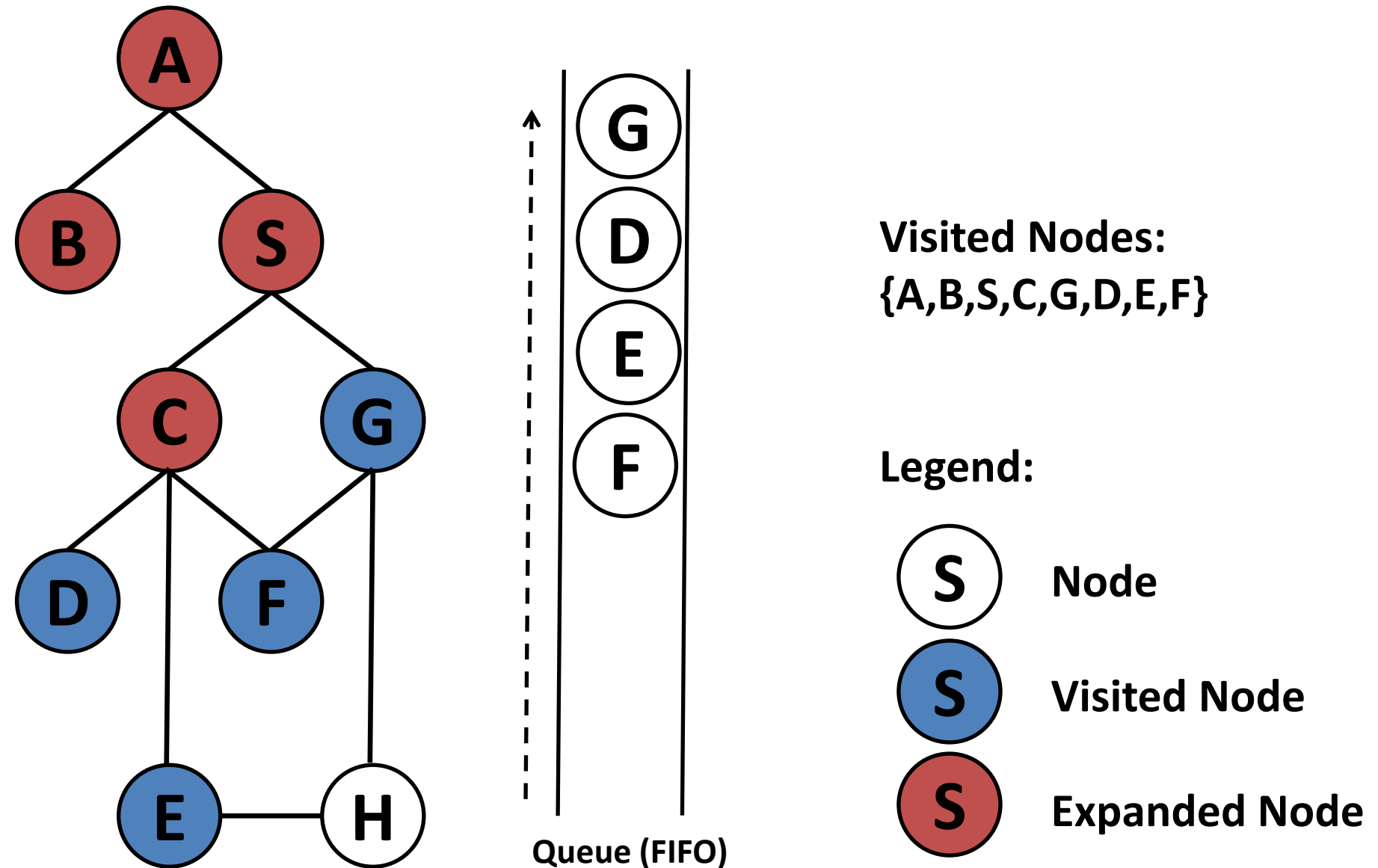
Breadth-First Search



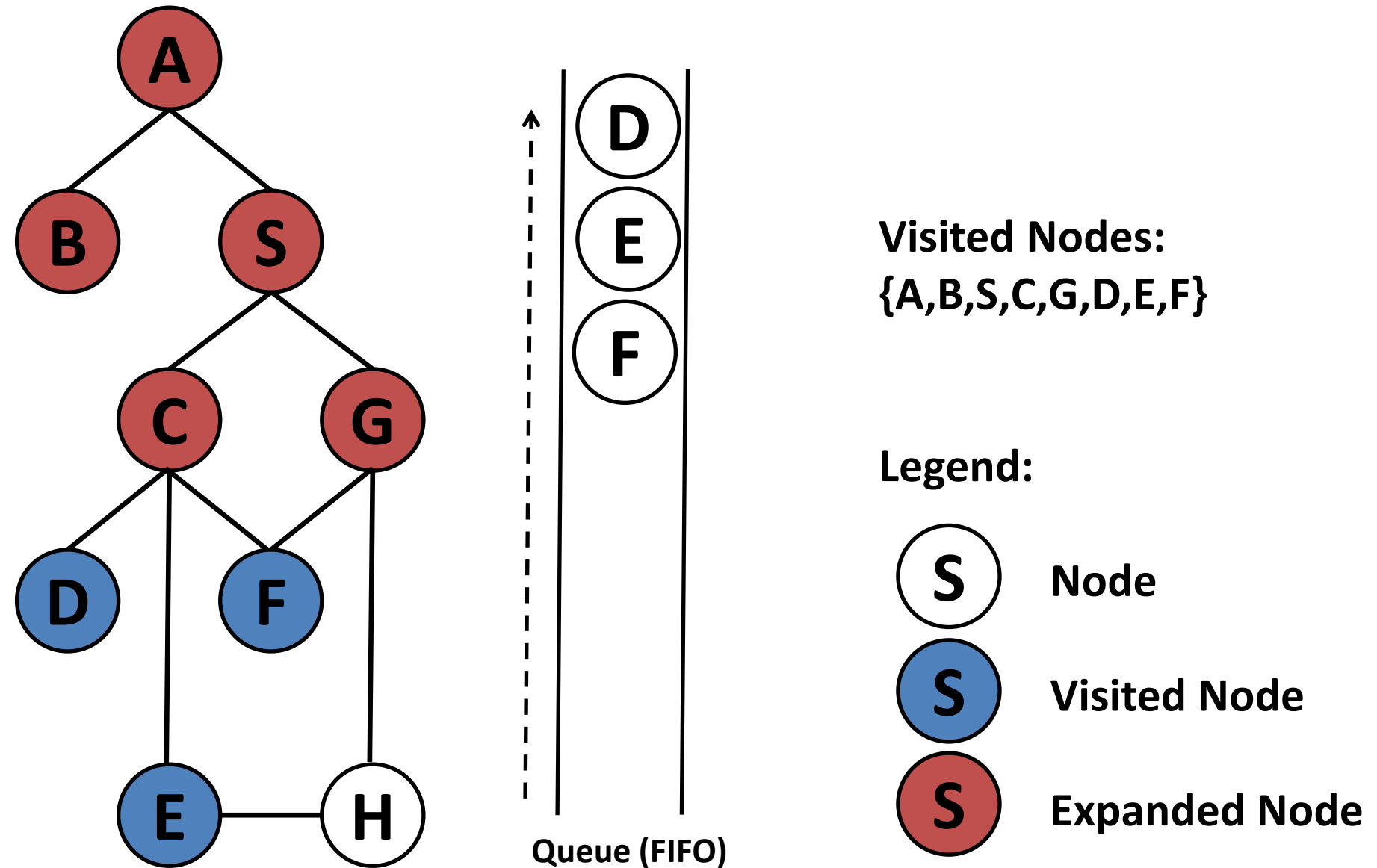
Breadth-First Search



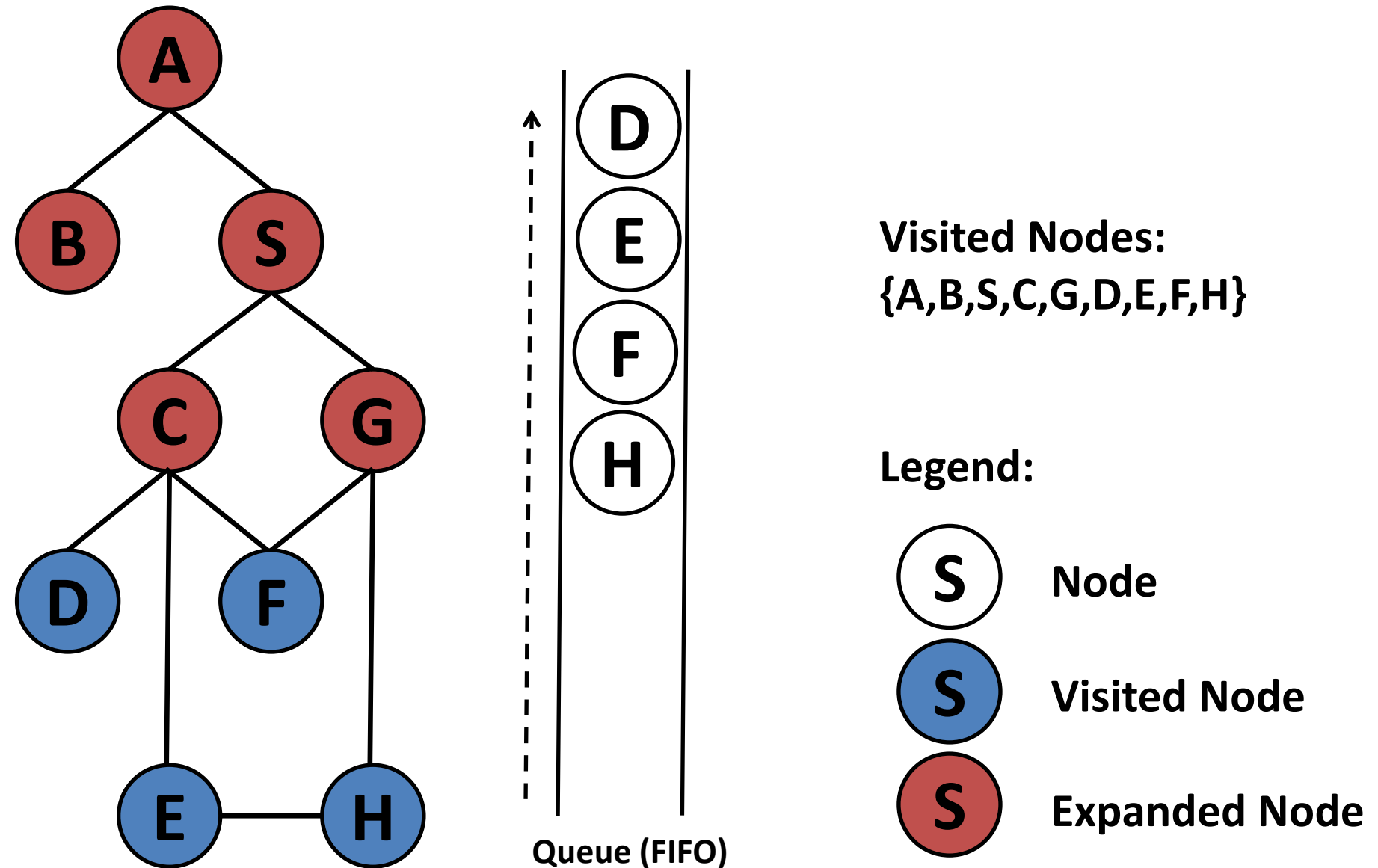
Breadth-First Search



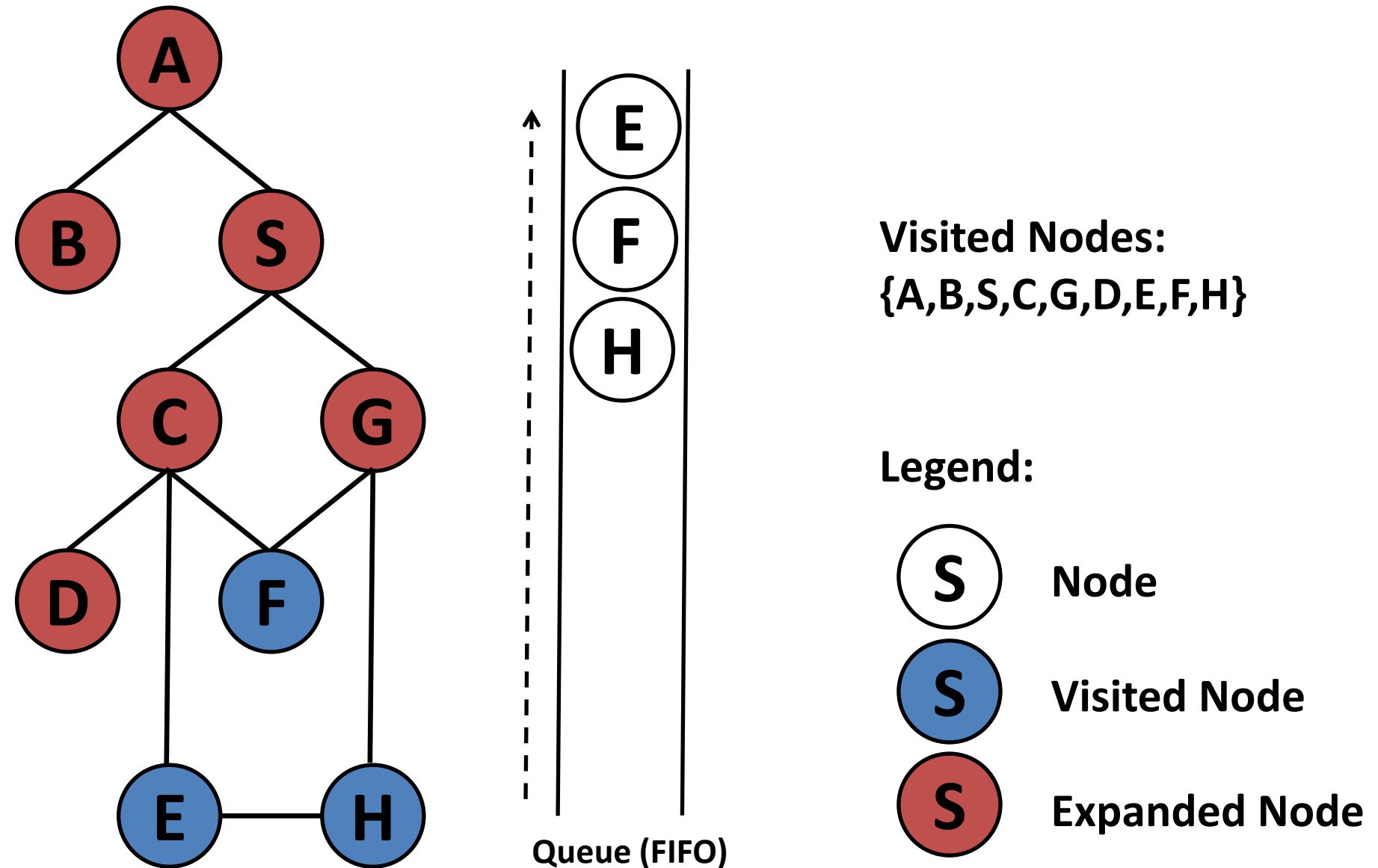
Breadth-First Search



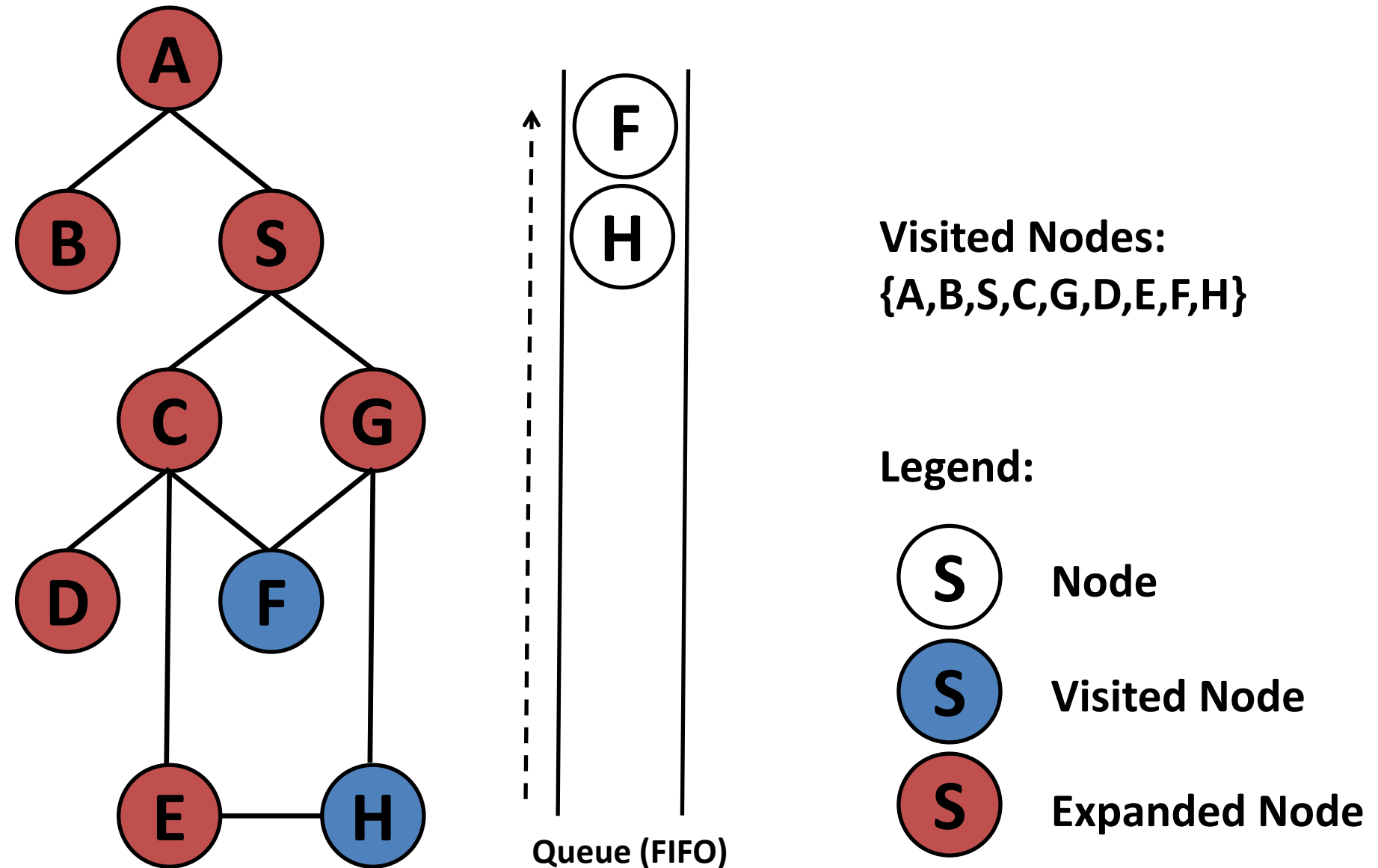
Breadth-First Search



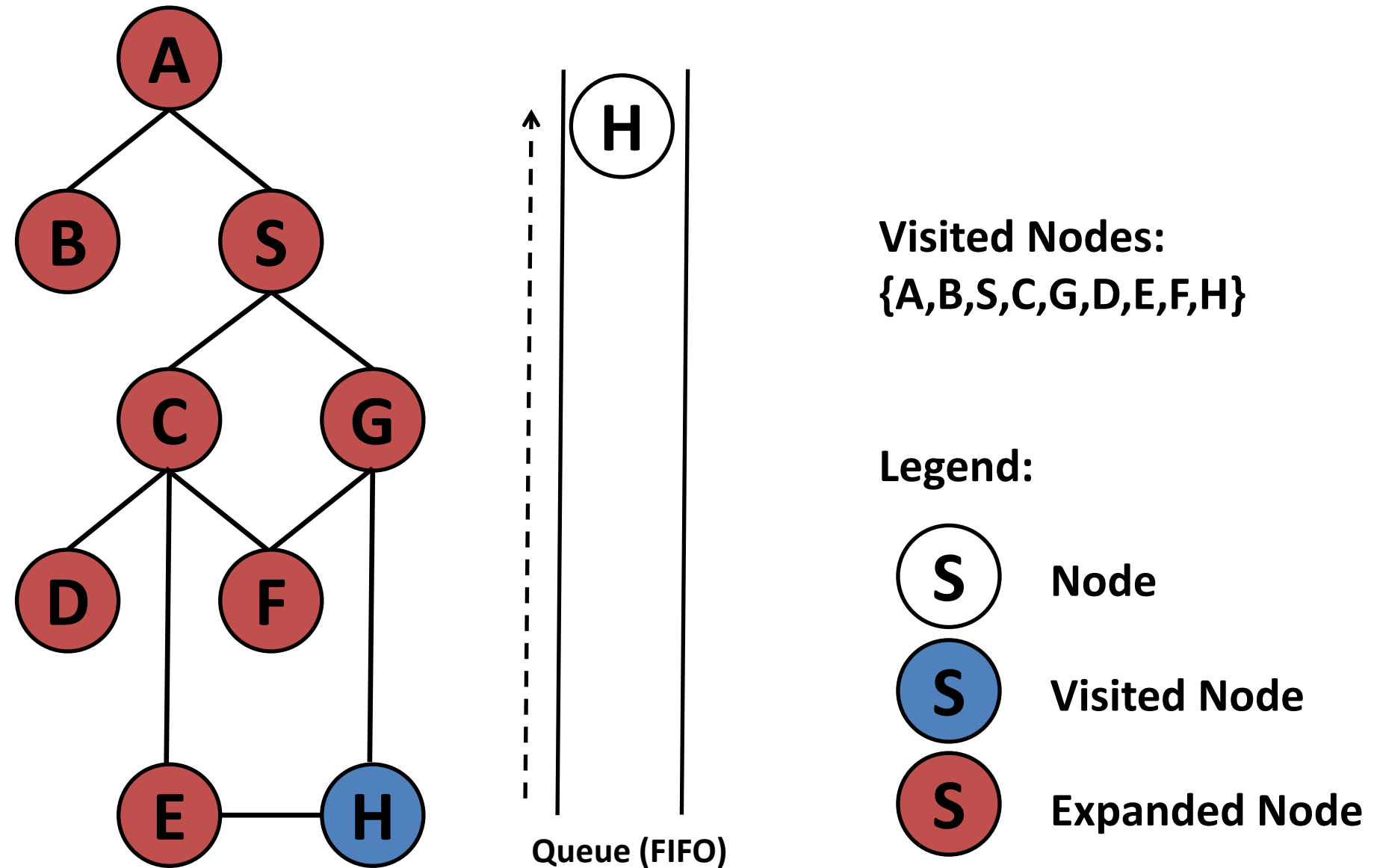
Breadth-First Search



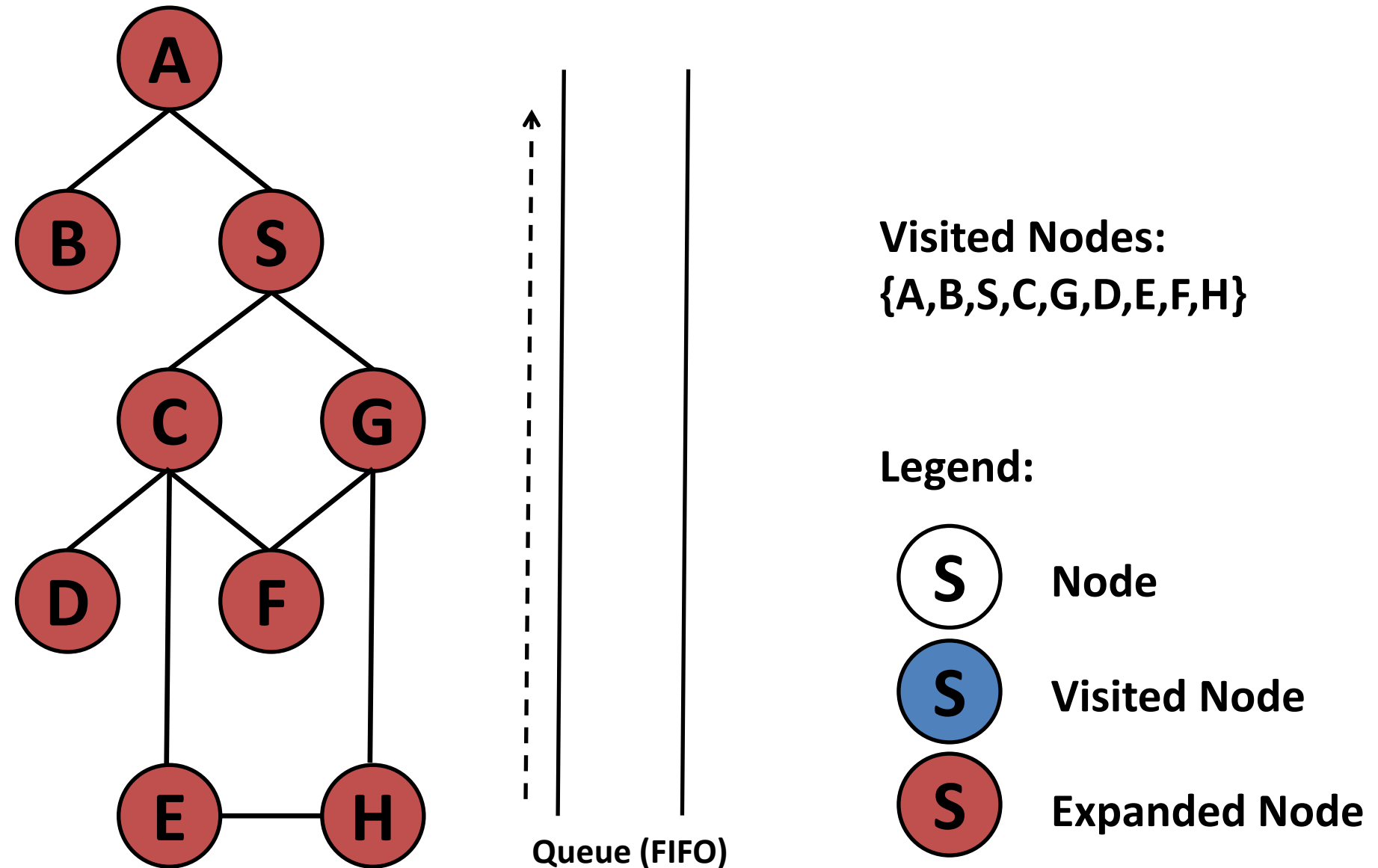
Breadth-First Search



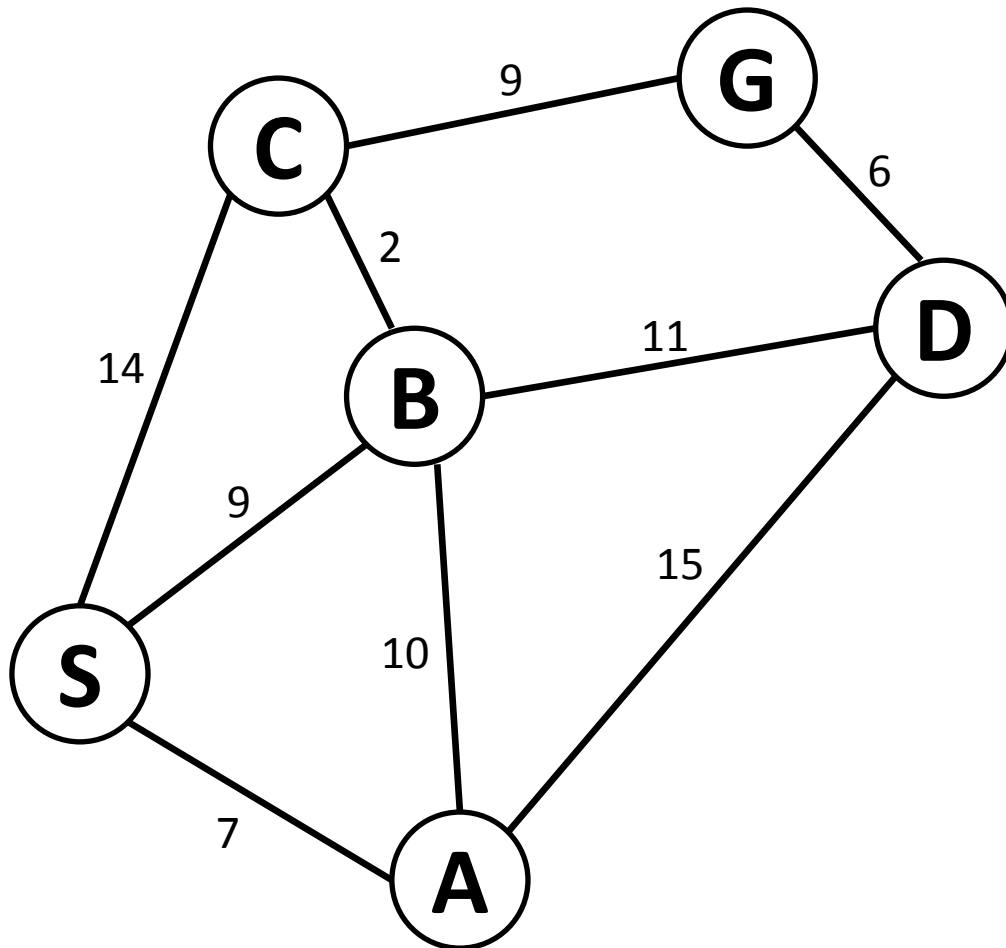
Breadth-First Search



Breadth-First Search

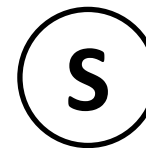


Uniform-Cost Search

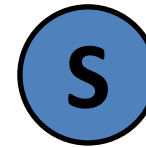


Visited Nodes:
{}

Legend:



Node

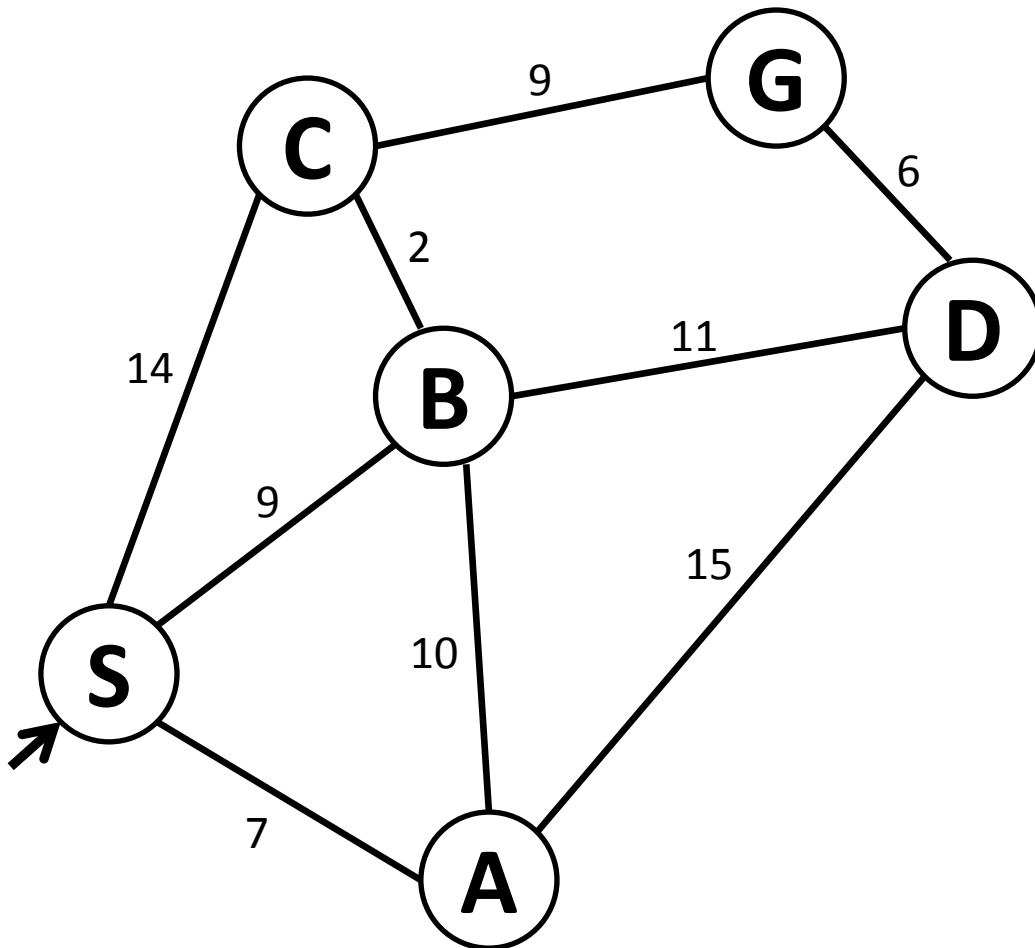


Visited Node






Expanded Node

Uniform-Cost Search

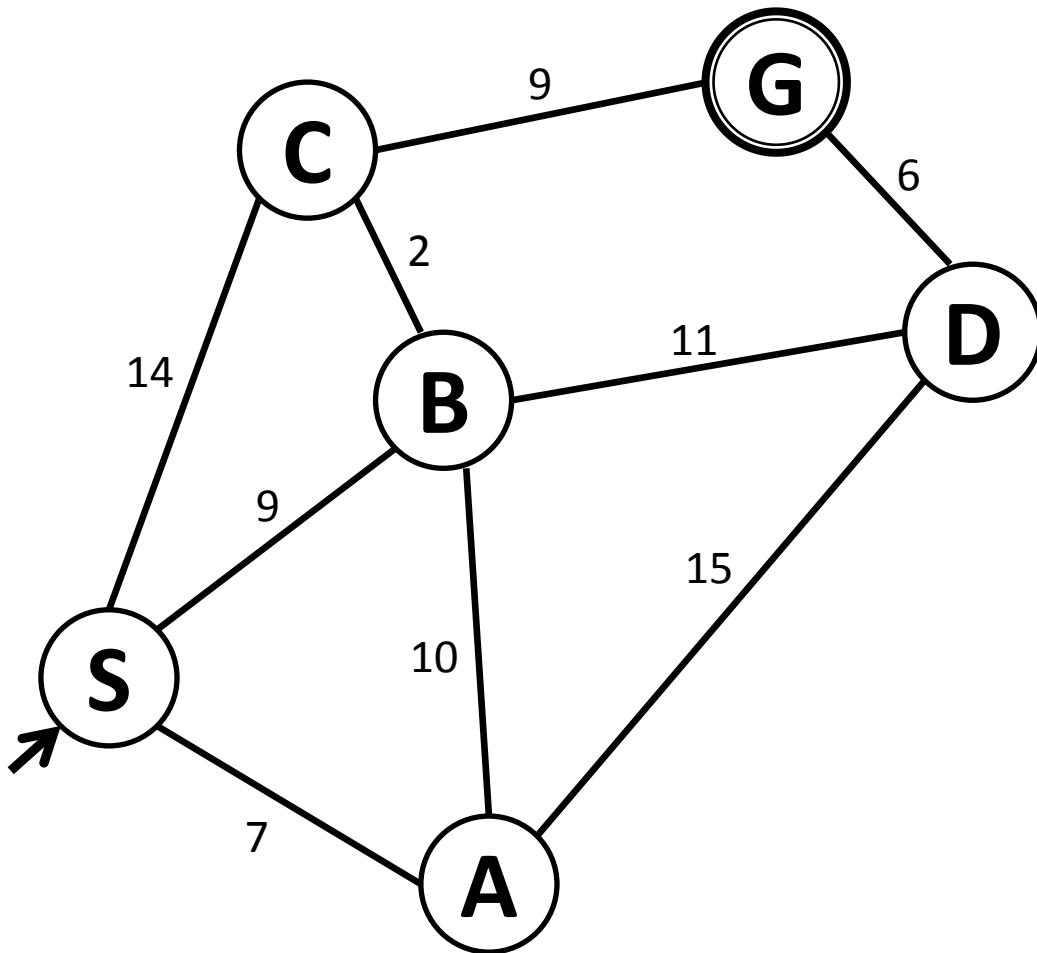


Visited Nodes:
{ }

Legend:

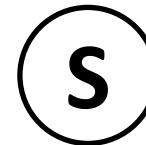
-  Node
-  Visited Node
-  Expanded Node

Uniform-Cost Search

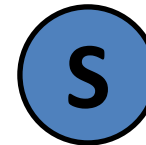


Visited Nodes:
{ }

Legend:



Node

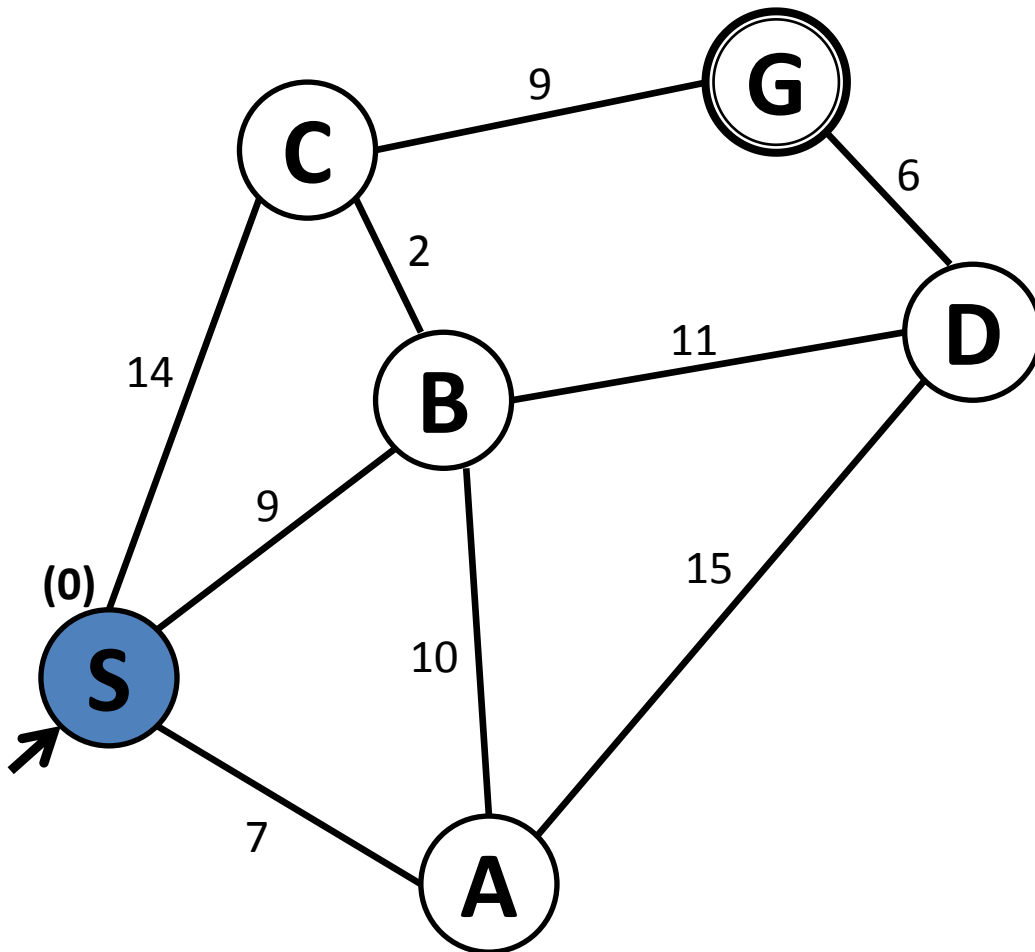


Visited Node



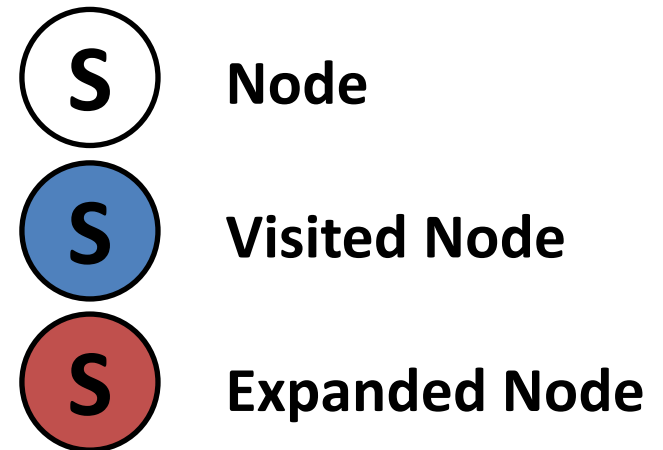
Expanded Node

Uniform-Cost Search

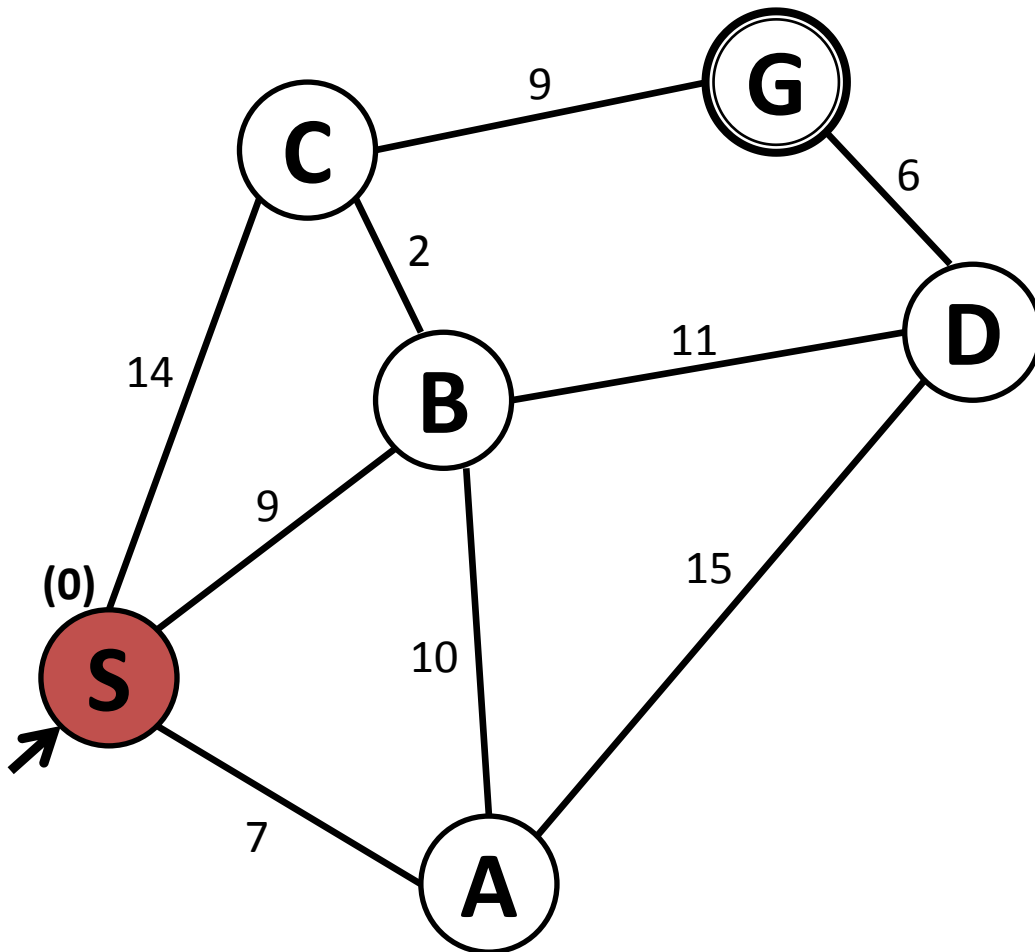


Visited Nodes:
 $\{S\}$

Legend:

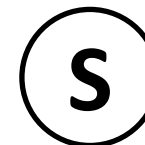


Uniform-Cost Search



Visited Nodes:
 $\{S\}$

Legend:



Node

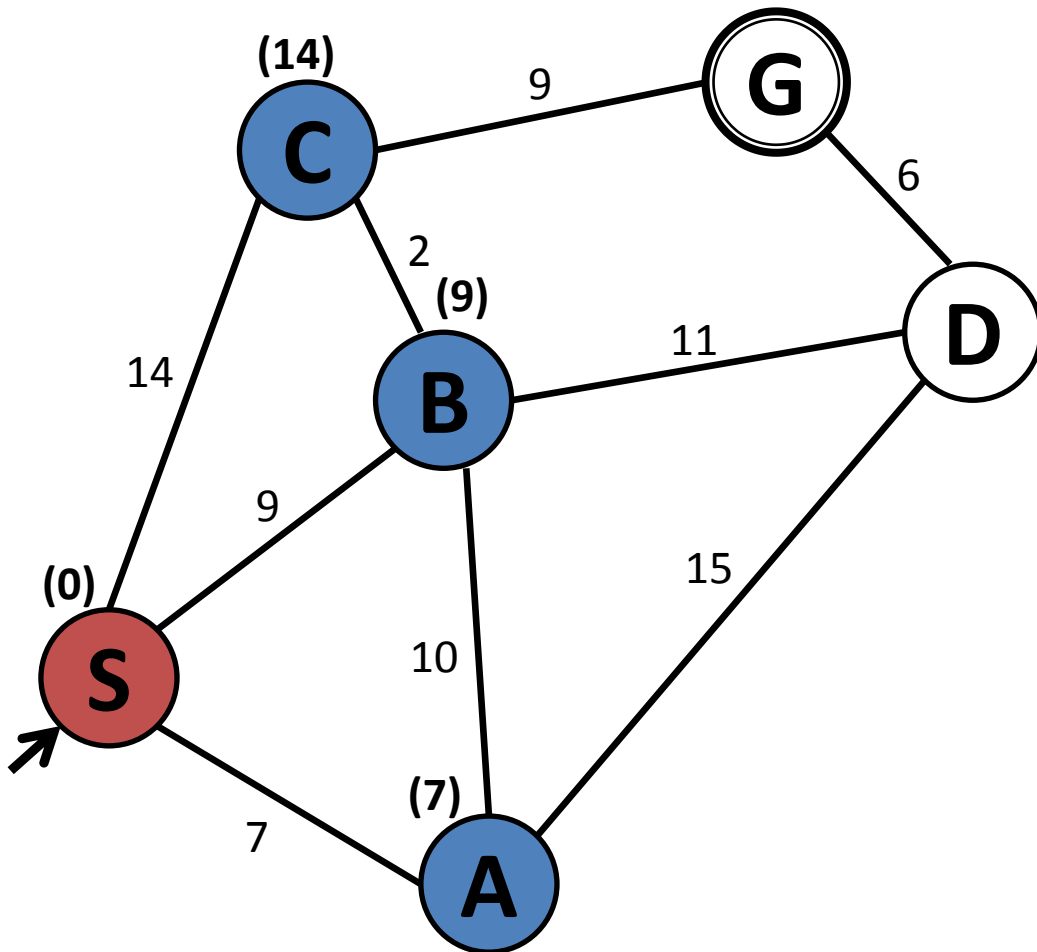


Visited Node






Expanded Node

Uniform-Cost Search

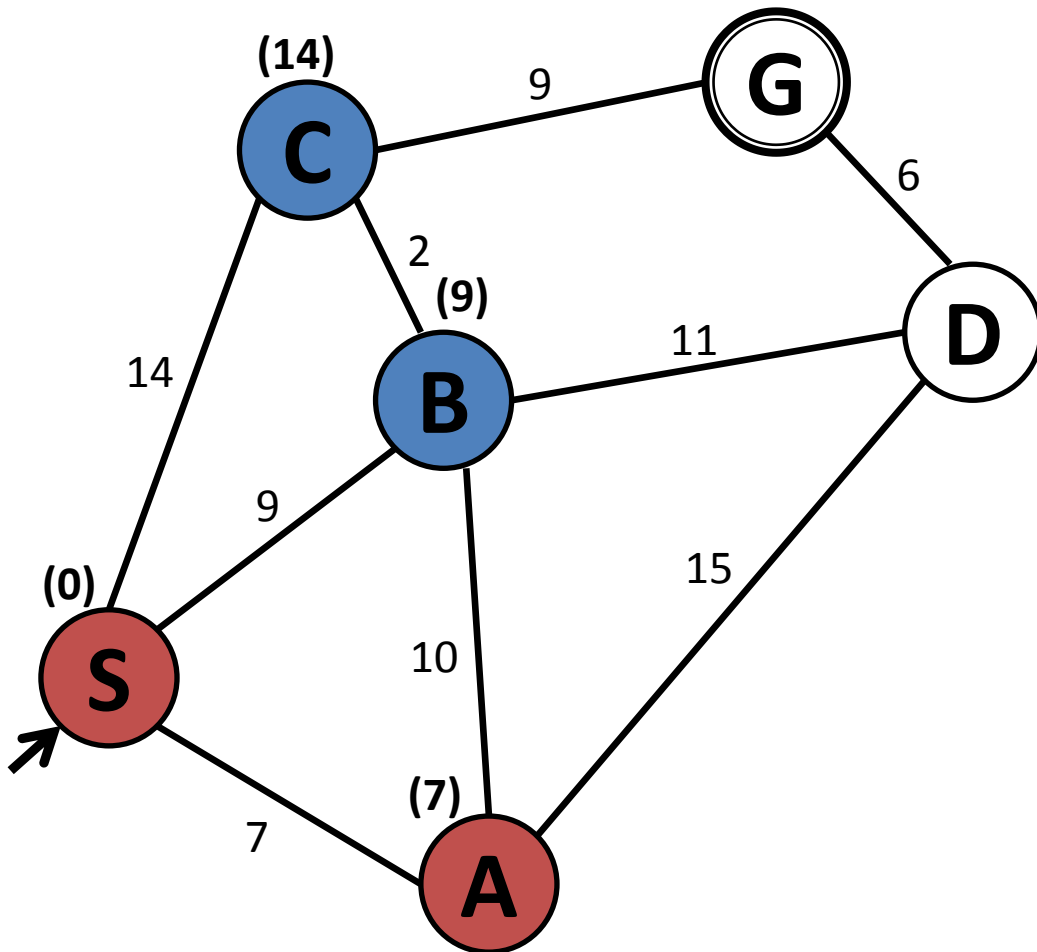


Visited Nodes:
 $\{S, A, B, C\}$

Legend:

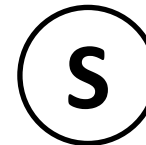
-  Node
-  Visited Node
-  Expanded Node

Uniform-Cost Search

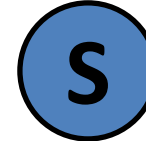


Visited Nodes:
 $\{S, A, B, C\}$

Legend:



Node

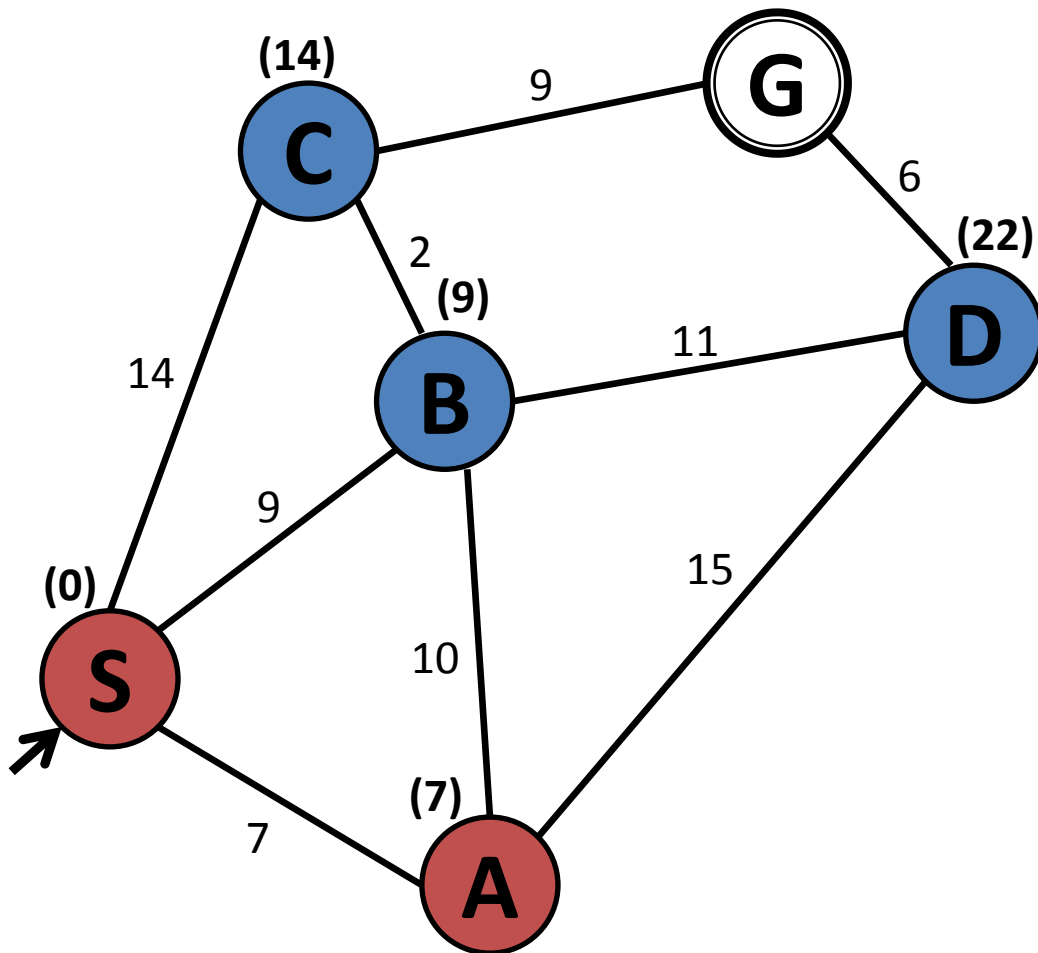


Visited Node



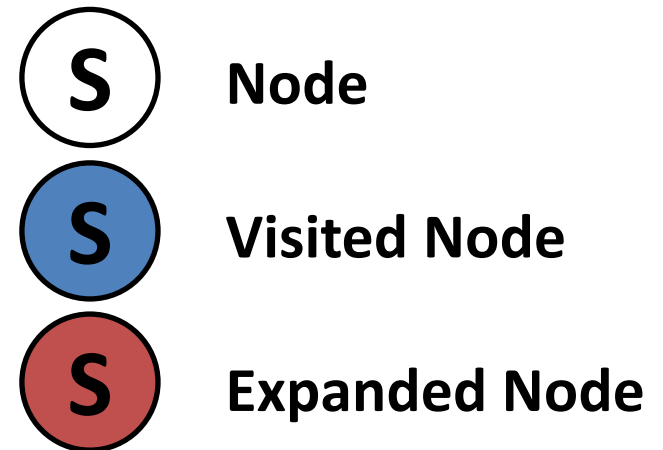
Expanded Node

Uniform-Cost Search

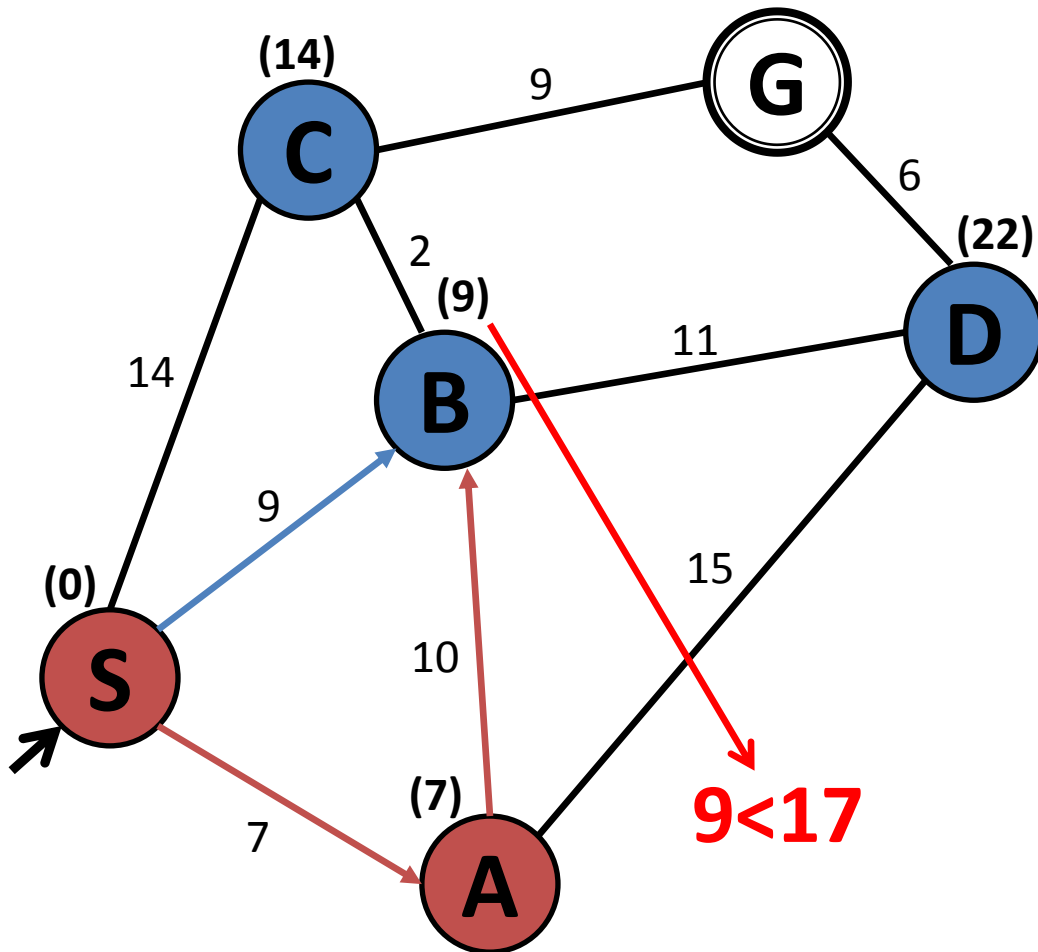


Visited Nodes:
 $\{S, A, B, C, D\}$

Legend:

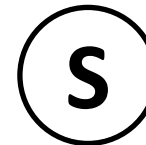


Uniform-Cost Search



Visited Nodes:
 $\{S, A, B, C, D\}$

Legend:



Node

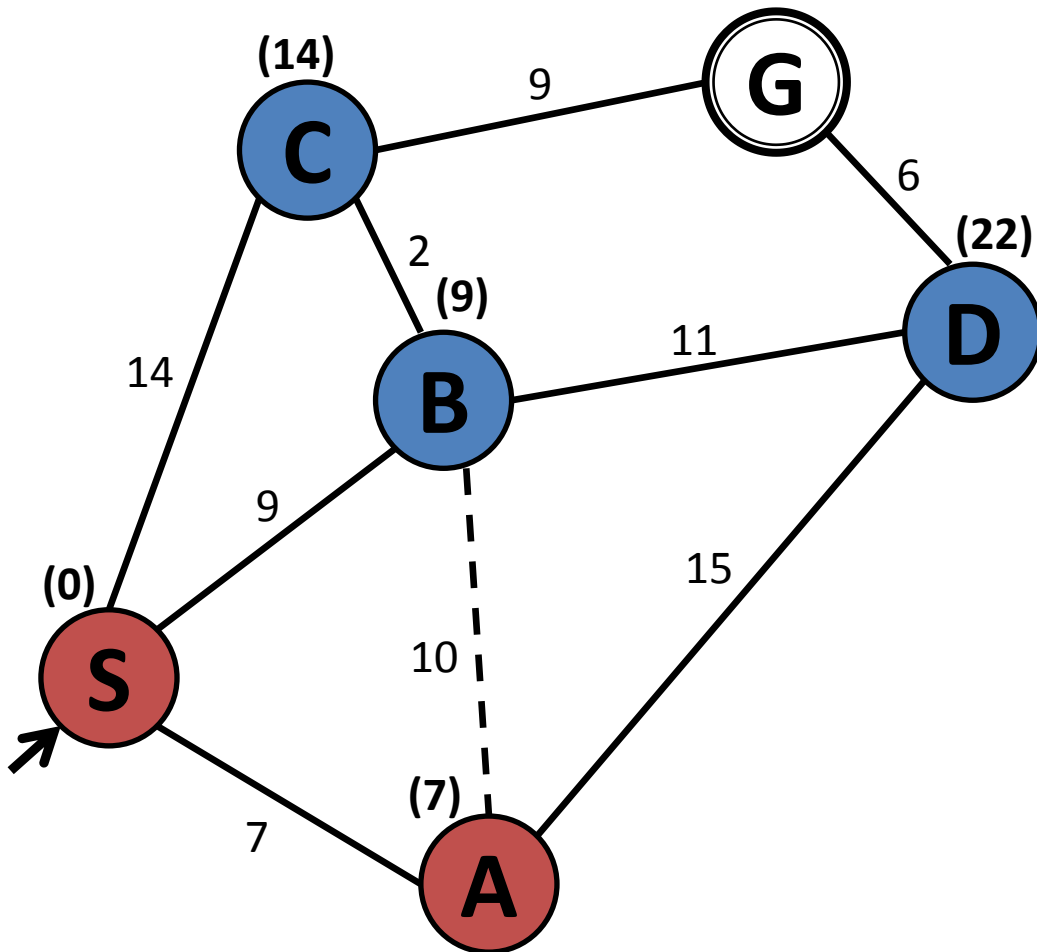


Visited Node



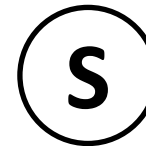
Expanded Node

Uniform-Cost Search



Visited Nodes:
 $\{S, A, B, C, D\}$

Legend:



Node

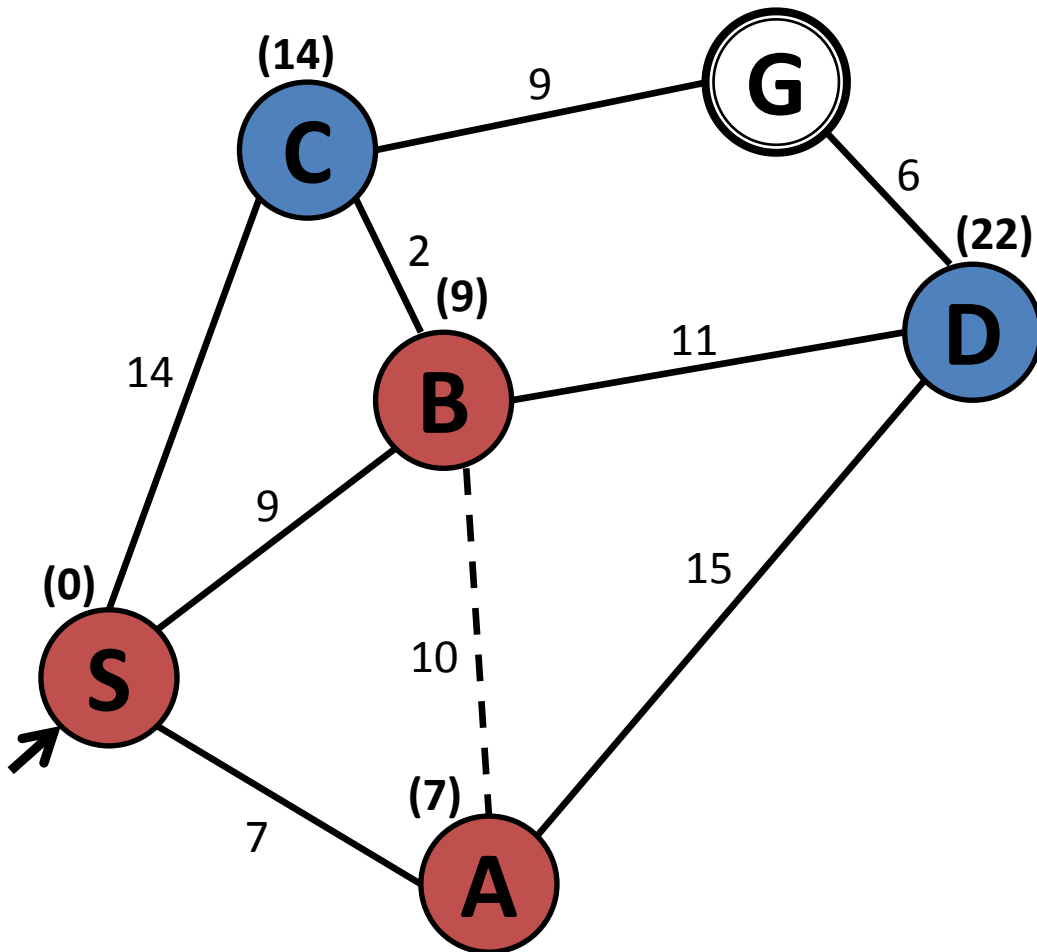


Visited Node



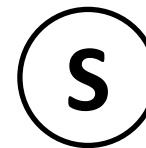
Expanded Node

Uniform-Cost Search

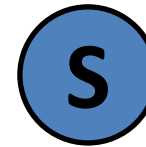


Visited Nodes:
{S,A,B,C,D}

Legend:



Node

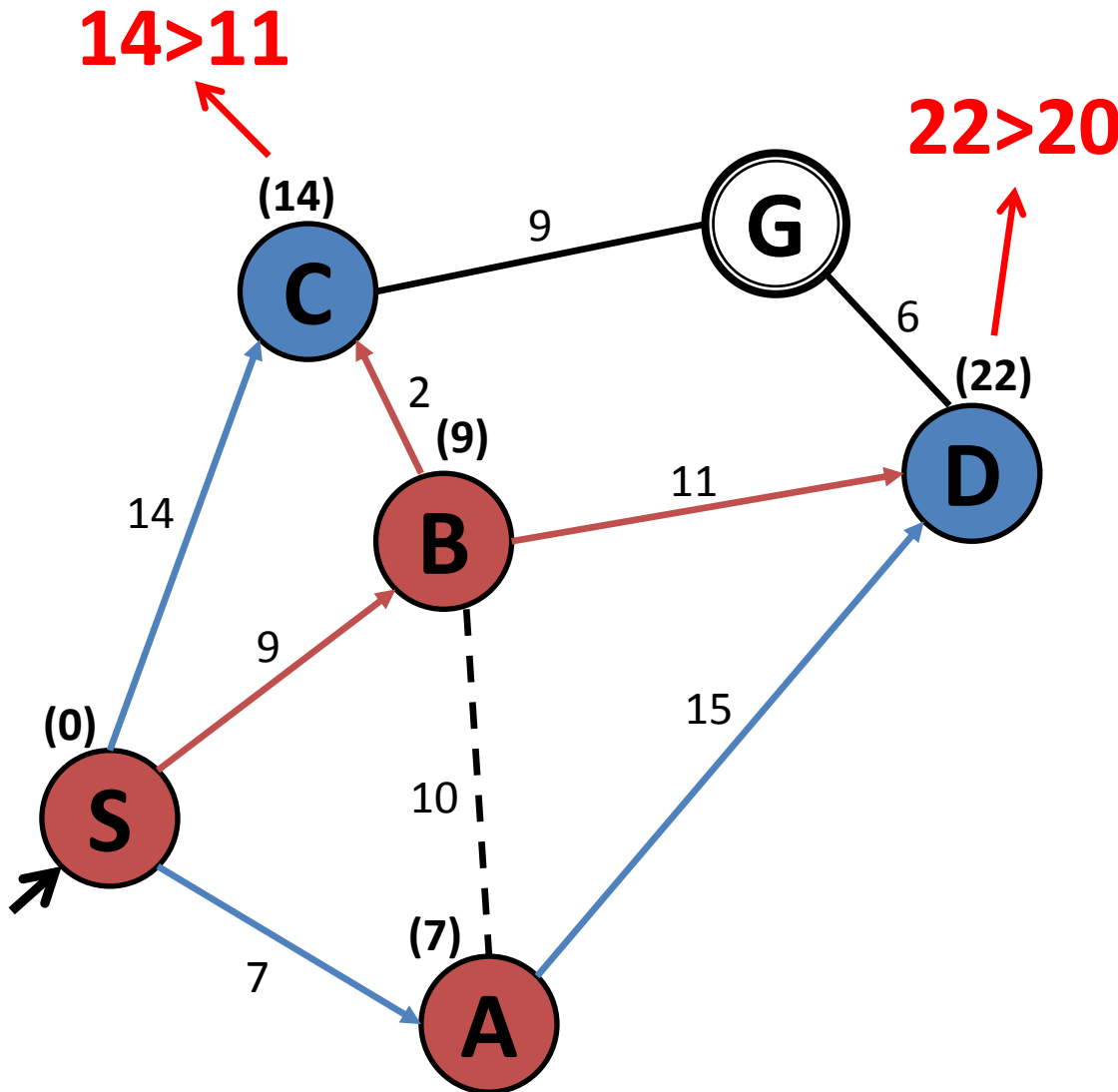


Visited Node

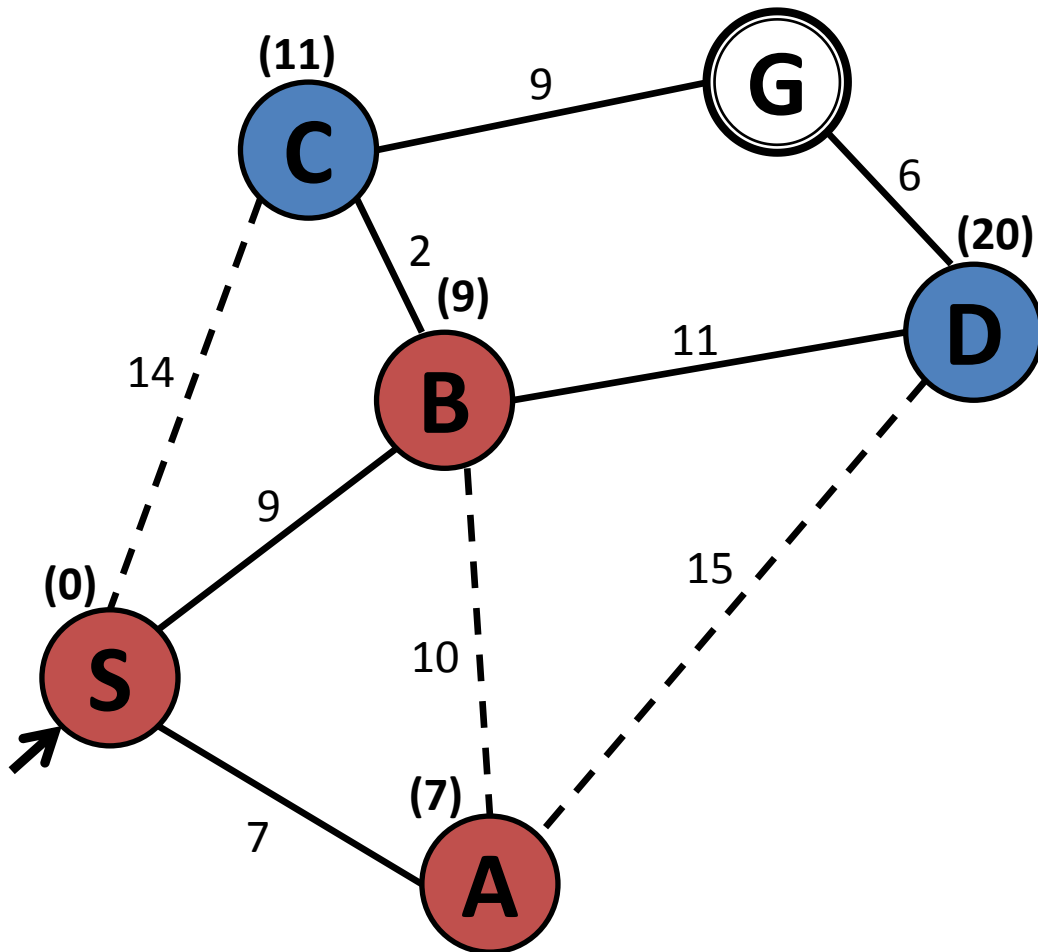


Expanded Node

Uniform-Cost Search

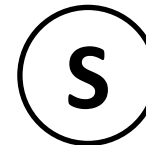


Uniform-Cost Search

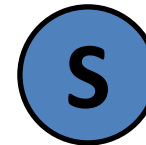


Visited Nodes:
 $\{S, A, B, C, D\}$

Legend:



Node

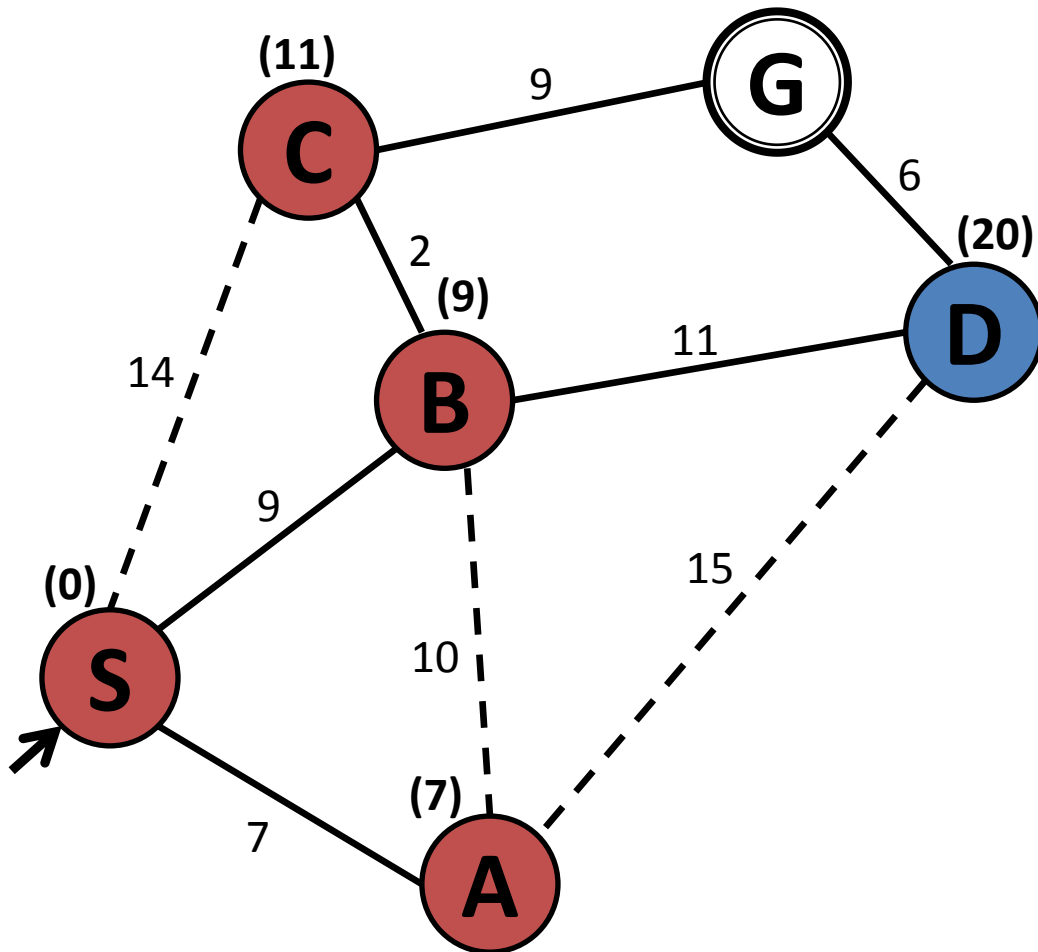


Visited Node



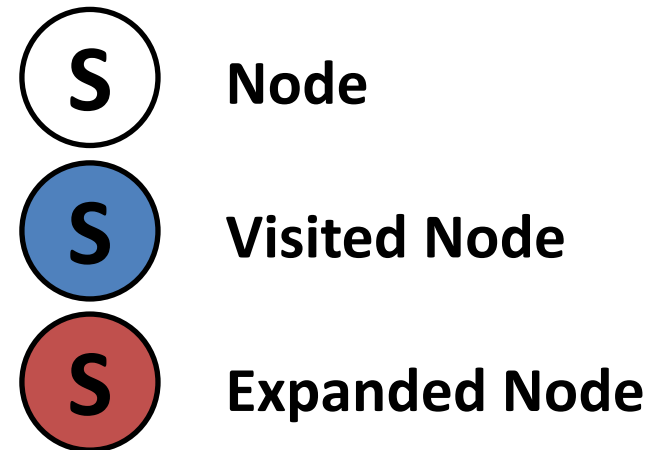
Expanded Node

Uniform-Cost Search

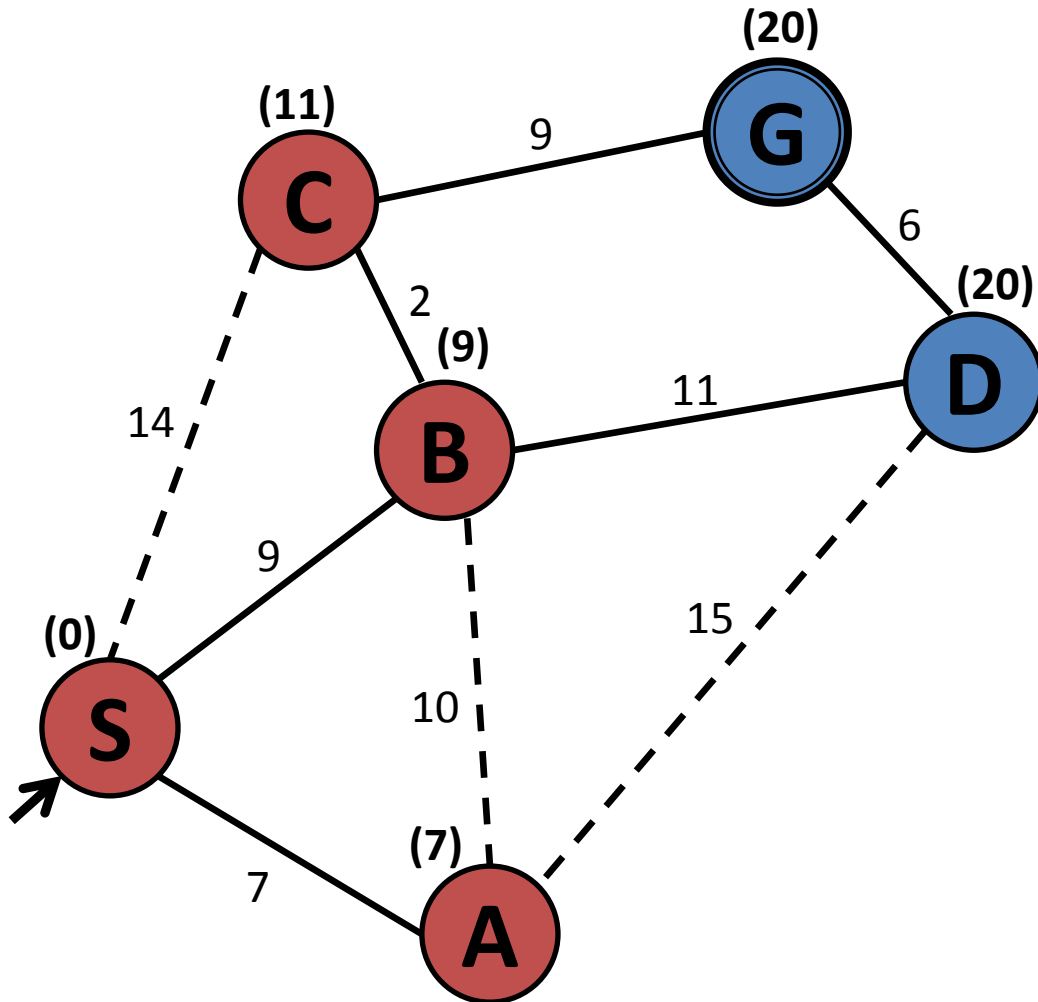


Visited Nodes:
 $\{S, A, B, C, D\}$

Legend:

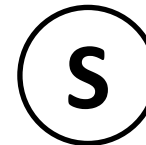


Uniform-Cost Search

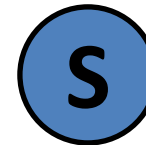


Visited Nodes:
 $\{S, A, B, C, D, \underline{G}\}$

Legend:



Node

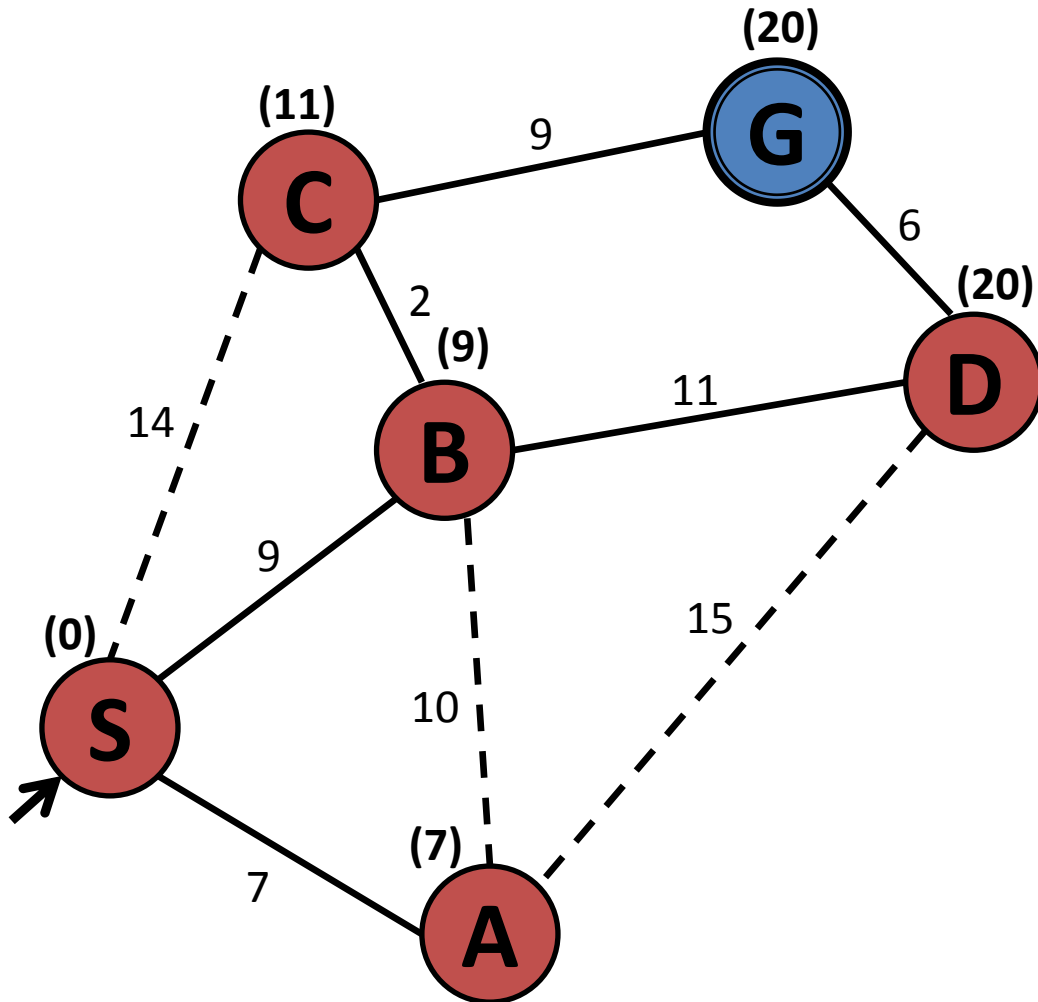


Visited Node



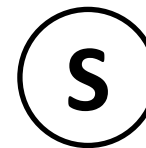
Expanded Node

Uniform-Cost Search

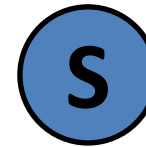


Visited Nodes:
 $\{S, A, B, C, D, \underline{G}\}$

Legend:



Node

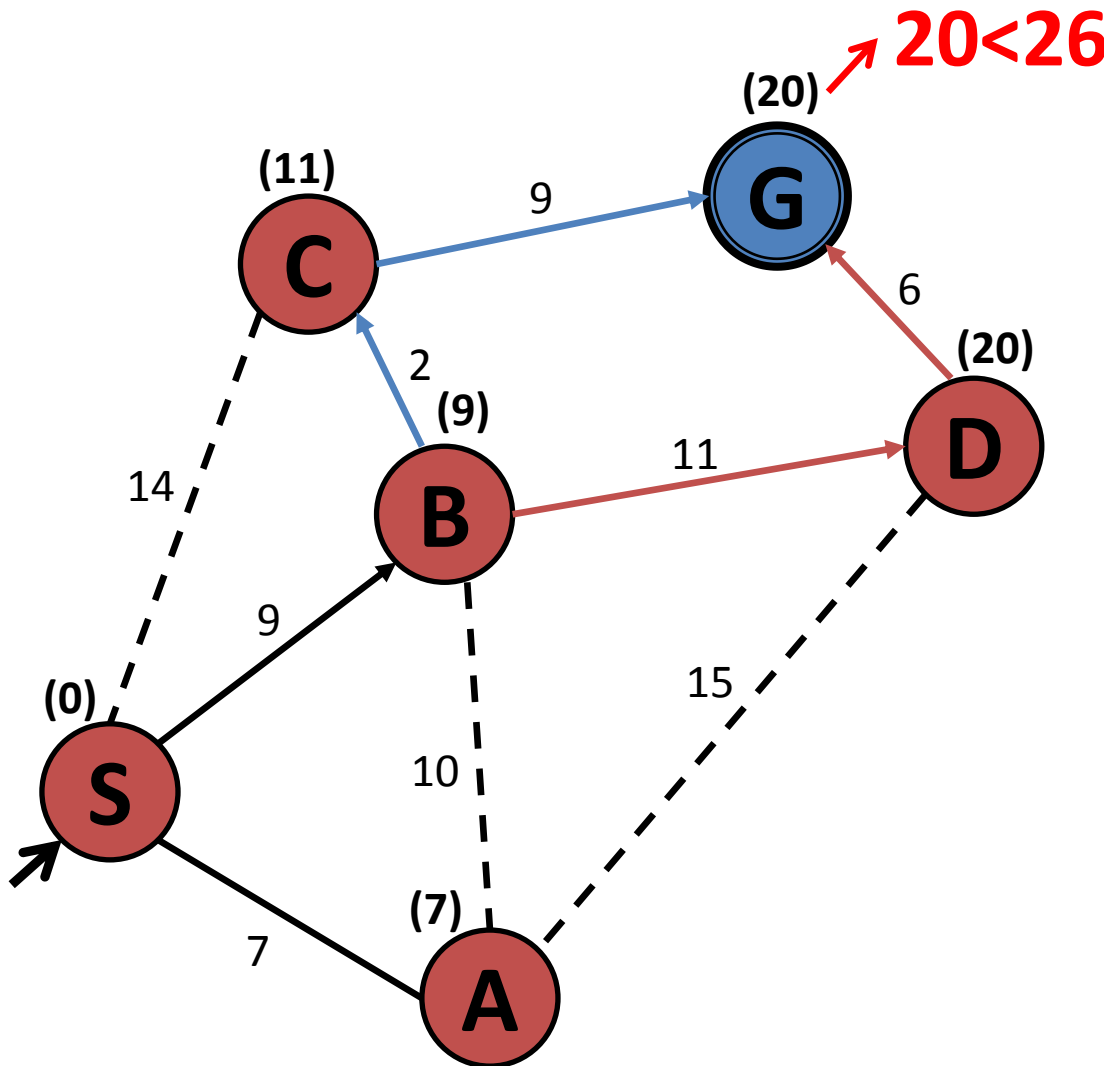


Visited Node



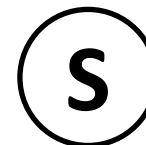
Expanded Node

Uniform-Cost Search



Visited Nodes:
 $\{S, A, B, C, D, \underline{G}\}$

Legend:



Node

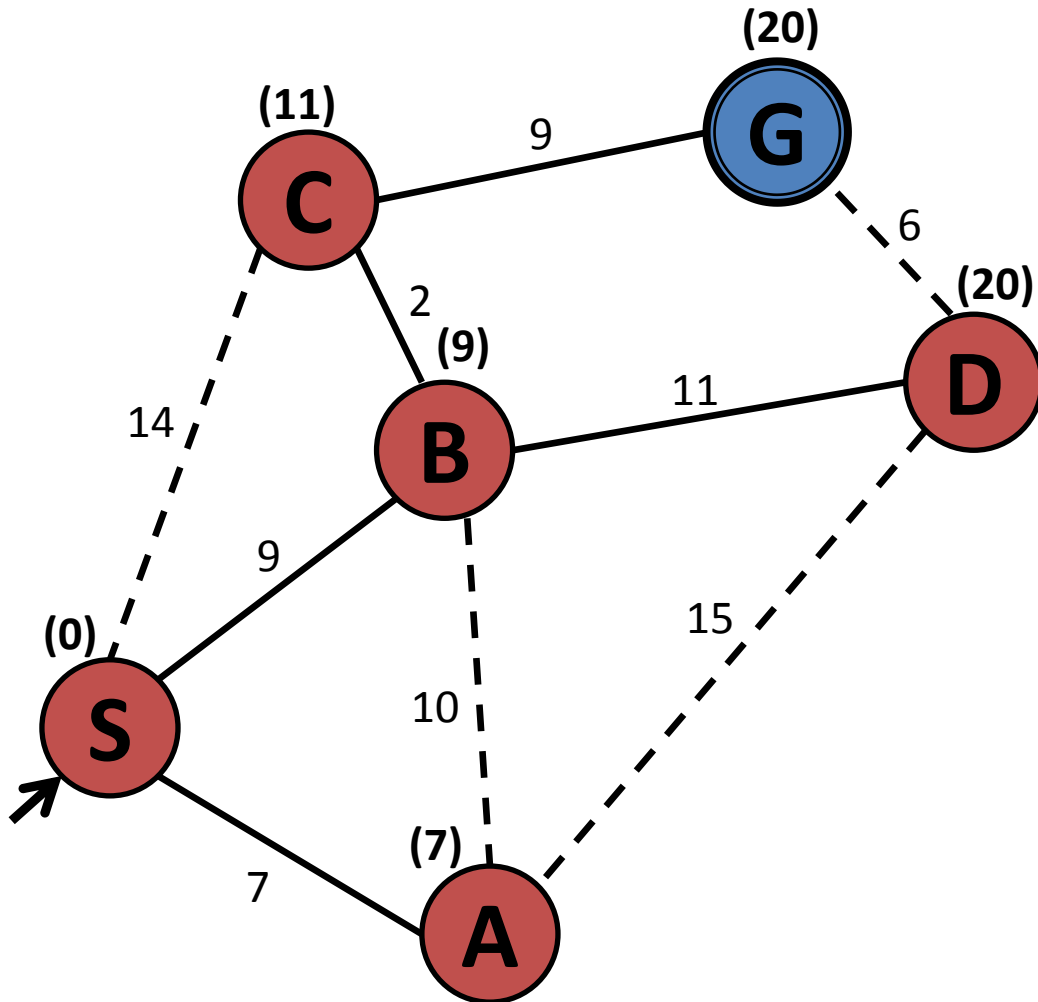


Visited Node



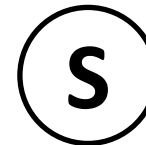
Expanded Node

Uniform-Cost Search

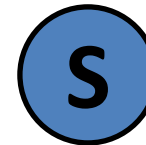


Visited Nodes:
 $\{S, A, B, C, D, \underline{G}\}$

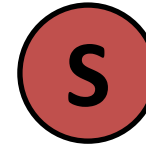
Legend:



Node

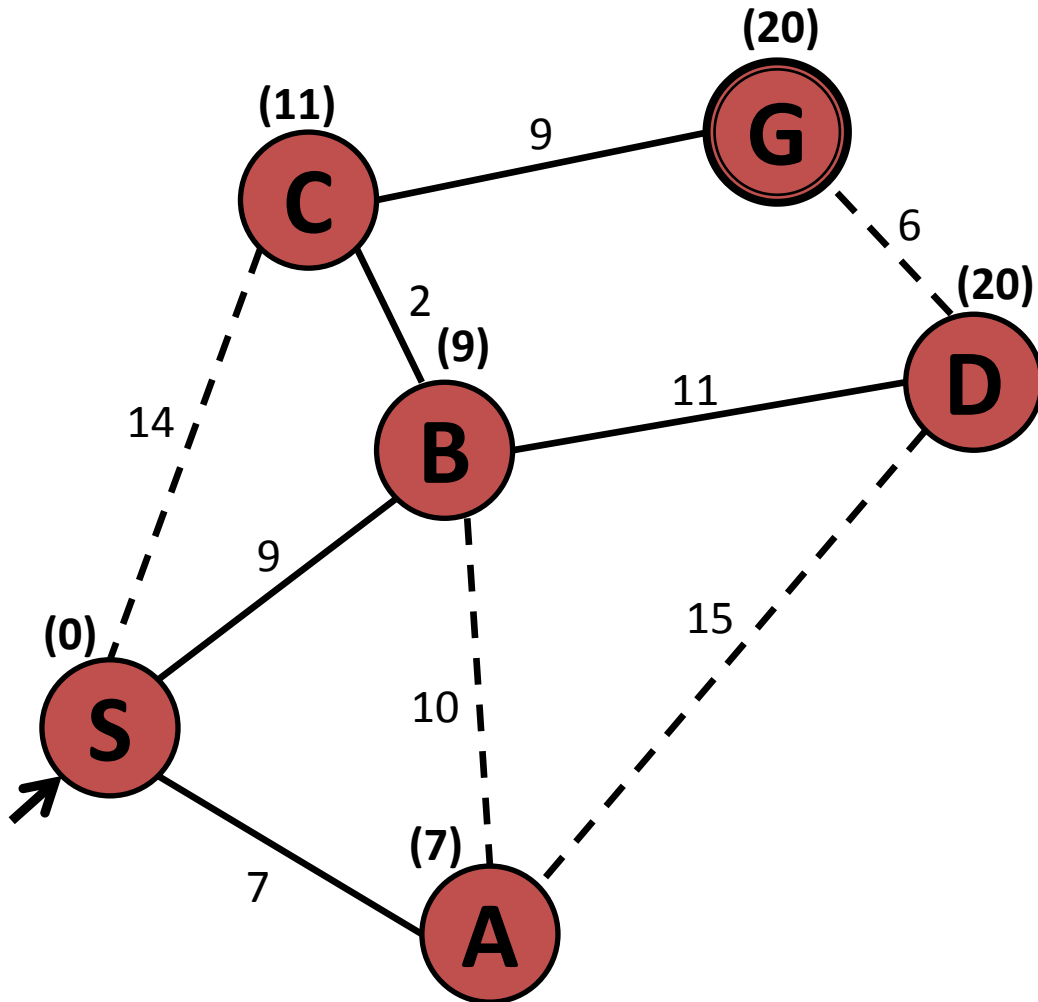


Visited Node



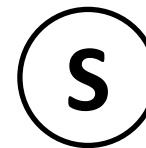
Expanded Node

Uniform-Cost Search

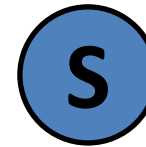


Visited Nodes:
 $\{S, A, B, C, D, \underline{G}\}$

Legend:



Node

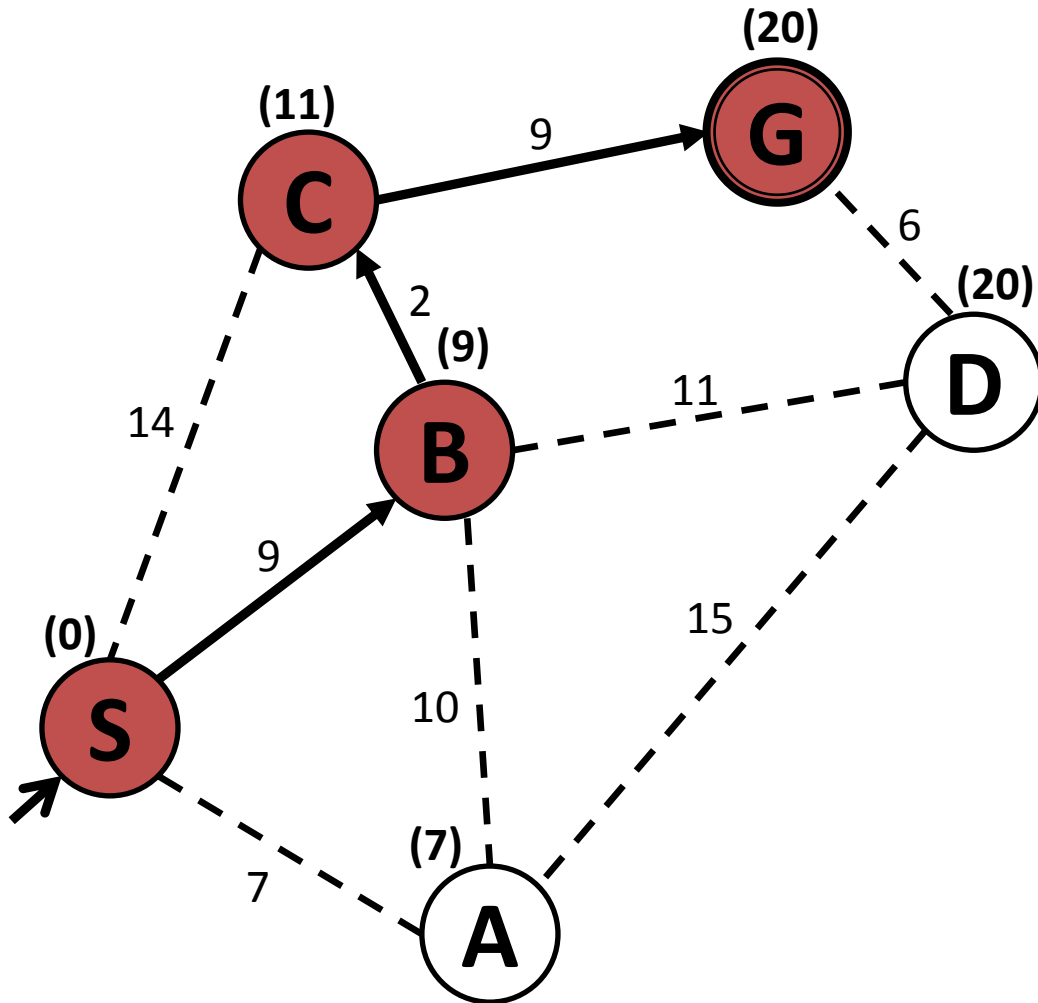


Visited Node



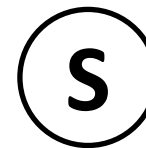
Expanded Node

Uniform-Cost Search

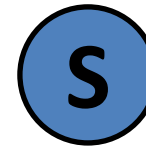


Visited Nodes:
 $\{S, A, B, C, D, \underline{G}\}$

Legend:



Node



Visited Node



Expanded Node

Depth-Limited Search

Iterative Deepening Search

Iterative deepening search $l = 0$

Limit = 0



Iterative Deepening Search

Iterative deepening search $l = 1$

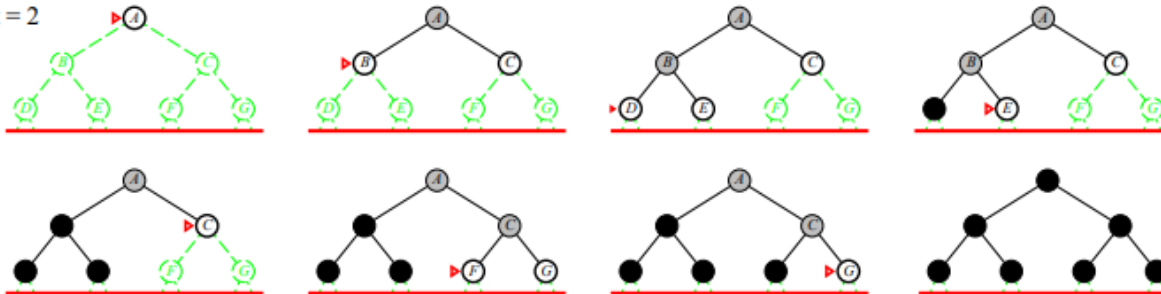
Limit = 1



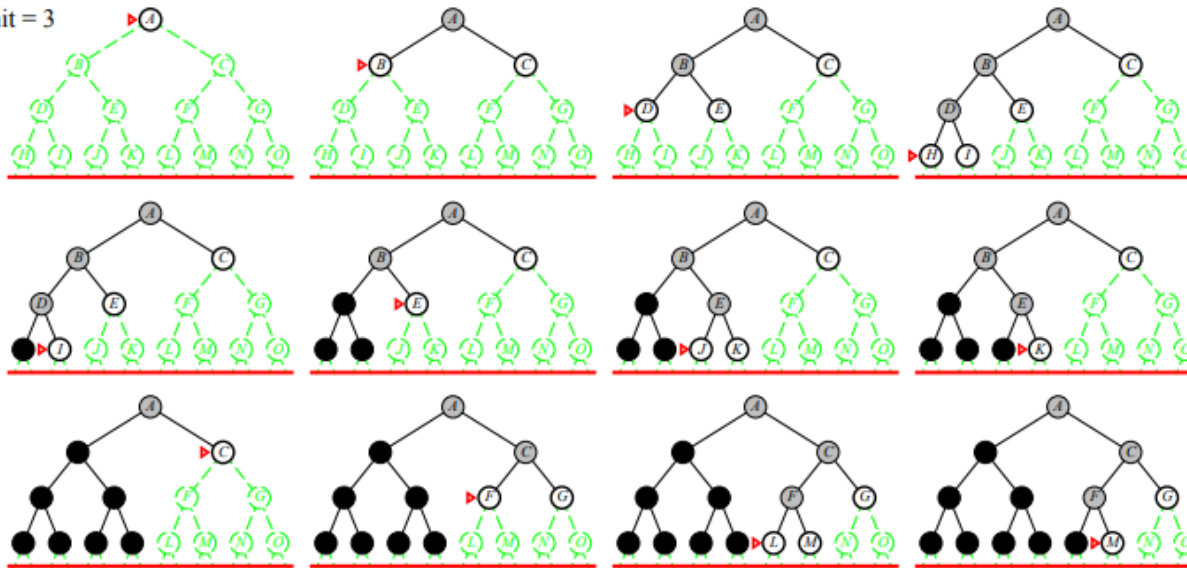
Iterative Deepening Search

Iterative deepening search $l = 2$

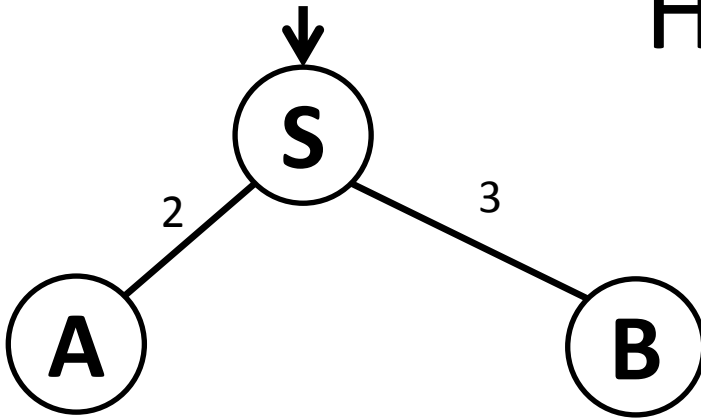
Limit = 2



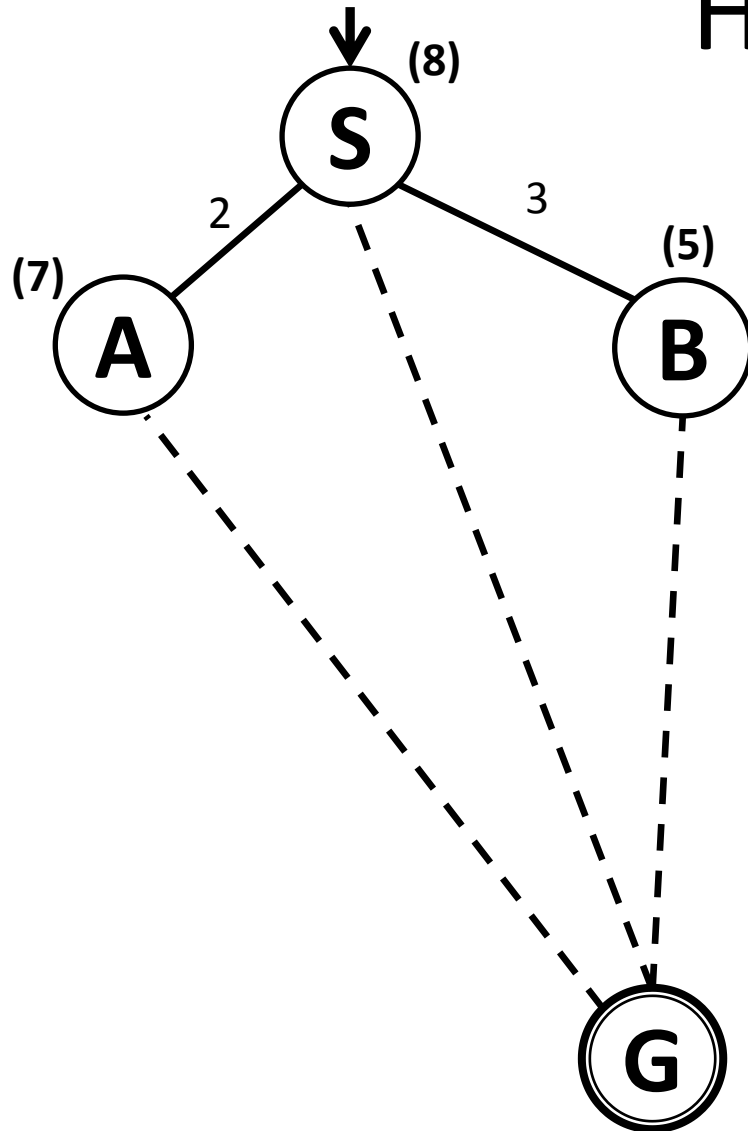
Iterative deepening search $l = 3$



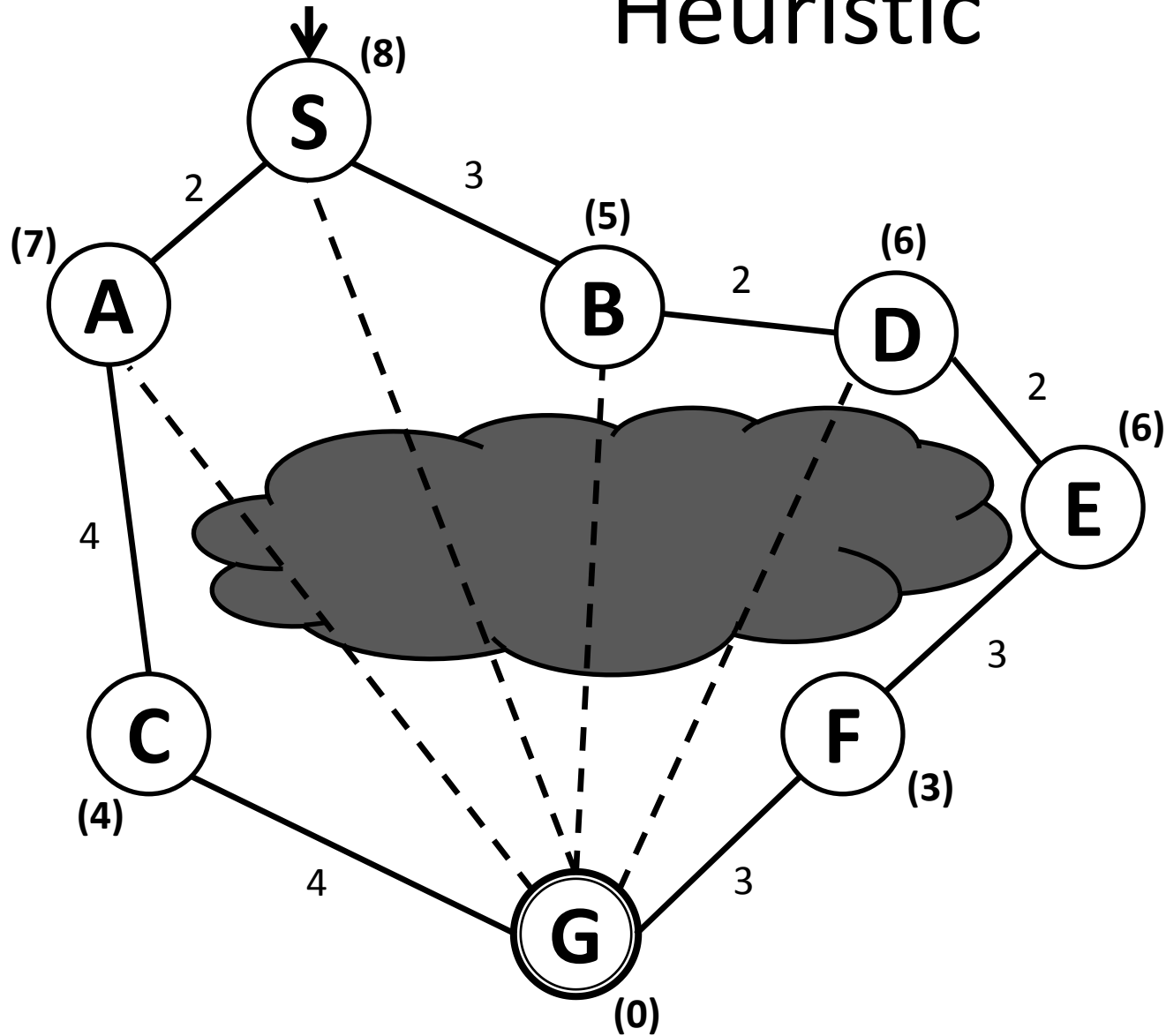
Heuristic



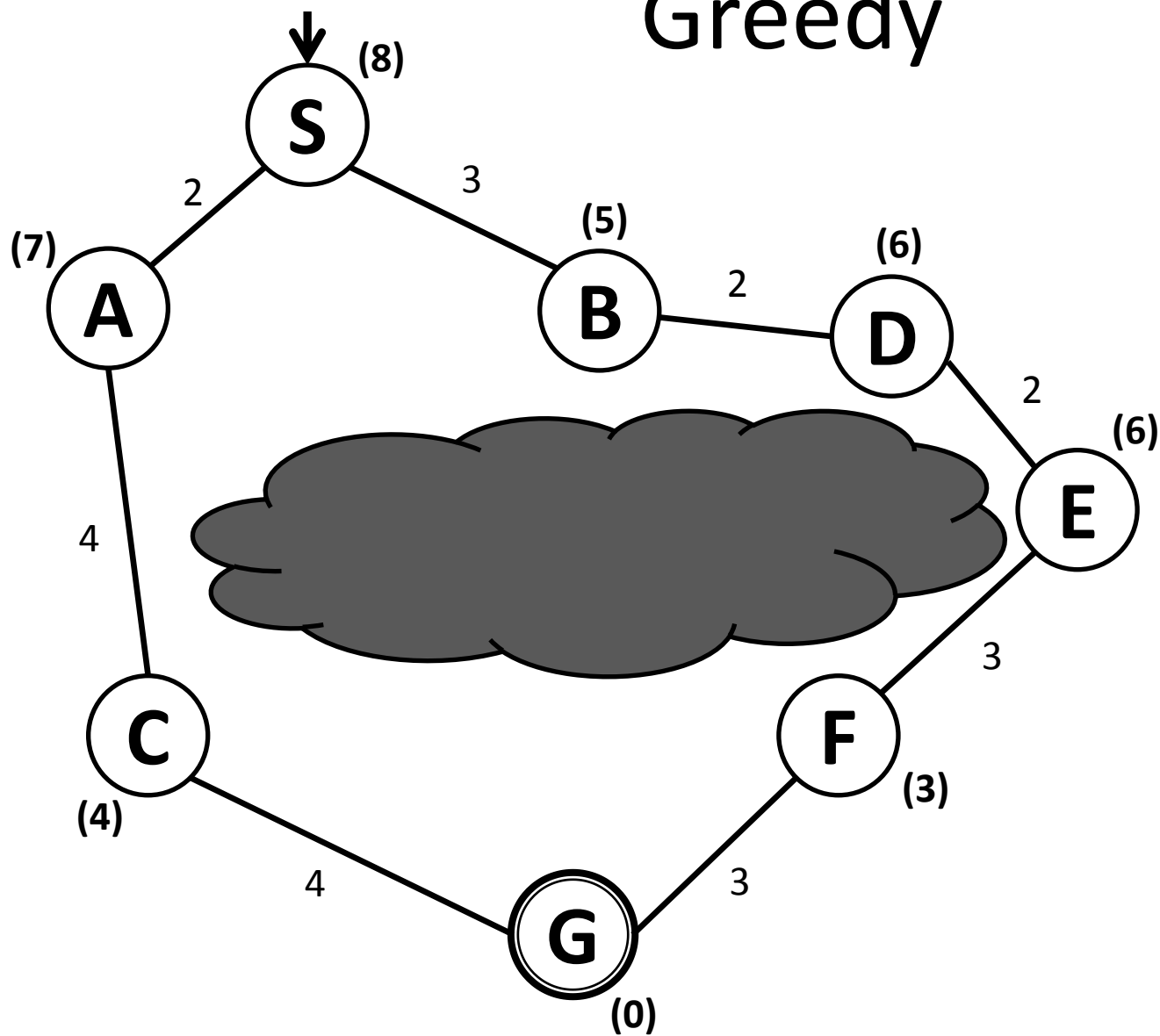
Heuristic

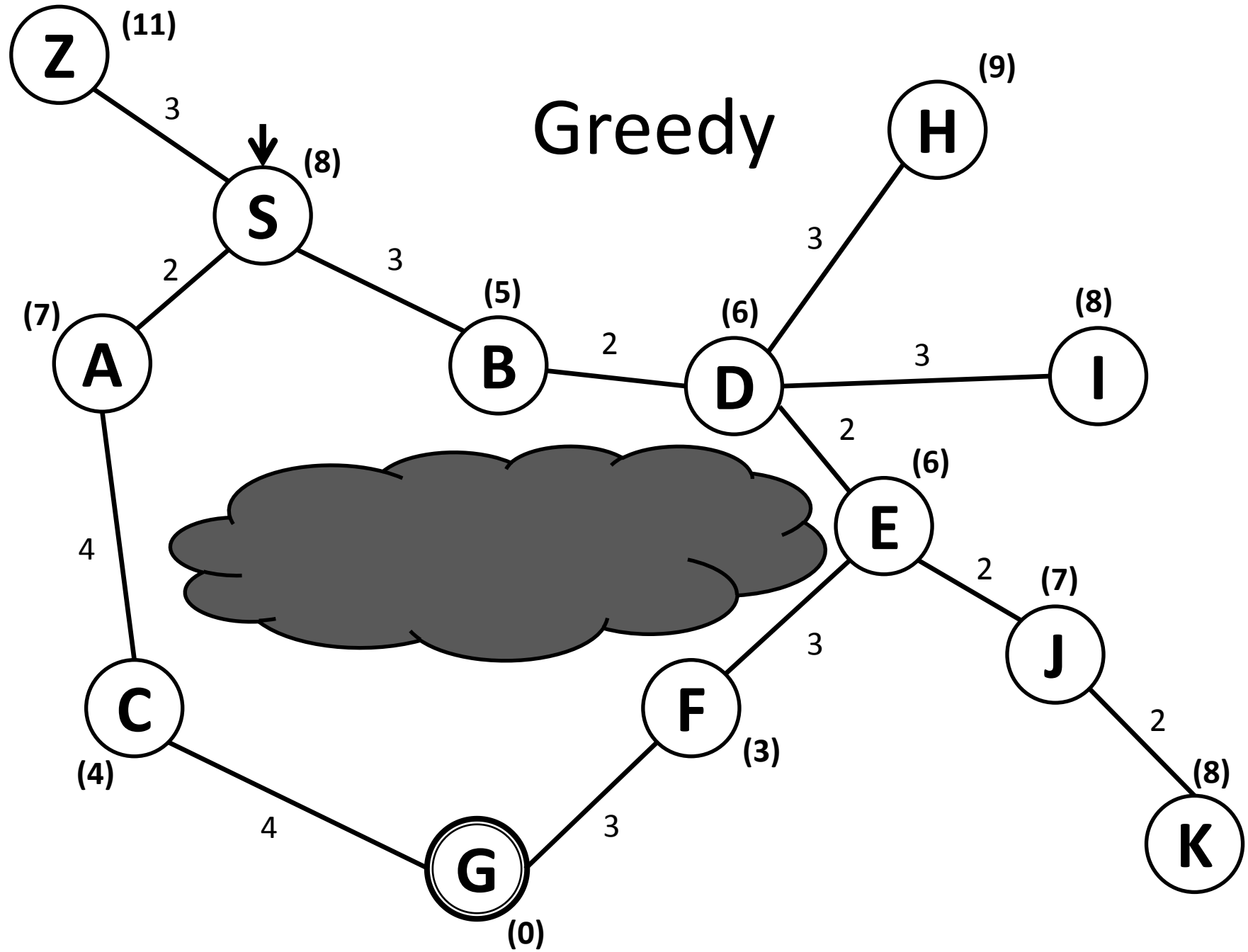


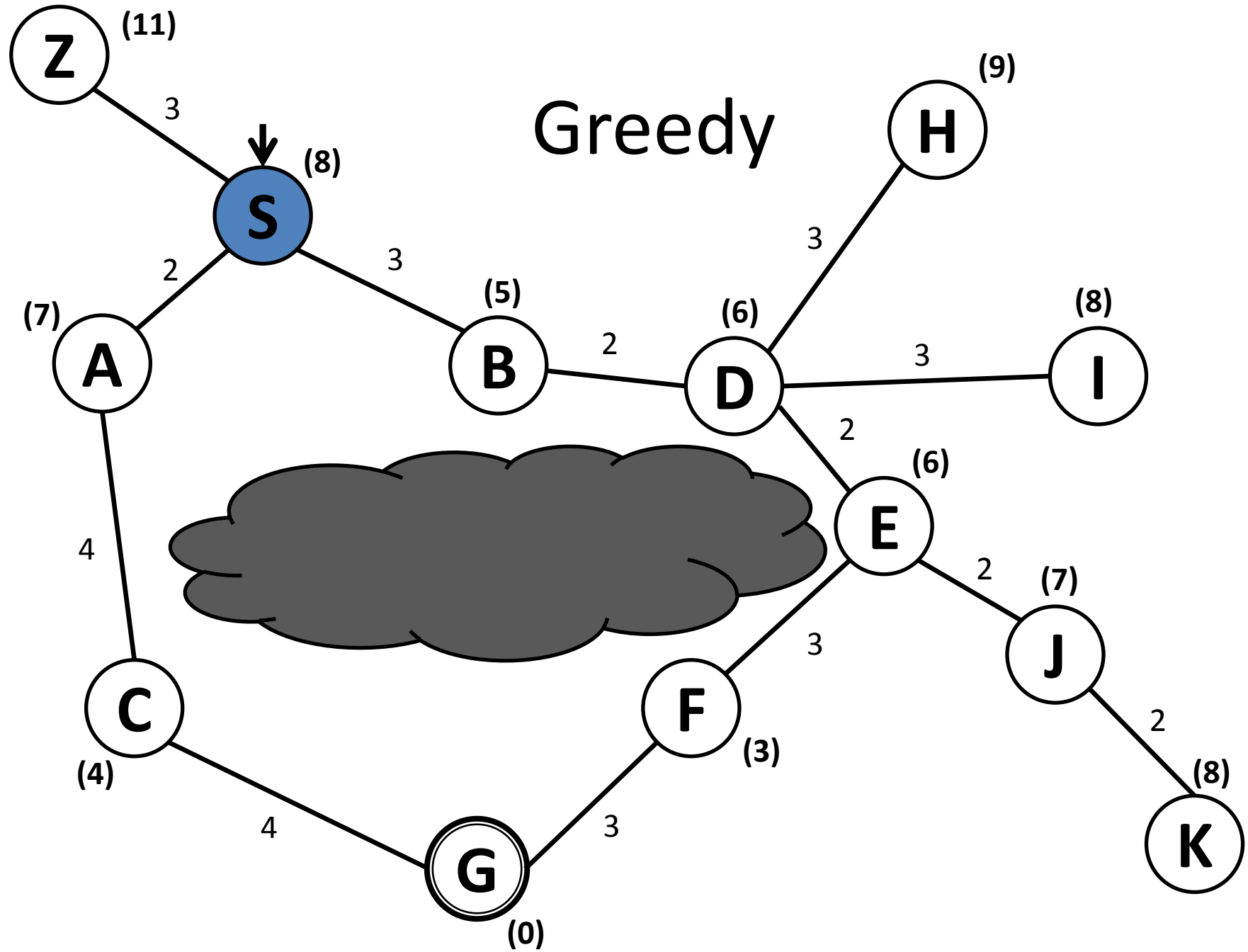
Heuristic

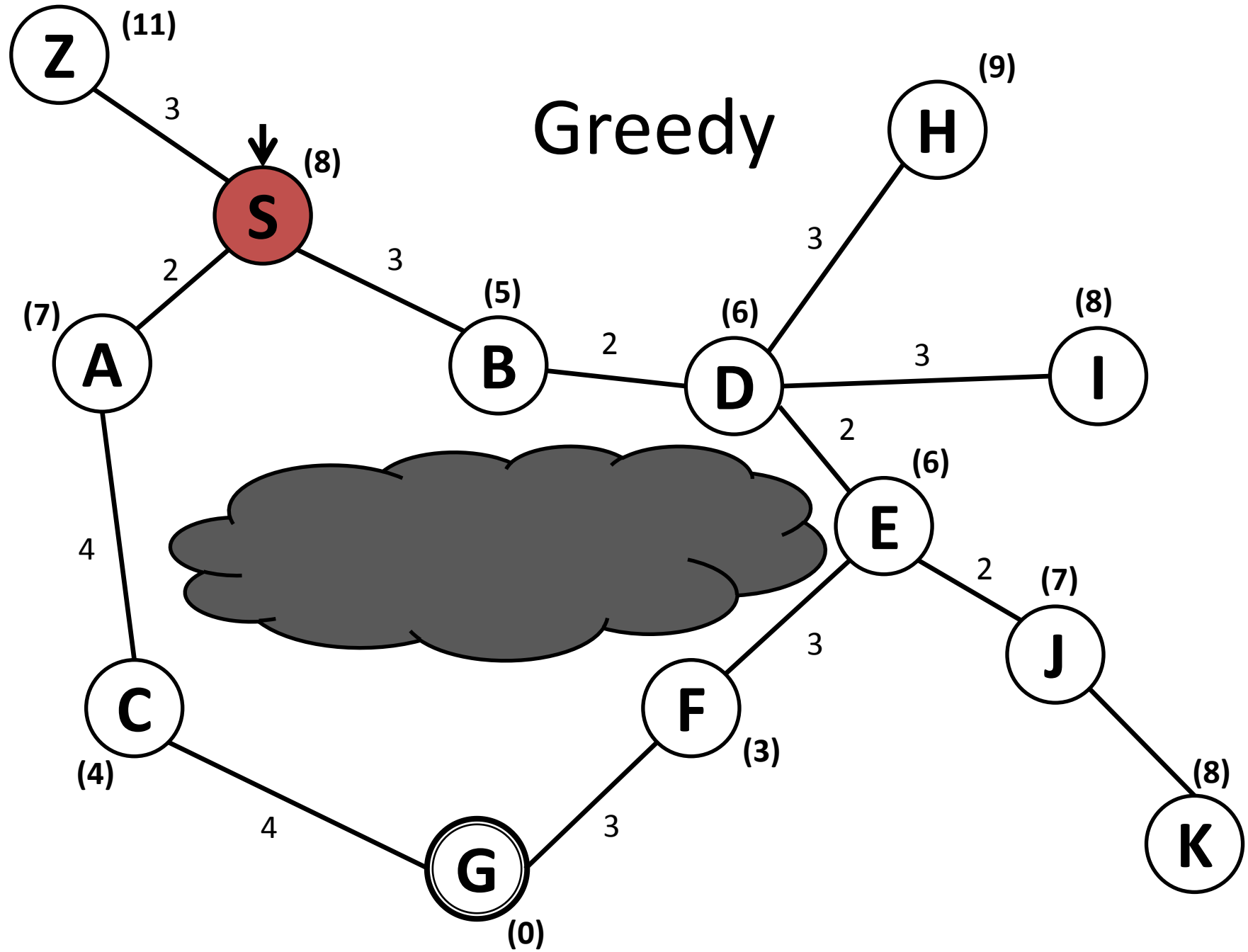


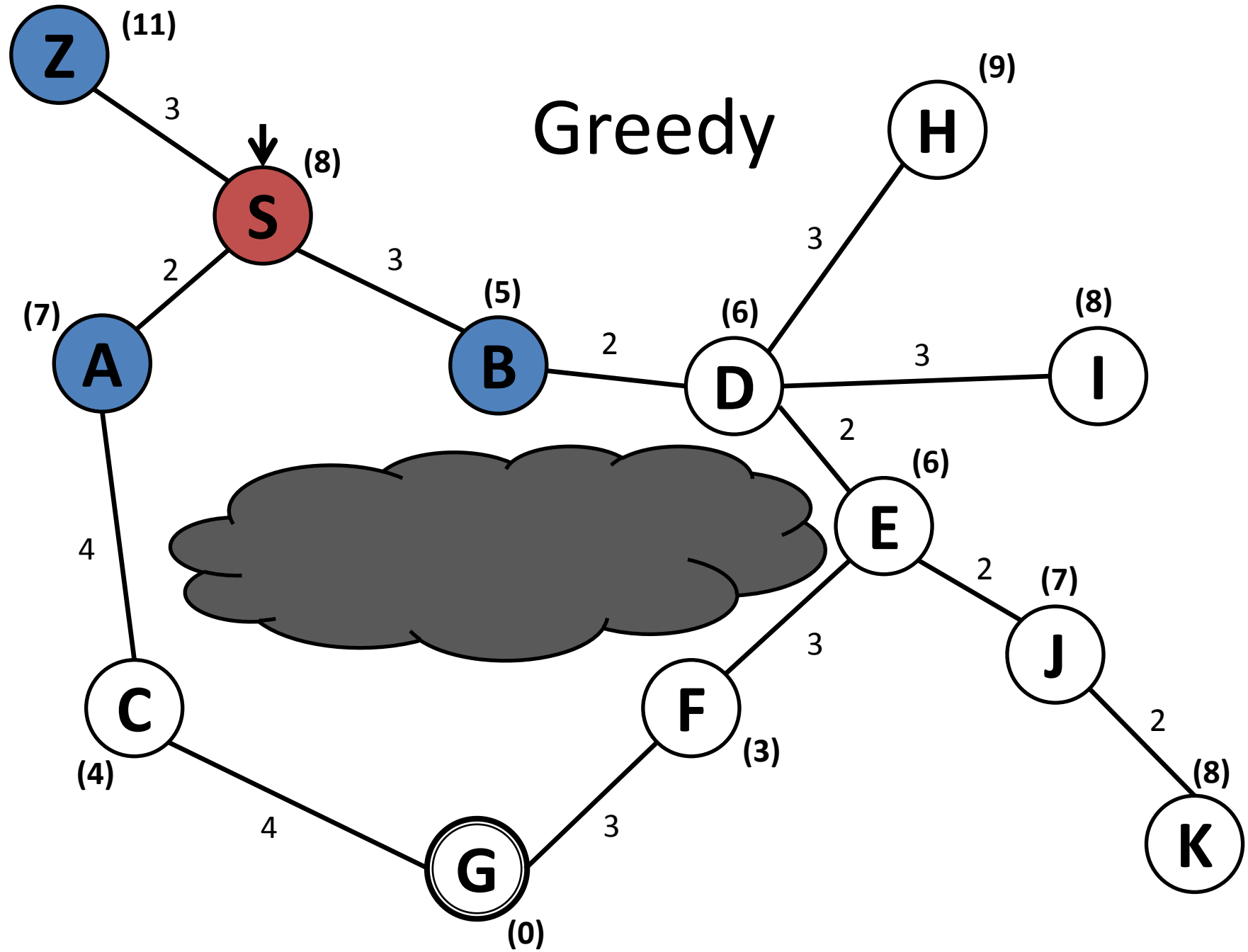
Greedy

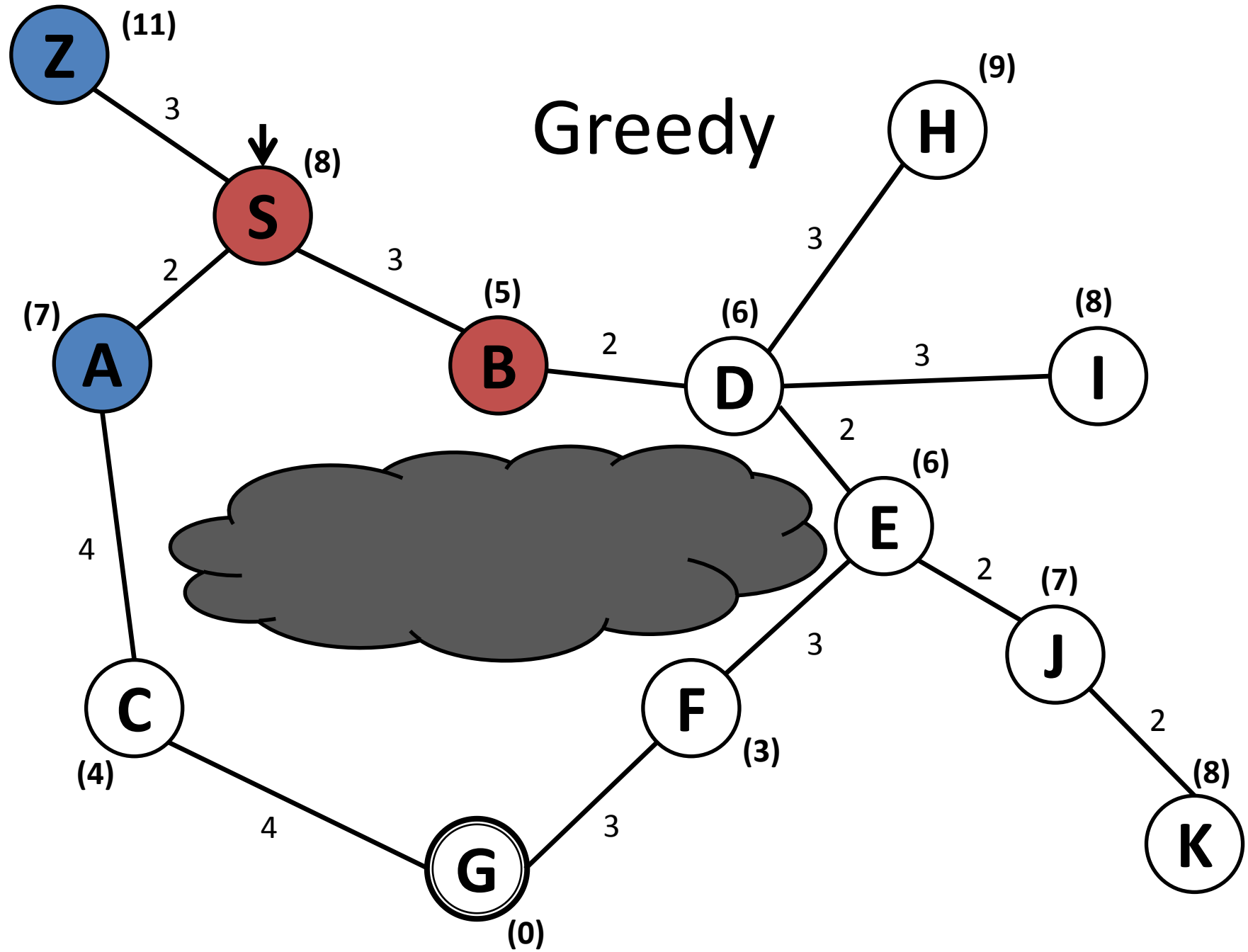


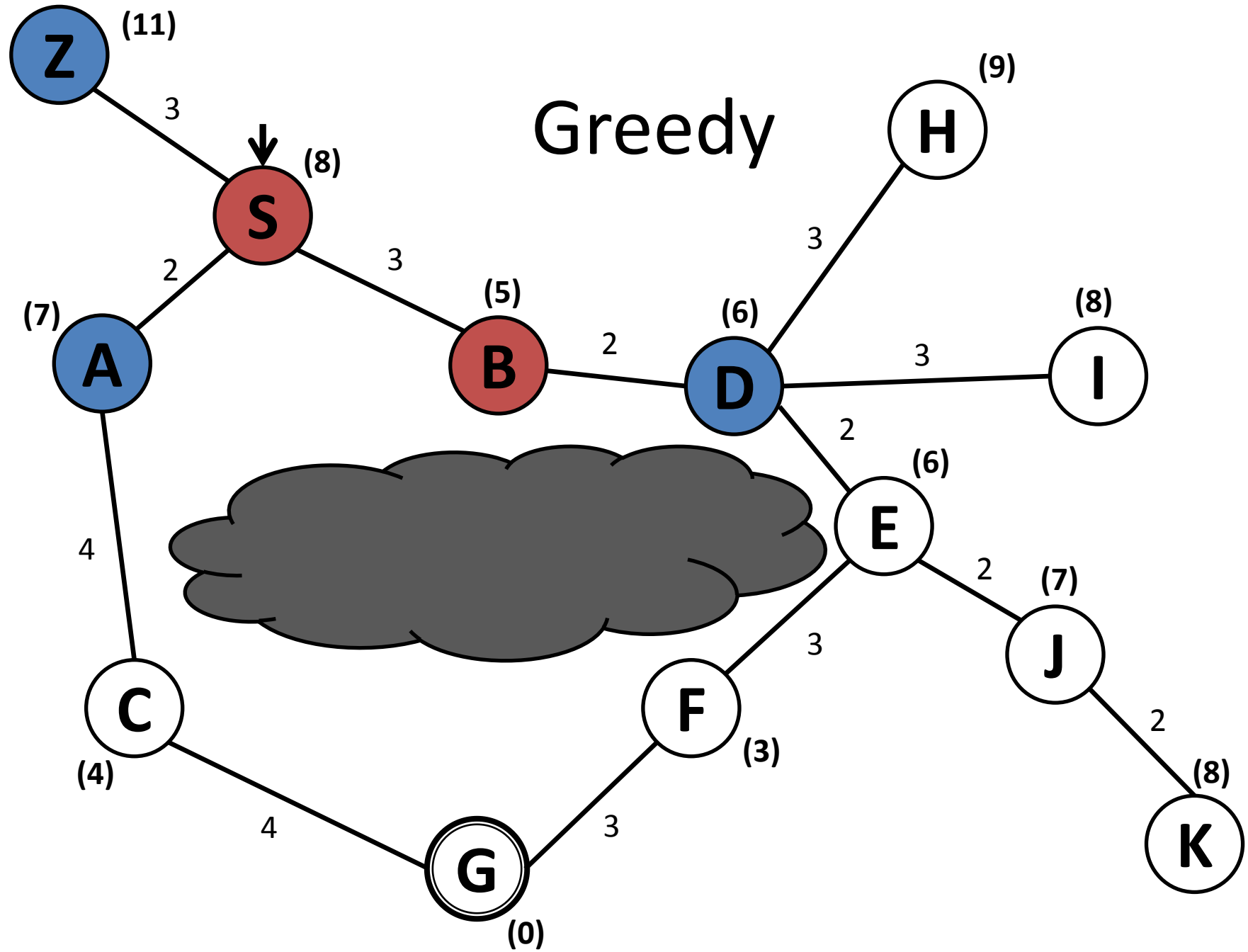


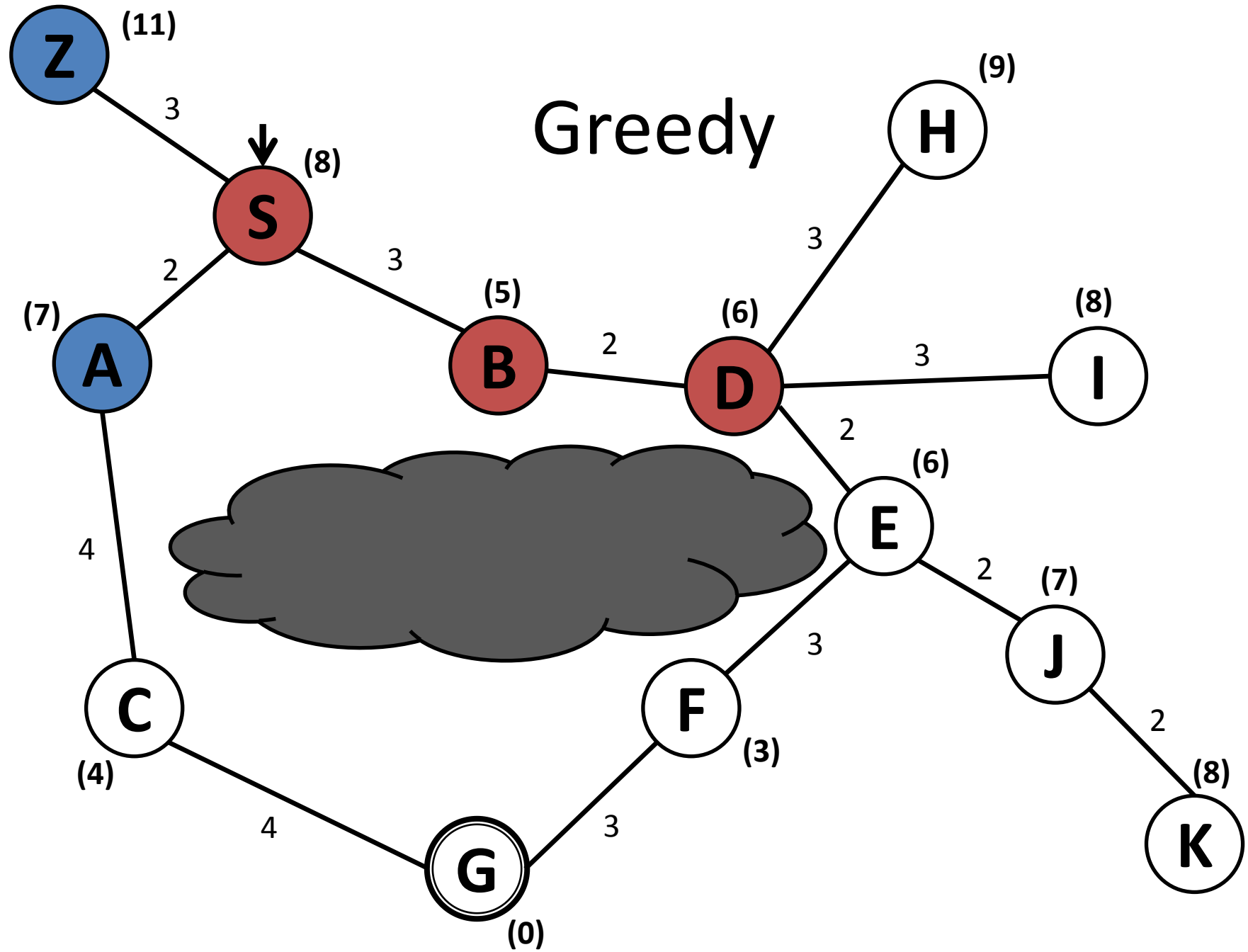


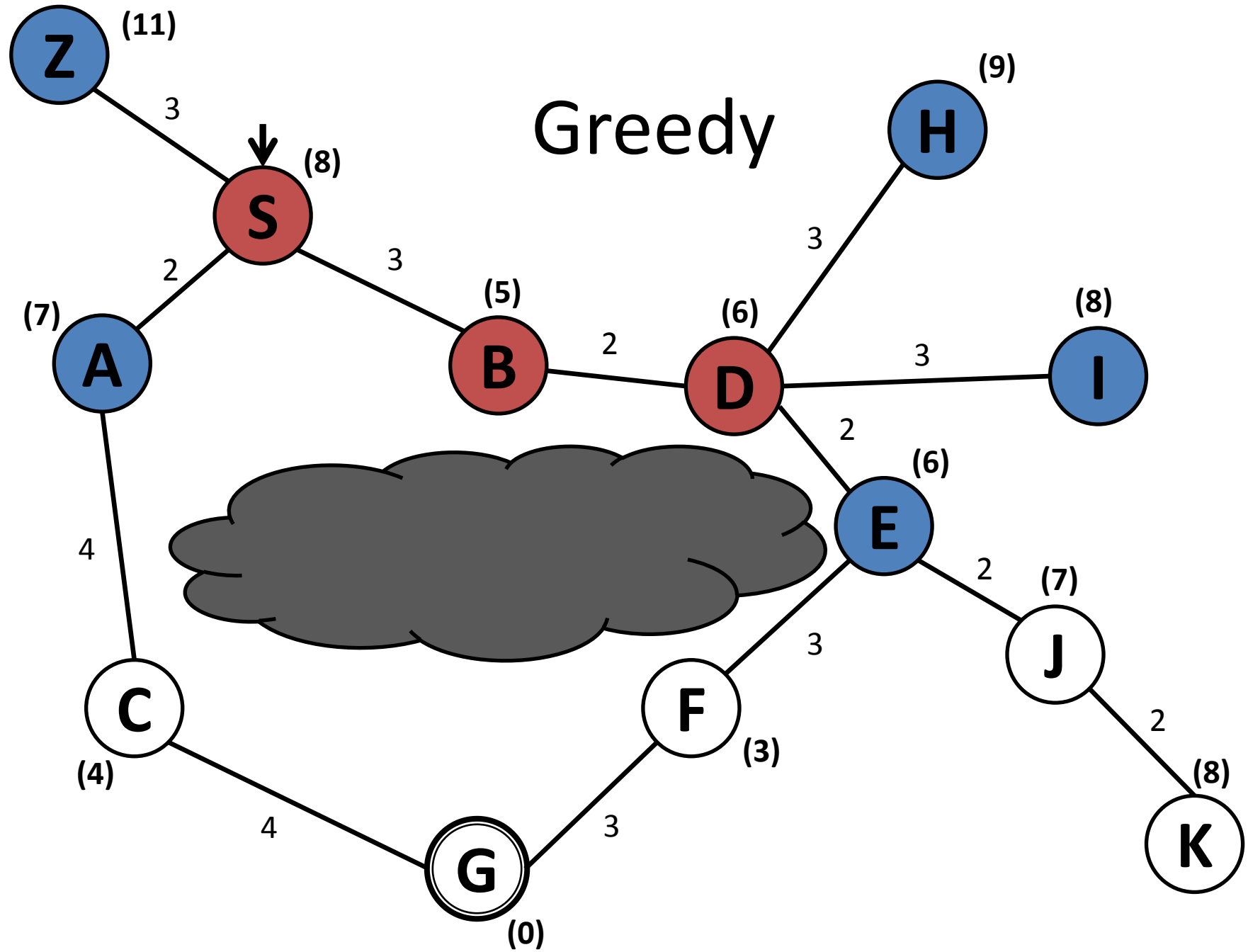


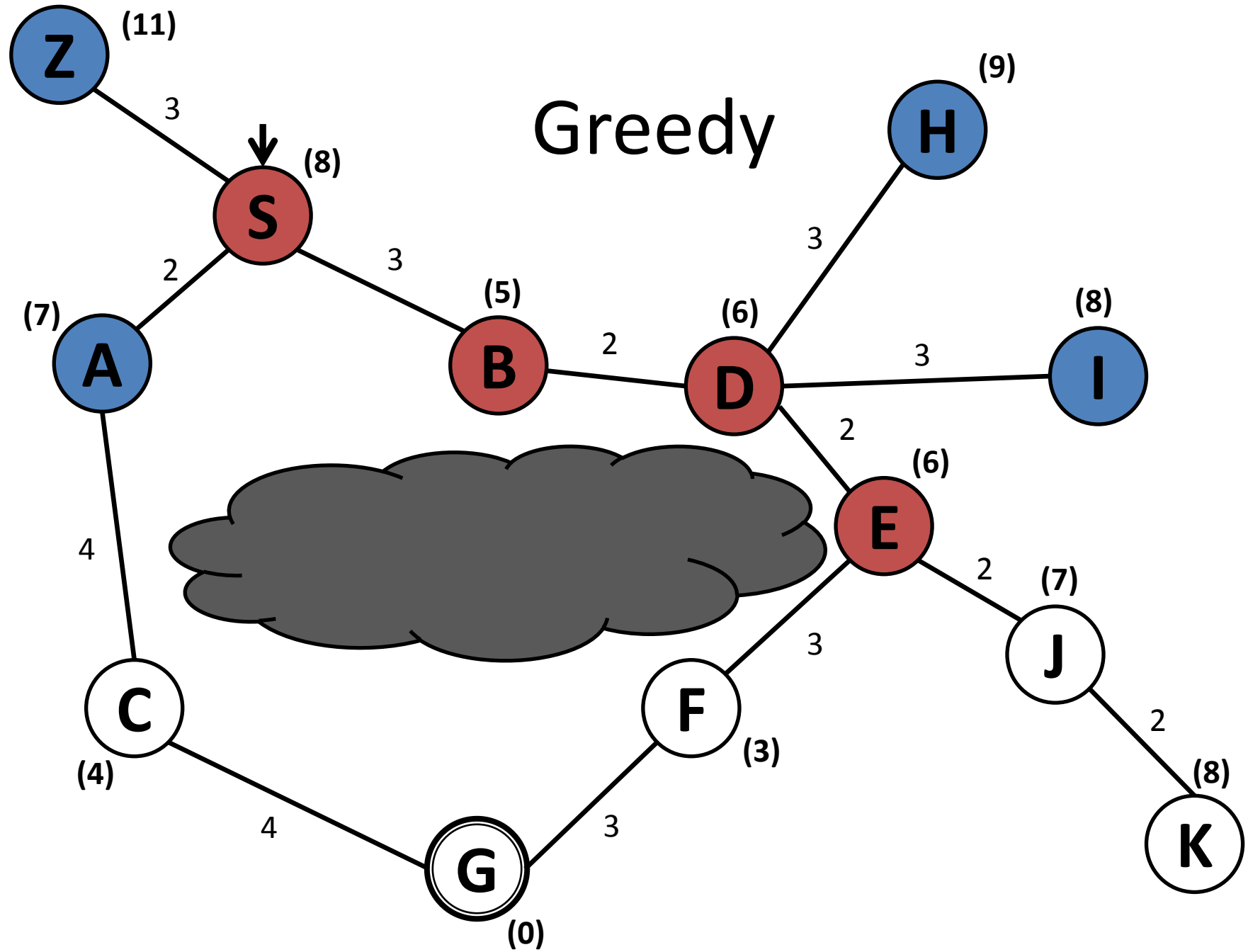


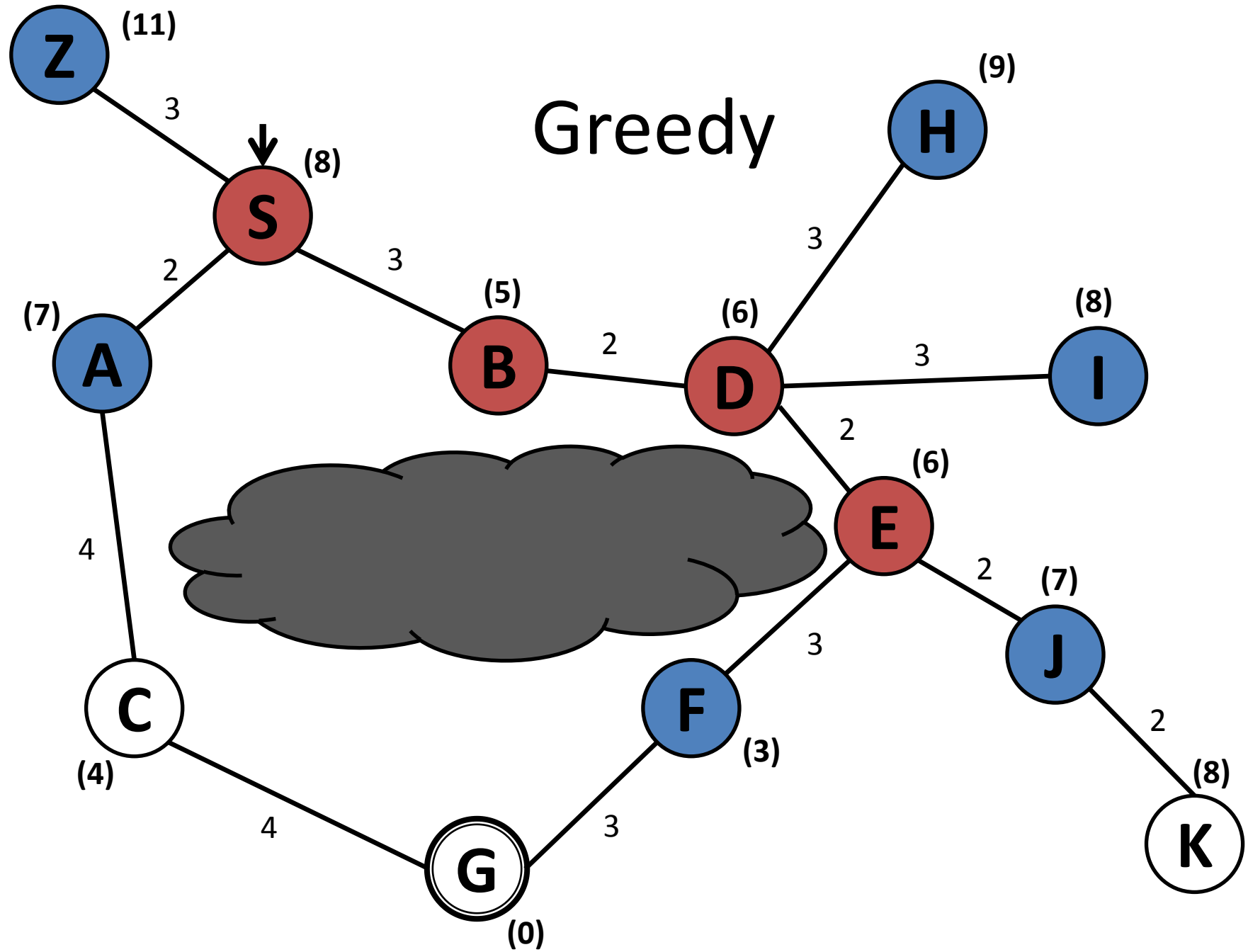


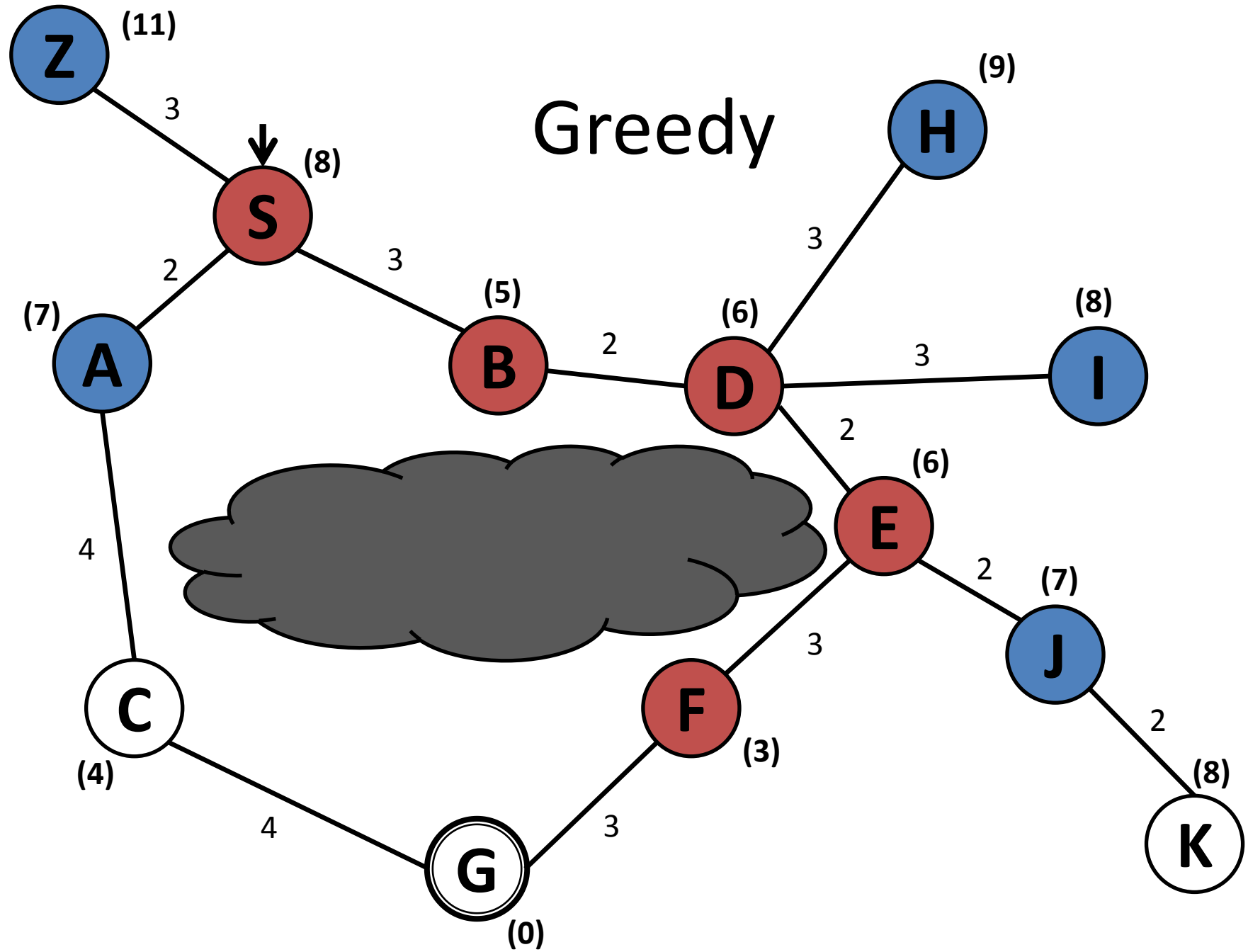


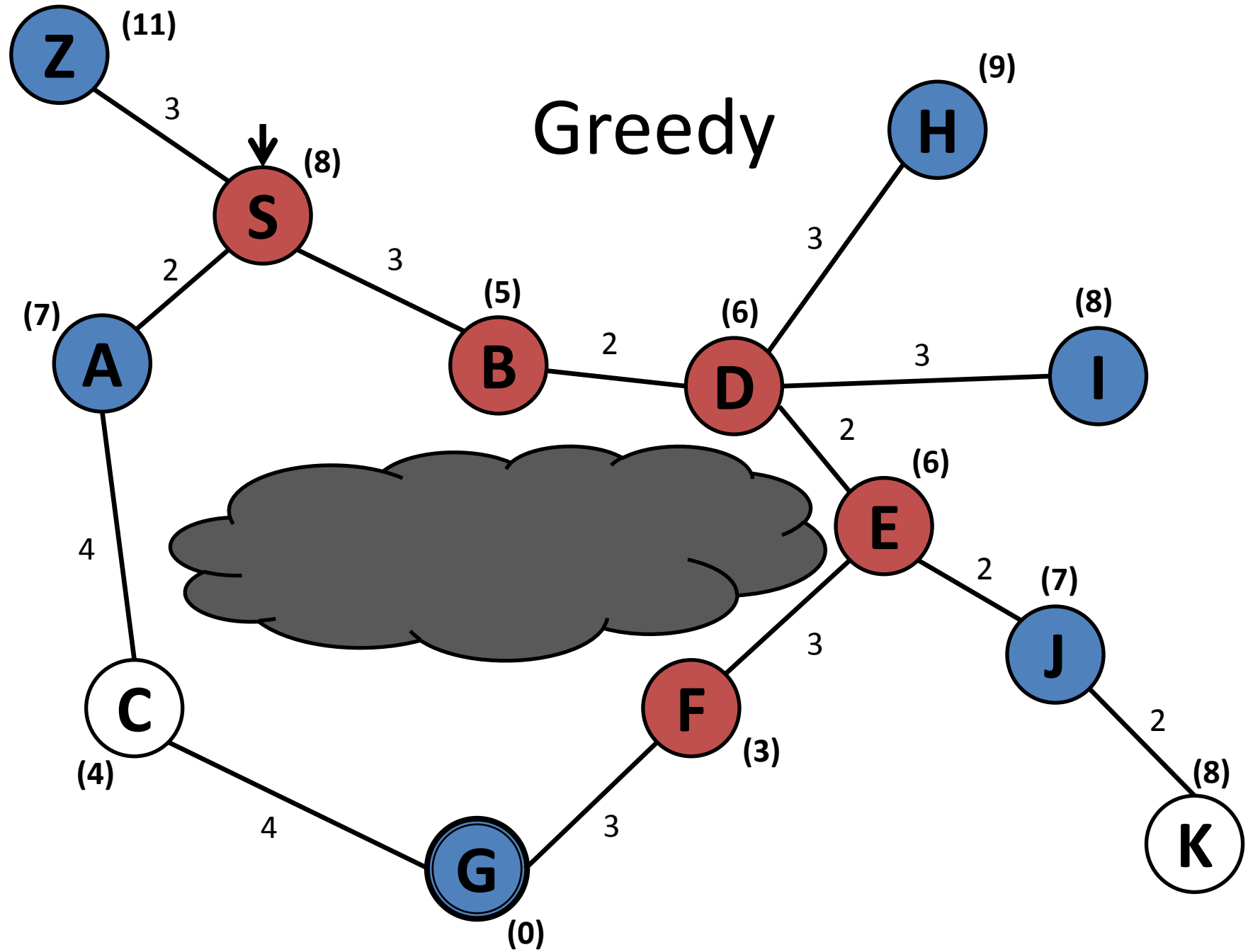


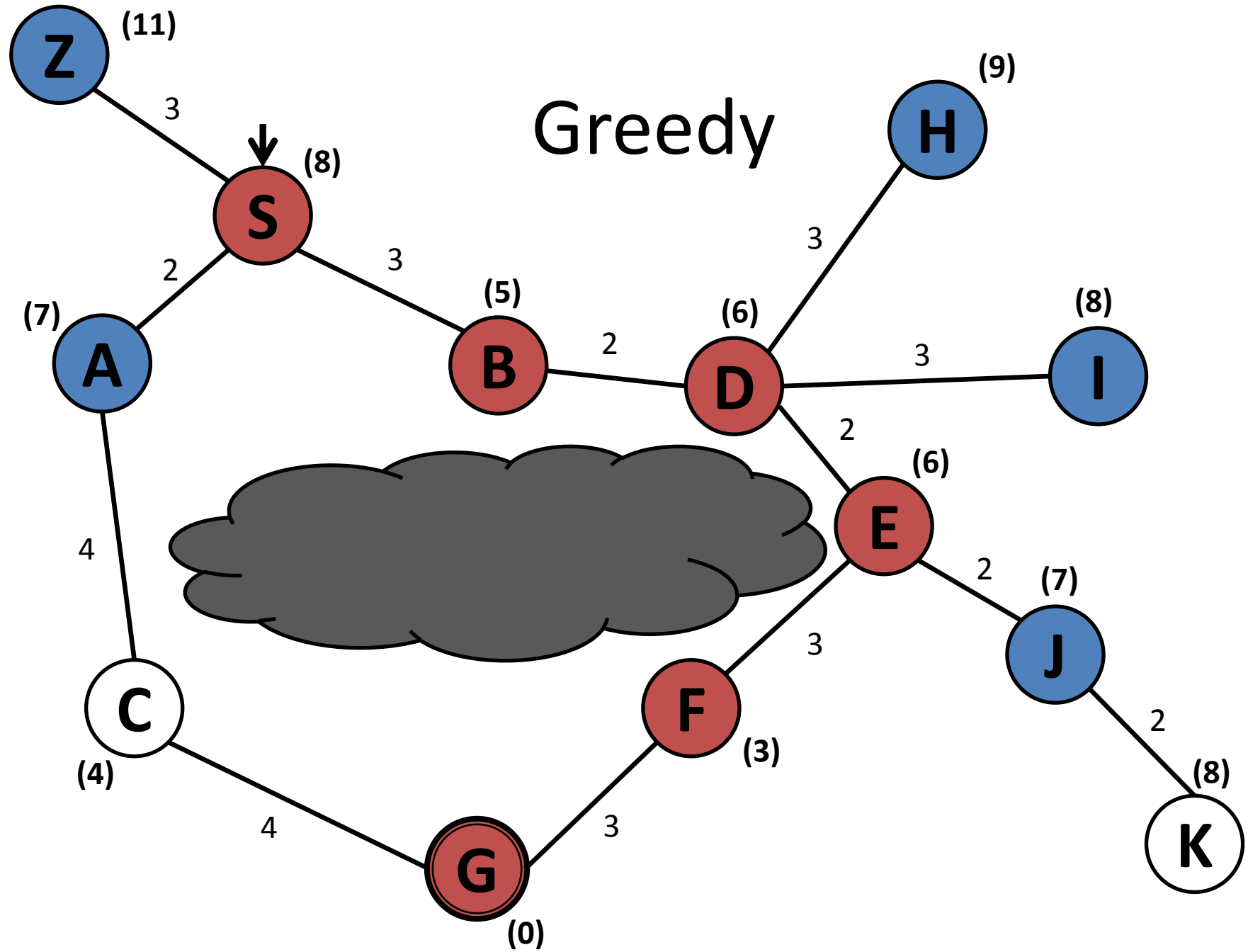


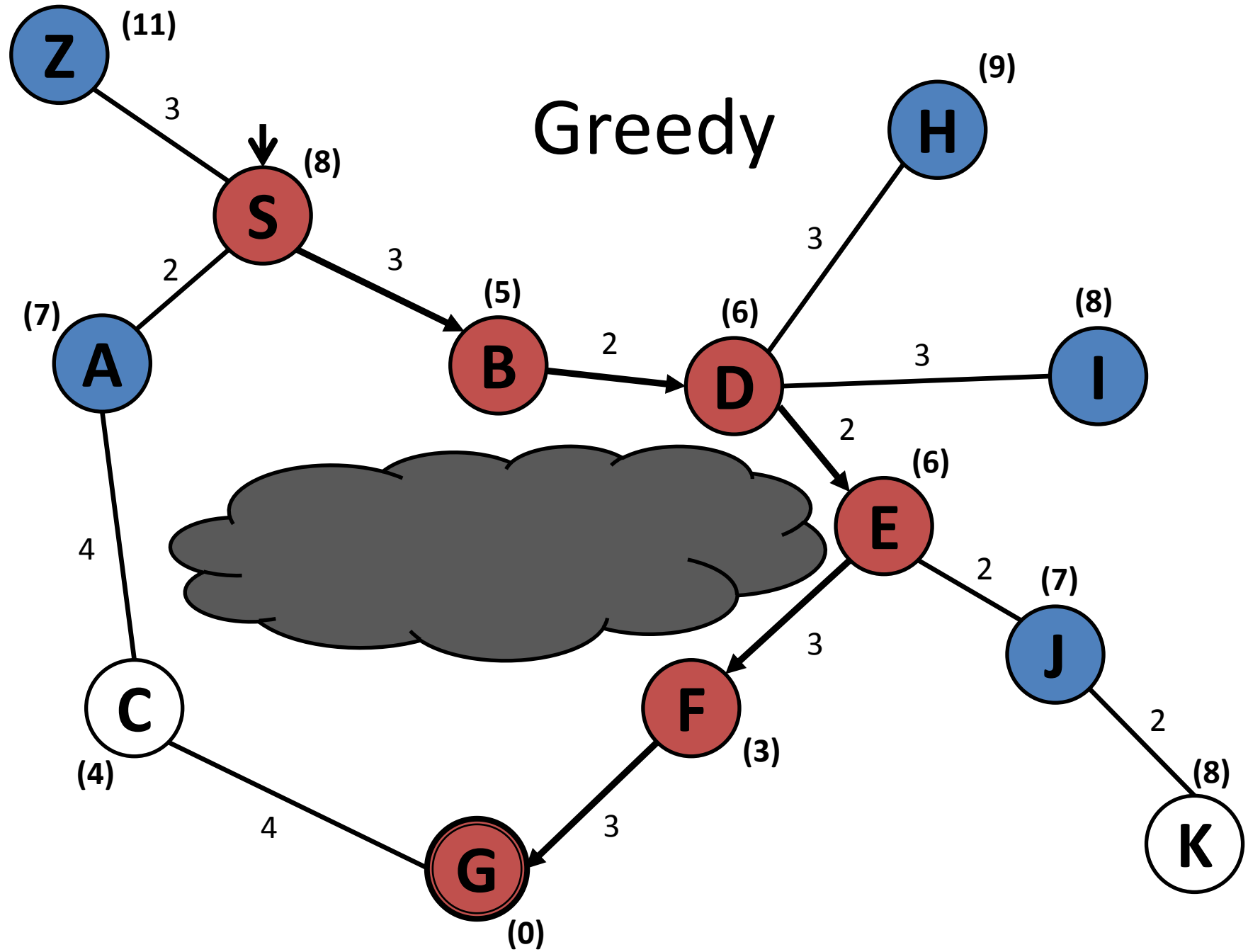


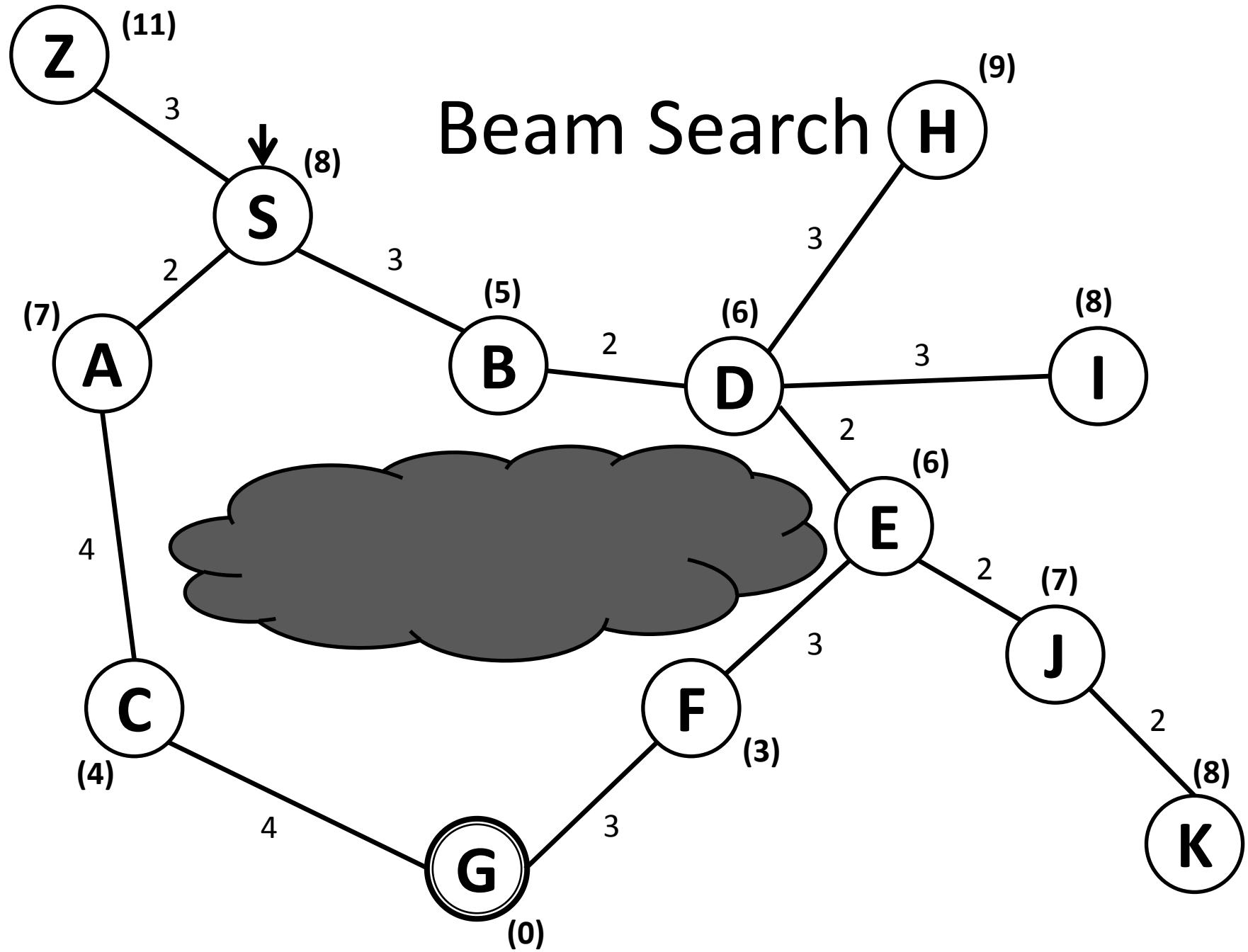


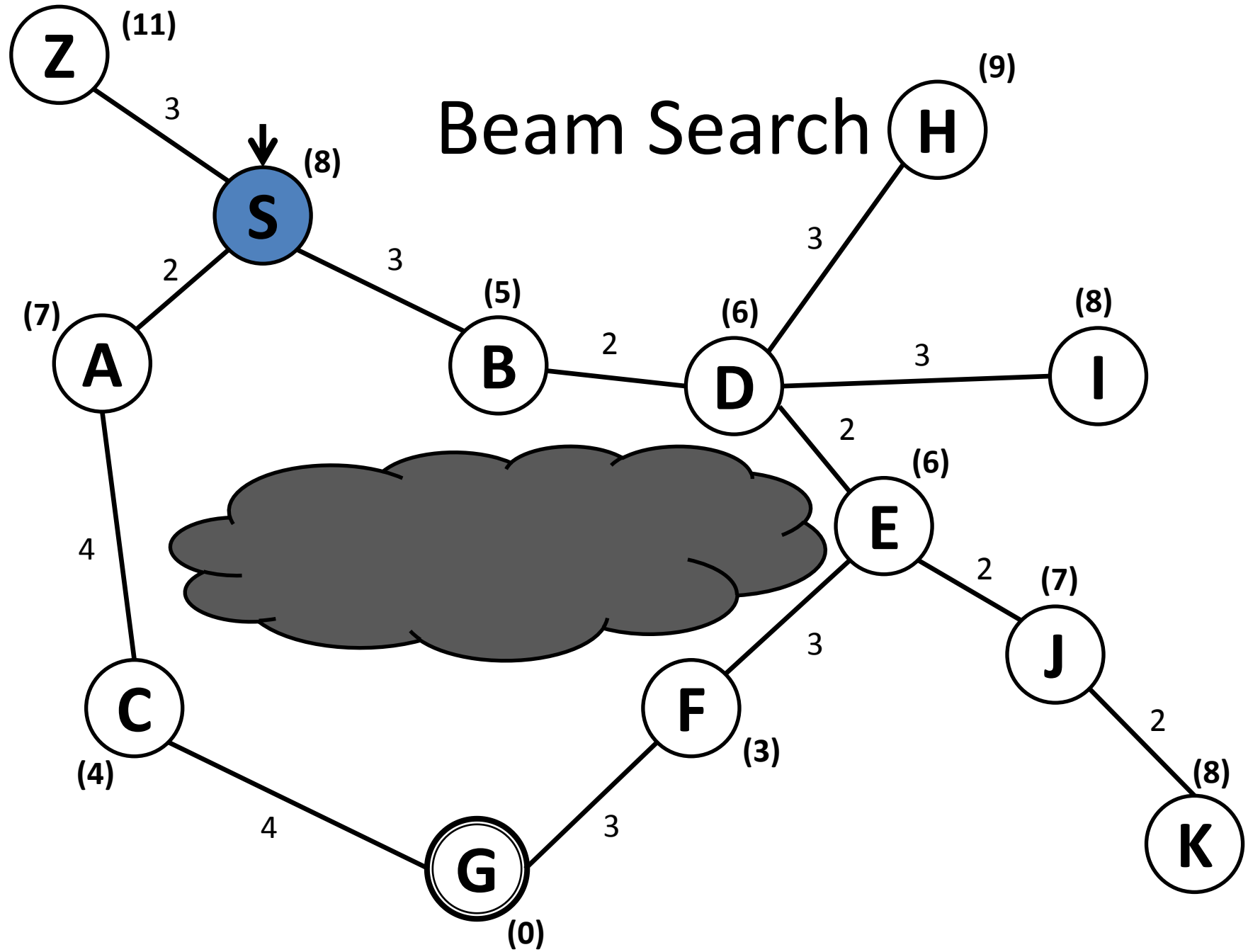


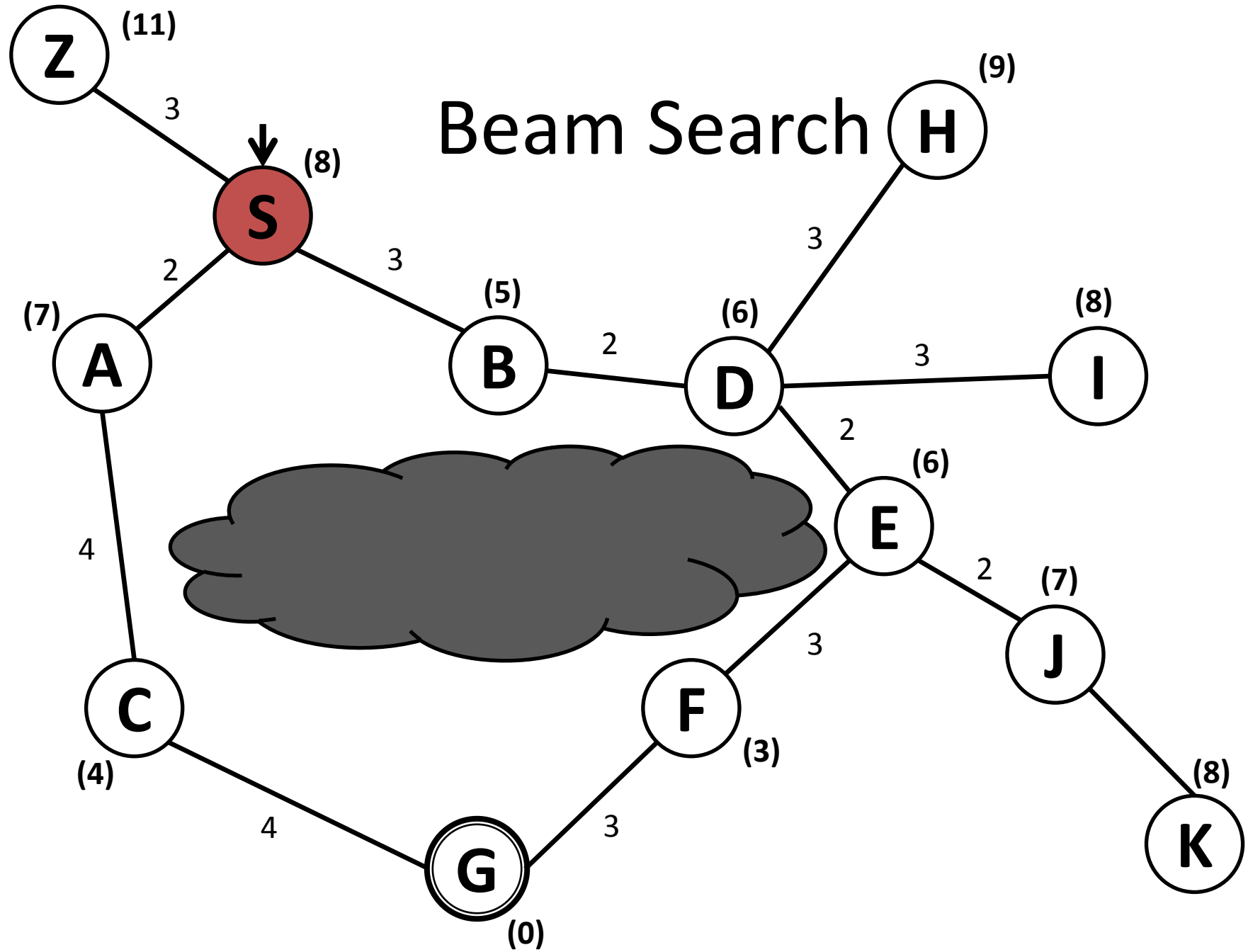






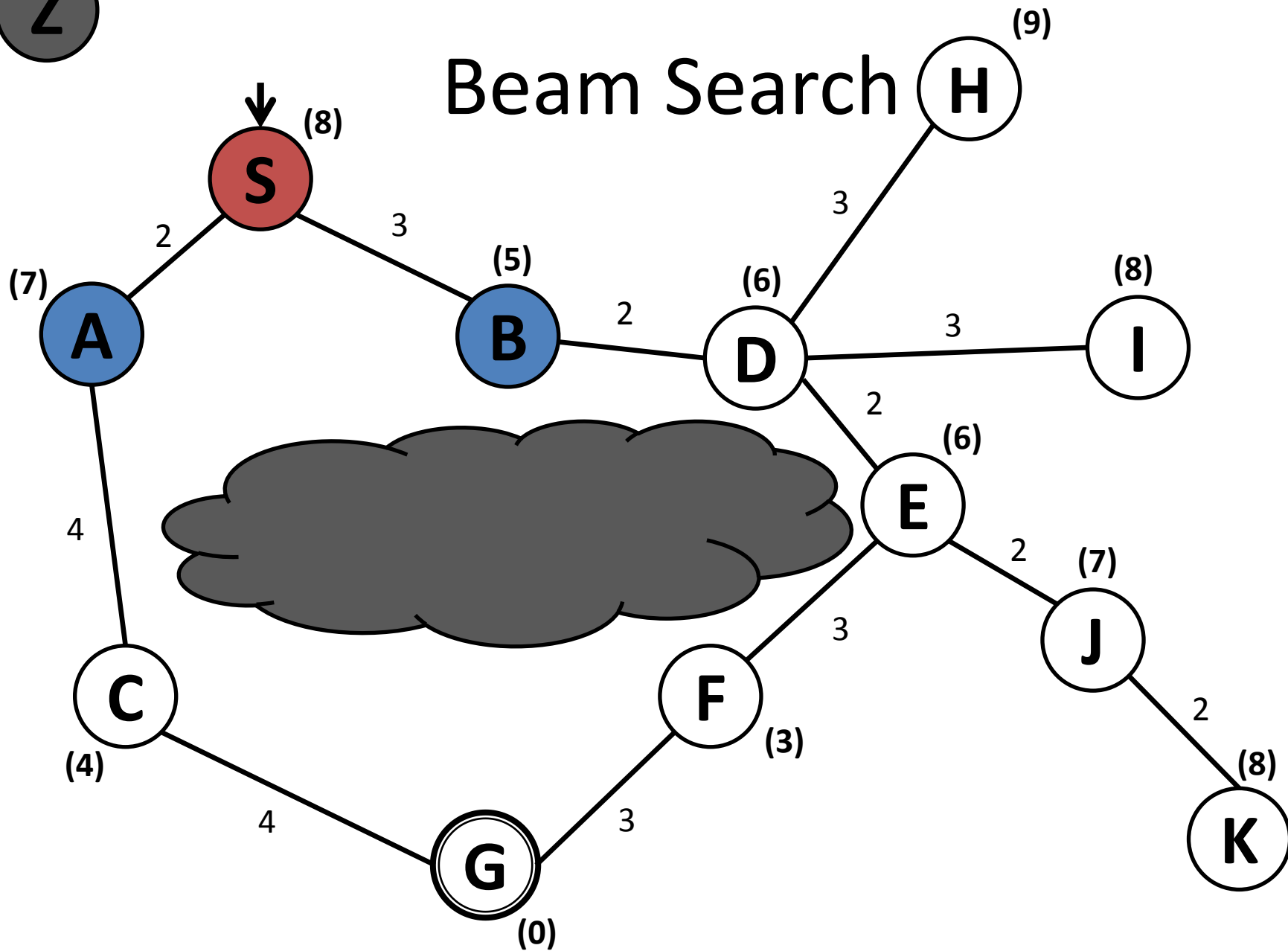






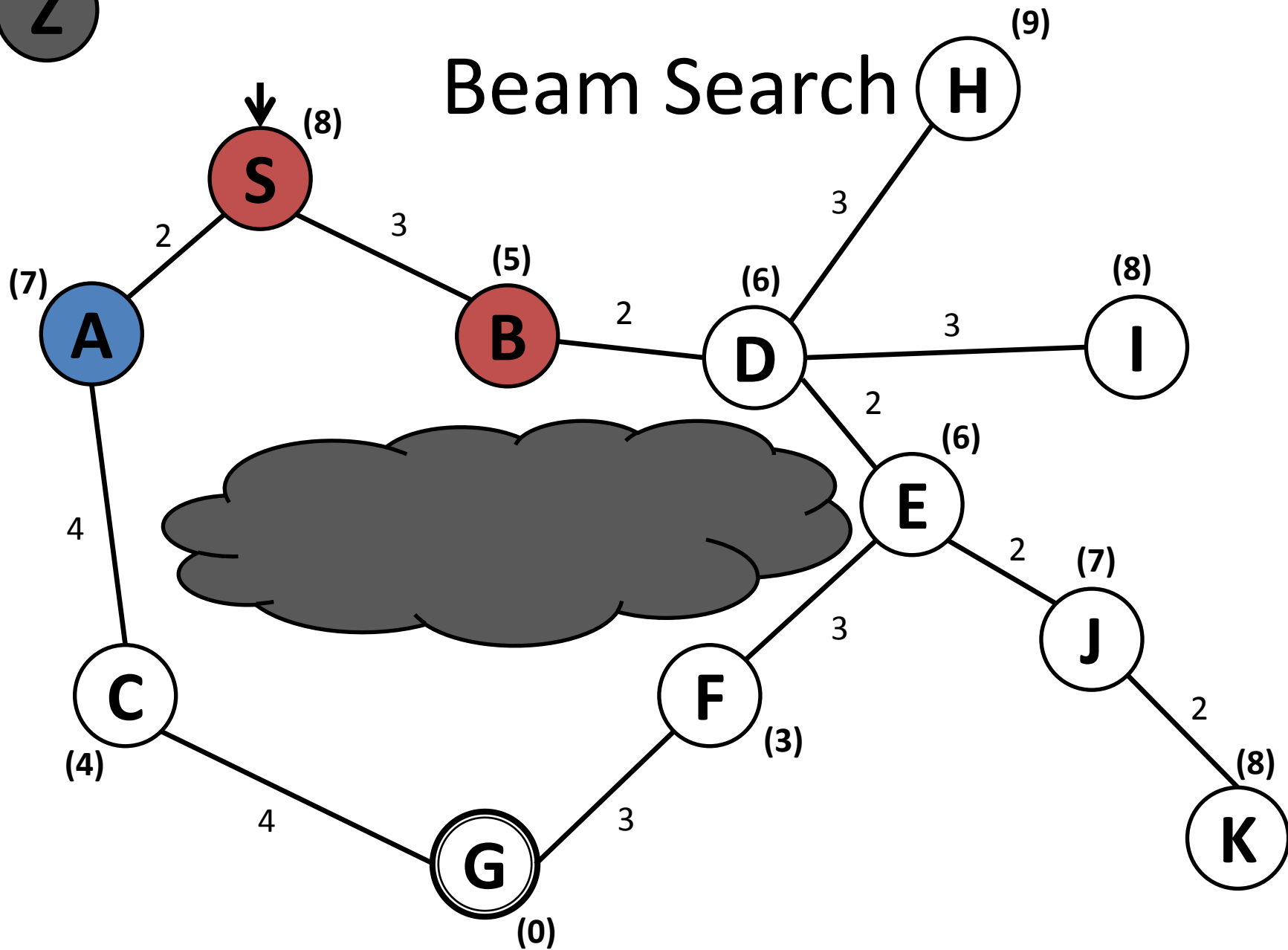
Z (11)

Beam Search



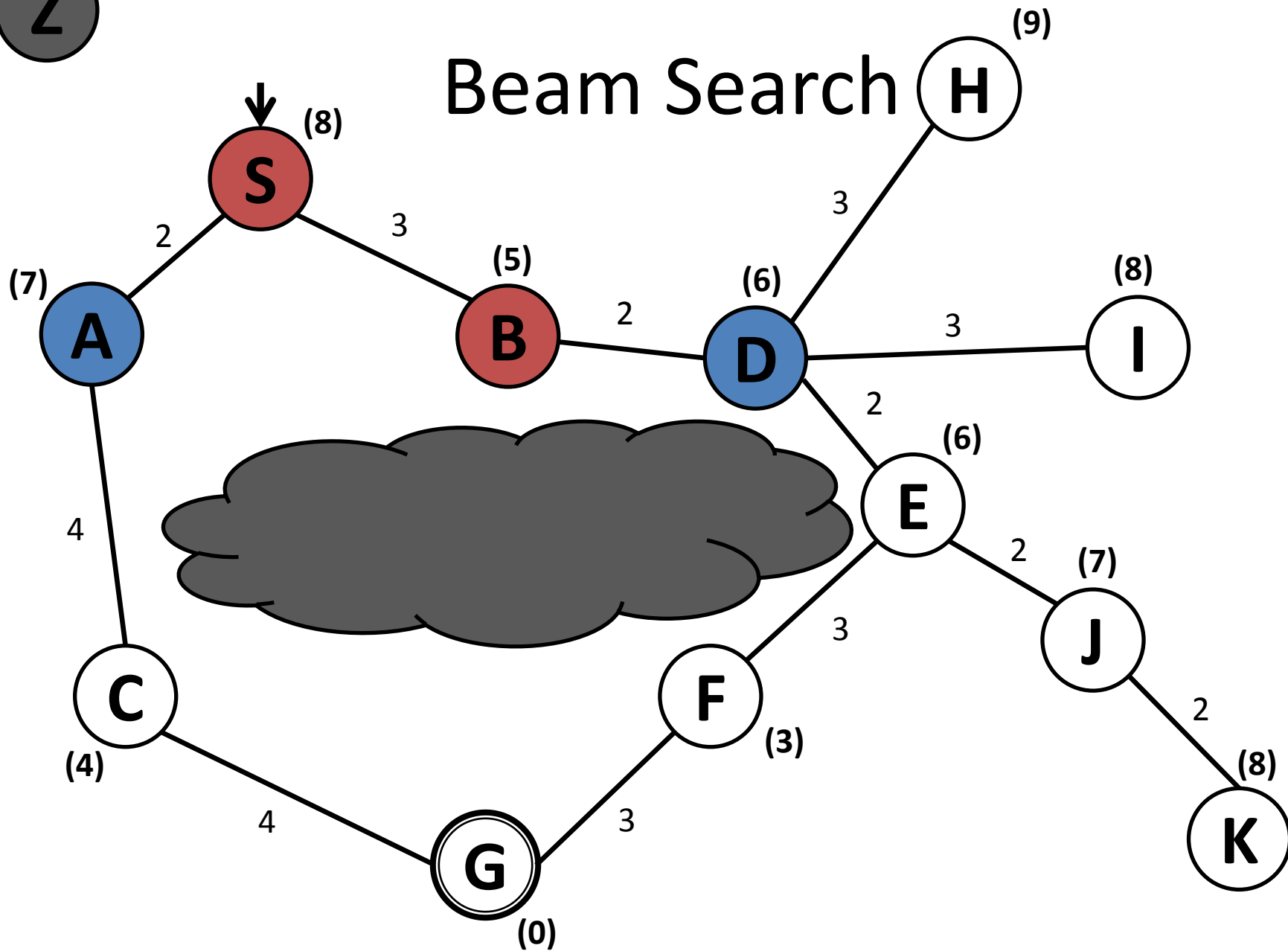
Z (11)

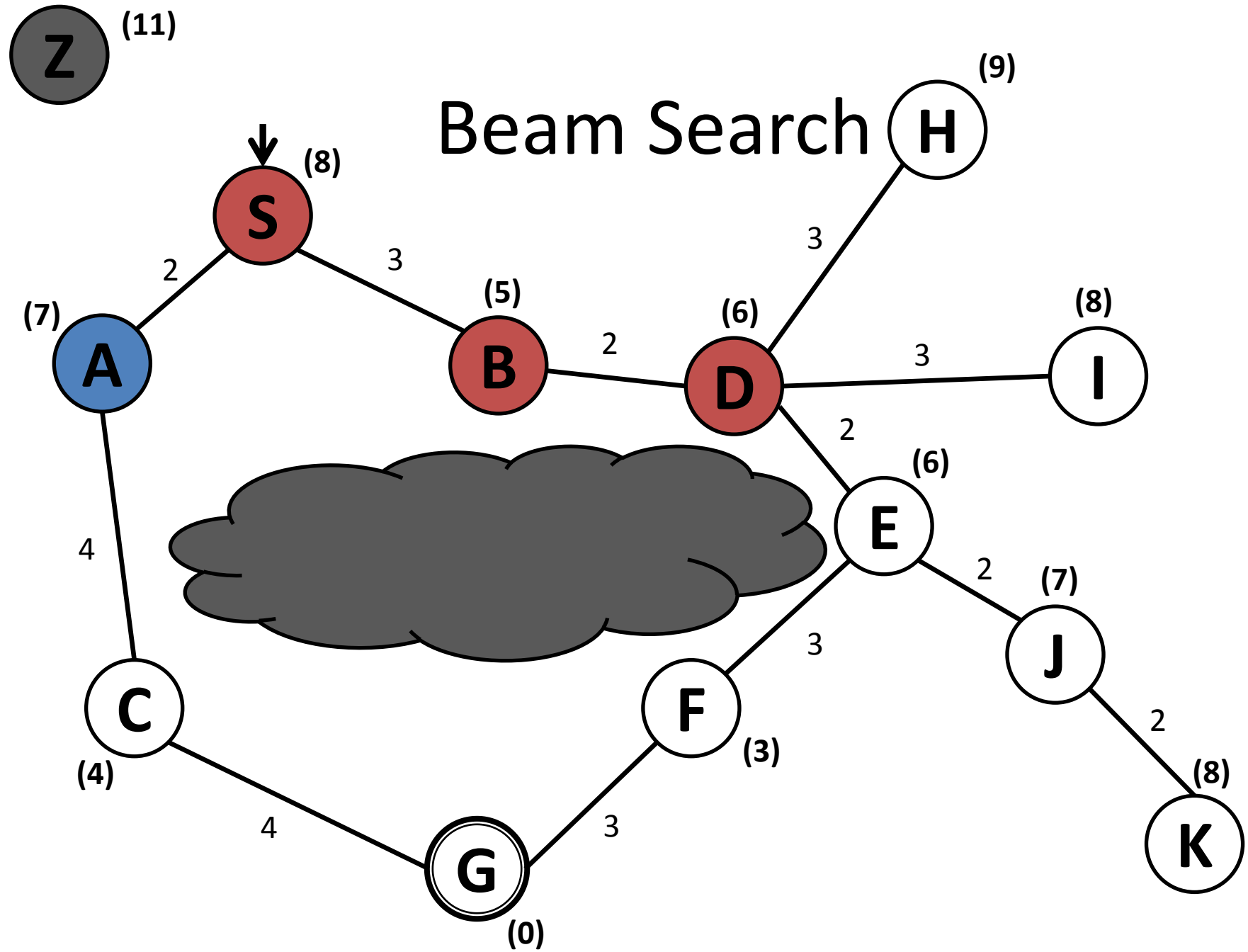
Beam Search



Z (11)

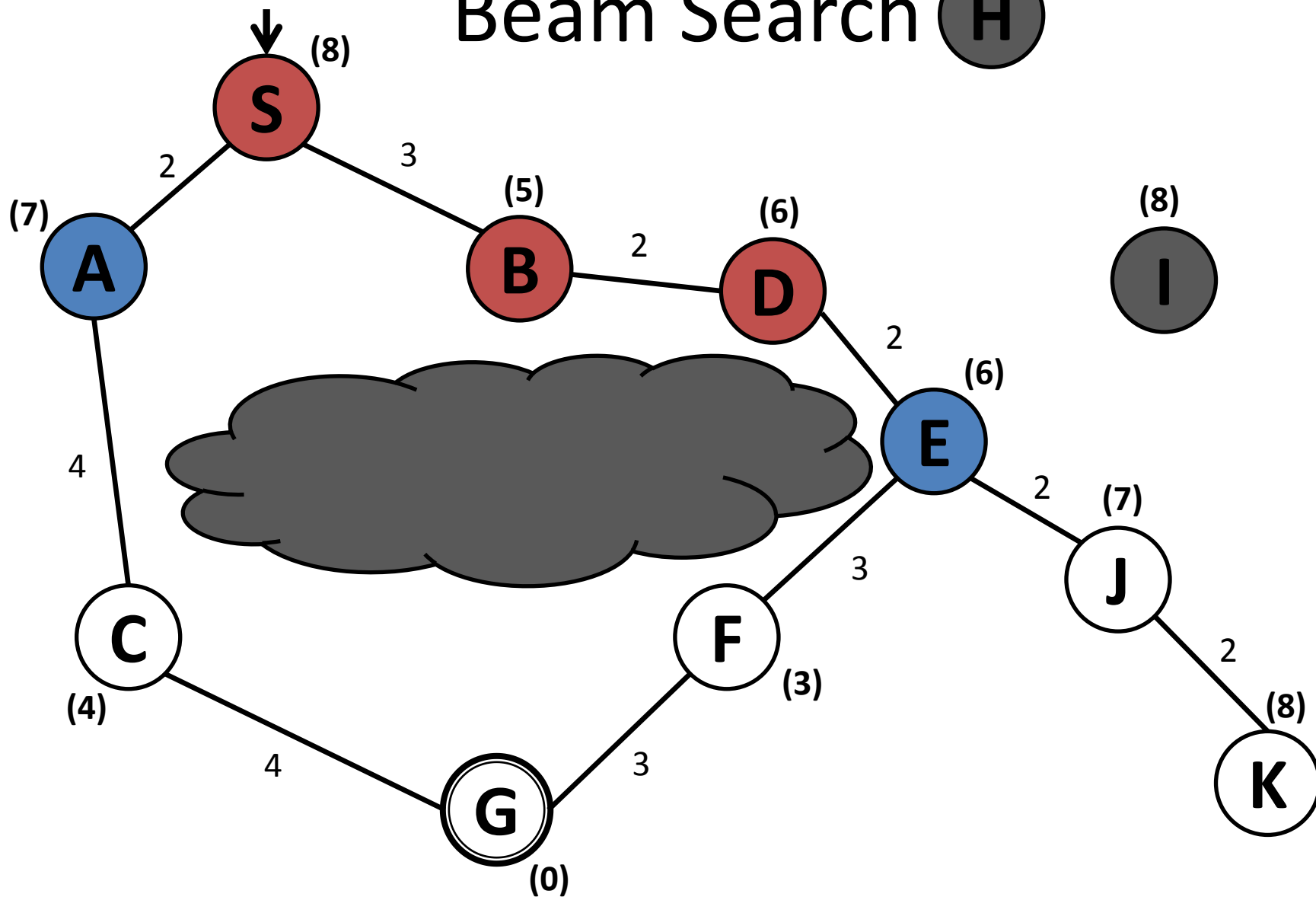
Beam Search





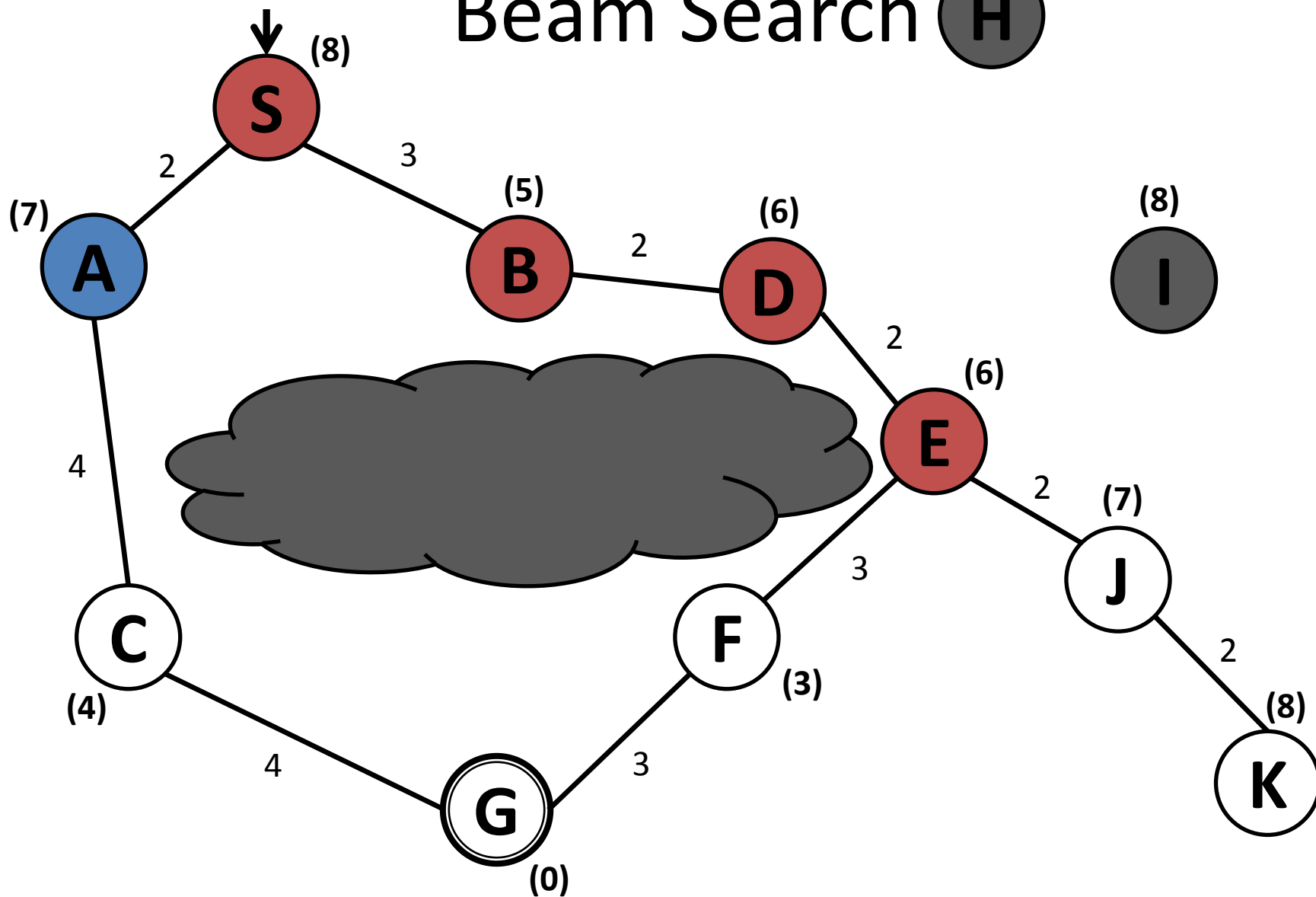
Z (11)

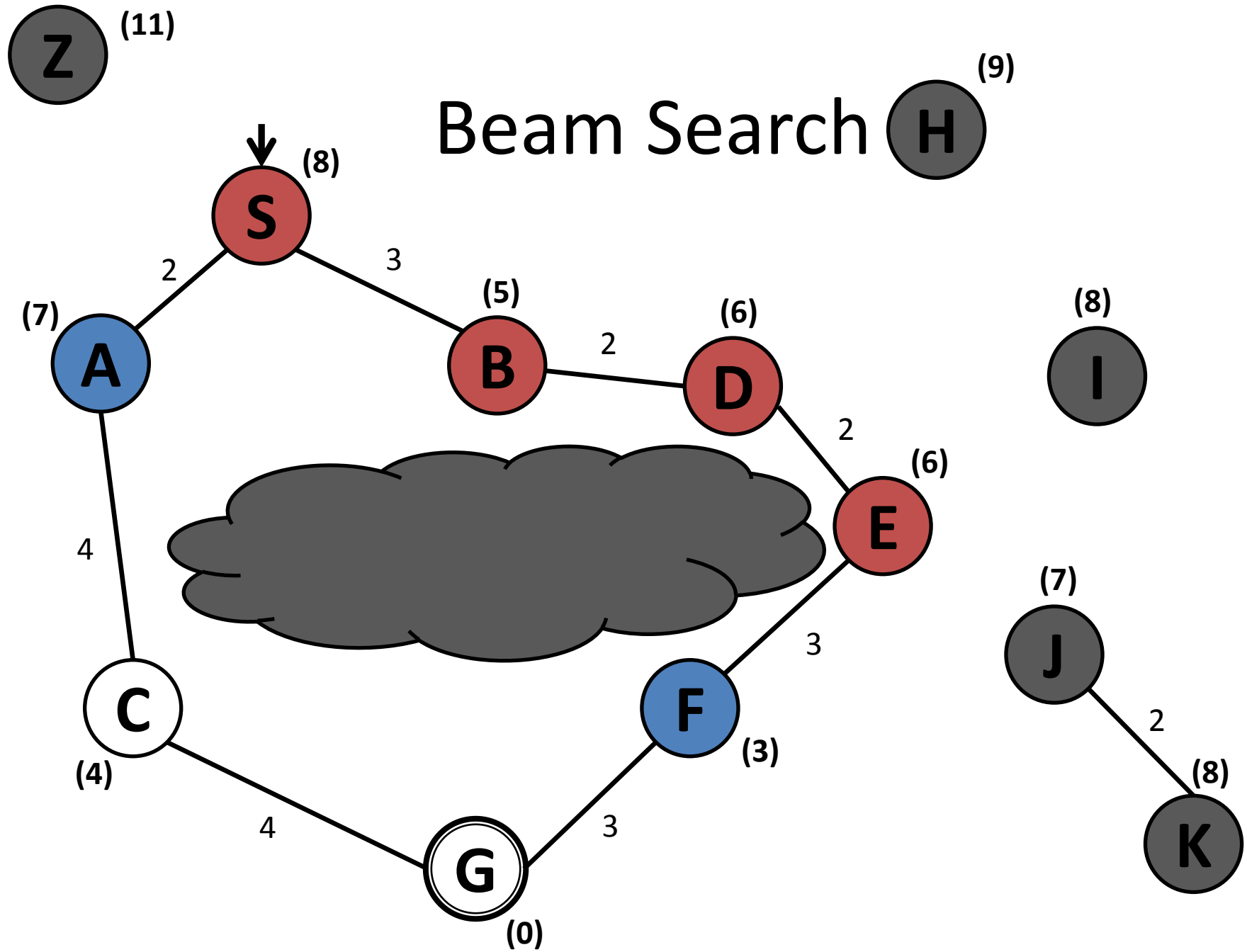
Beam Search **H** (9)

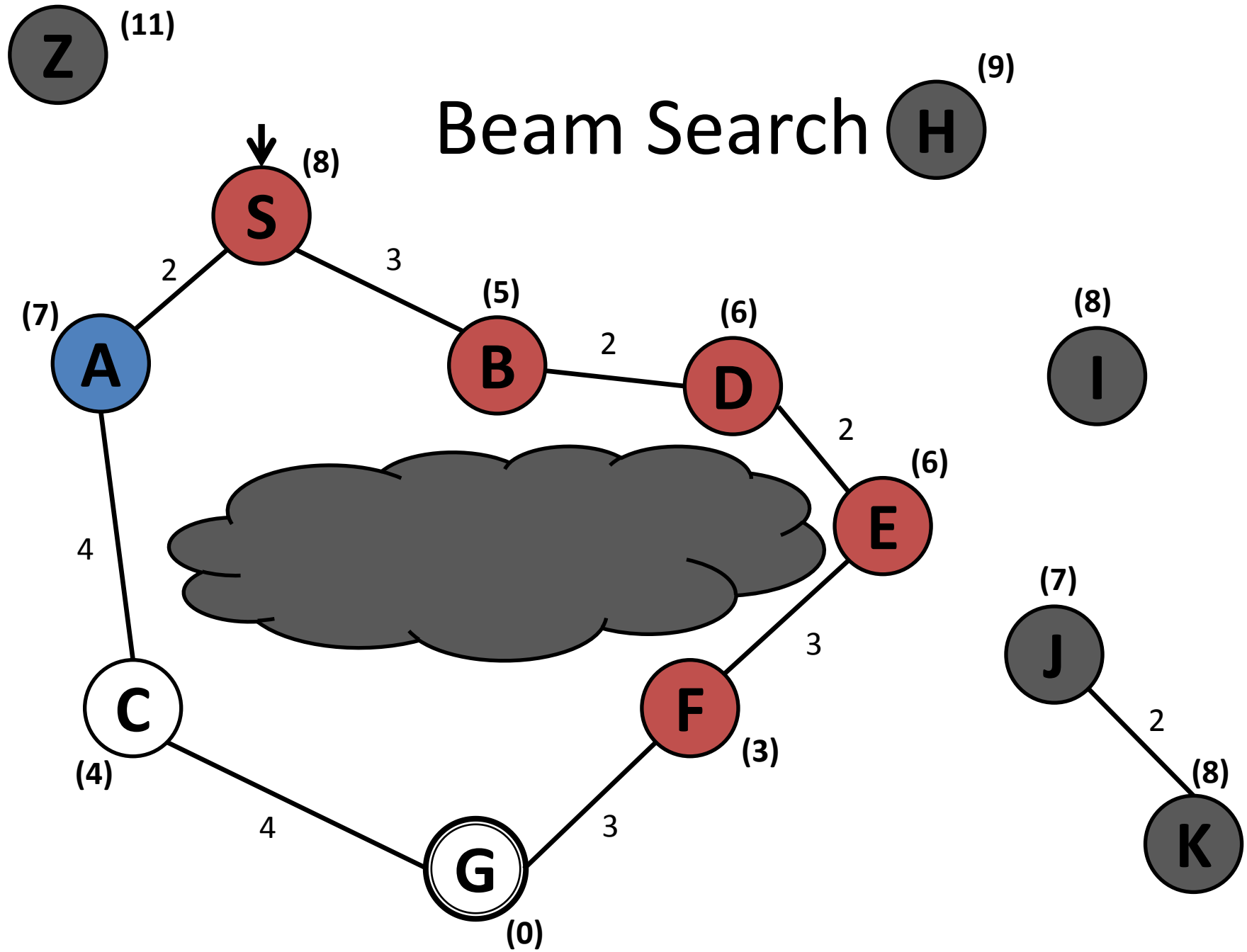


Z (11)

Beam Search **H** (9)

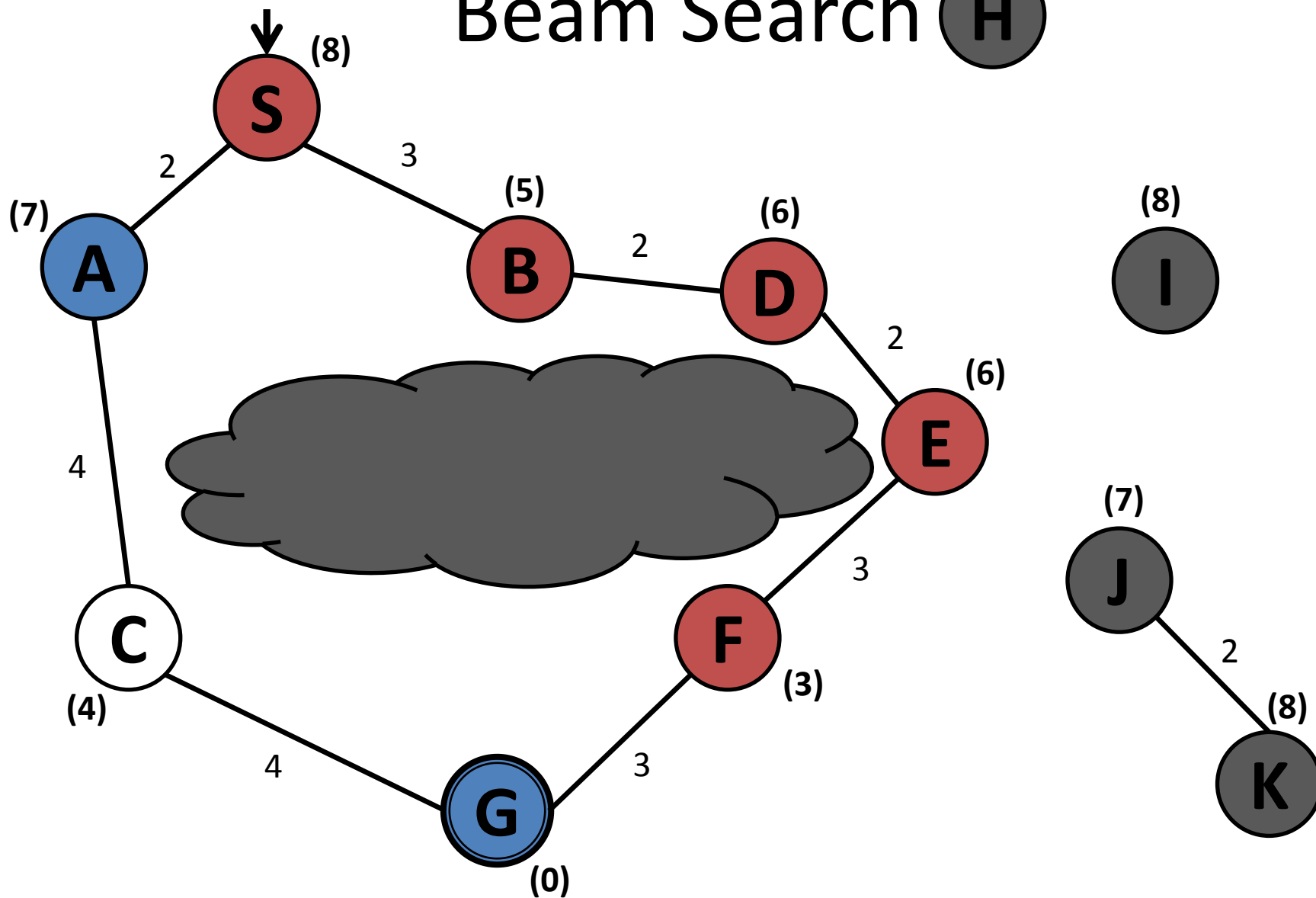






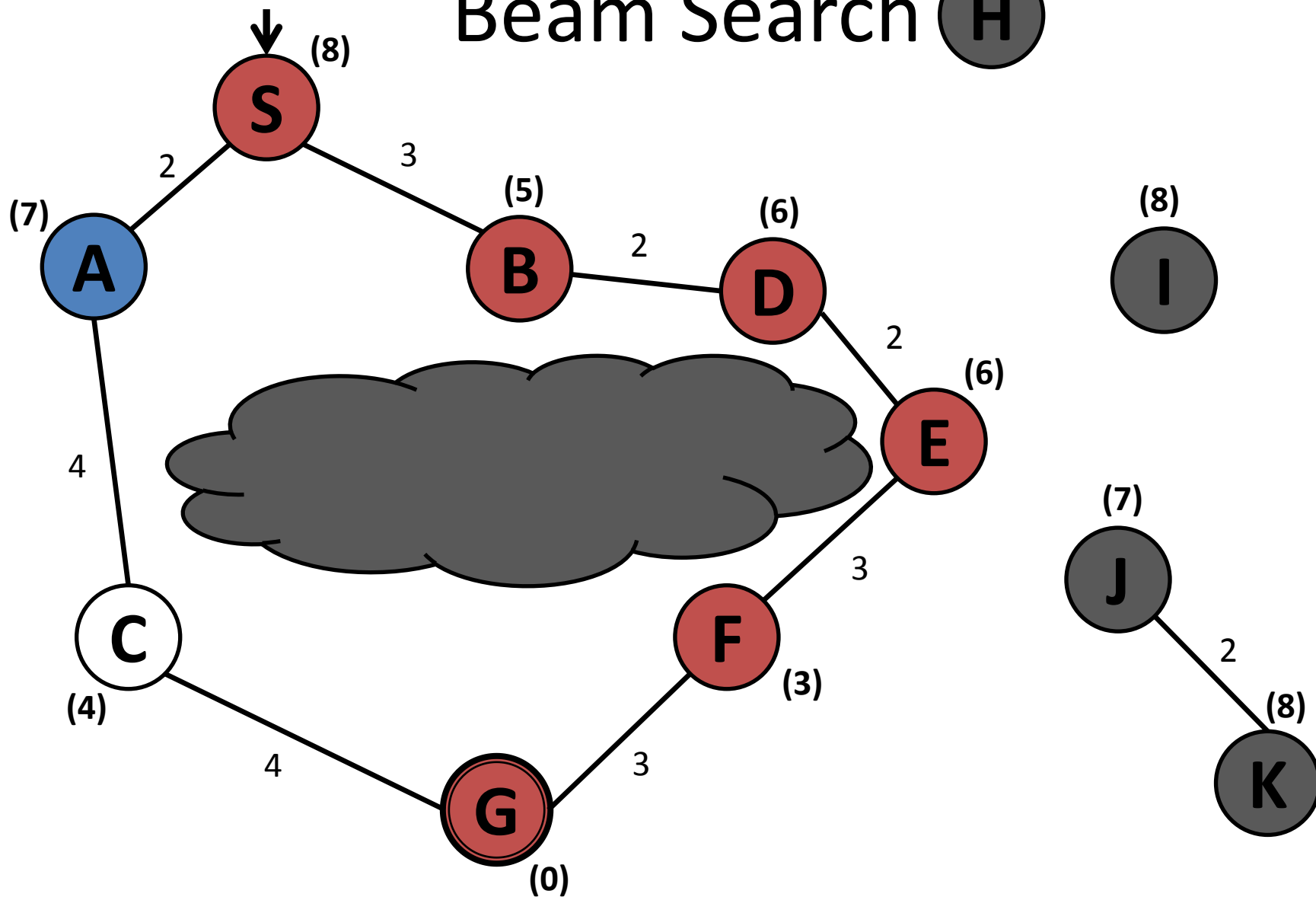
Z (11)

Beam Search **H** (9)



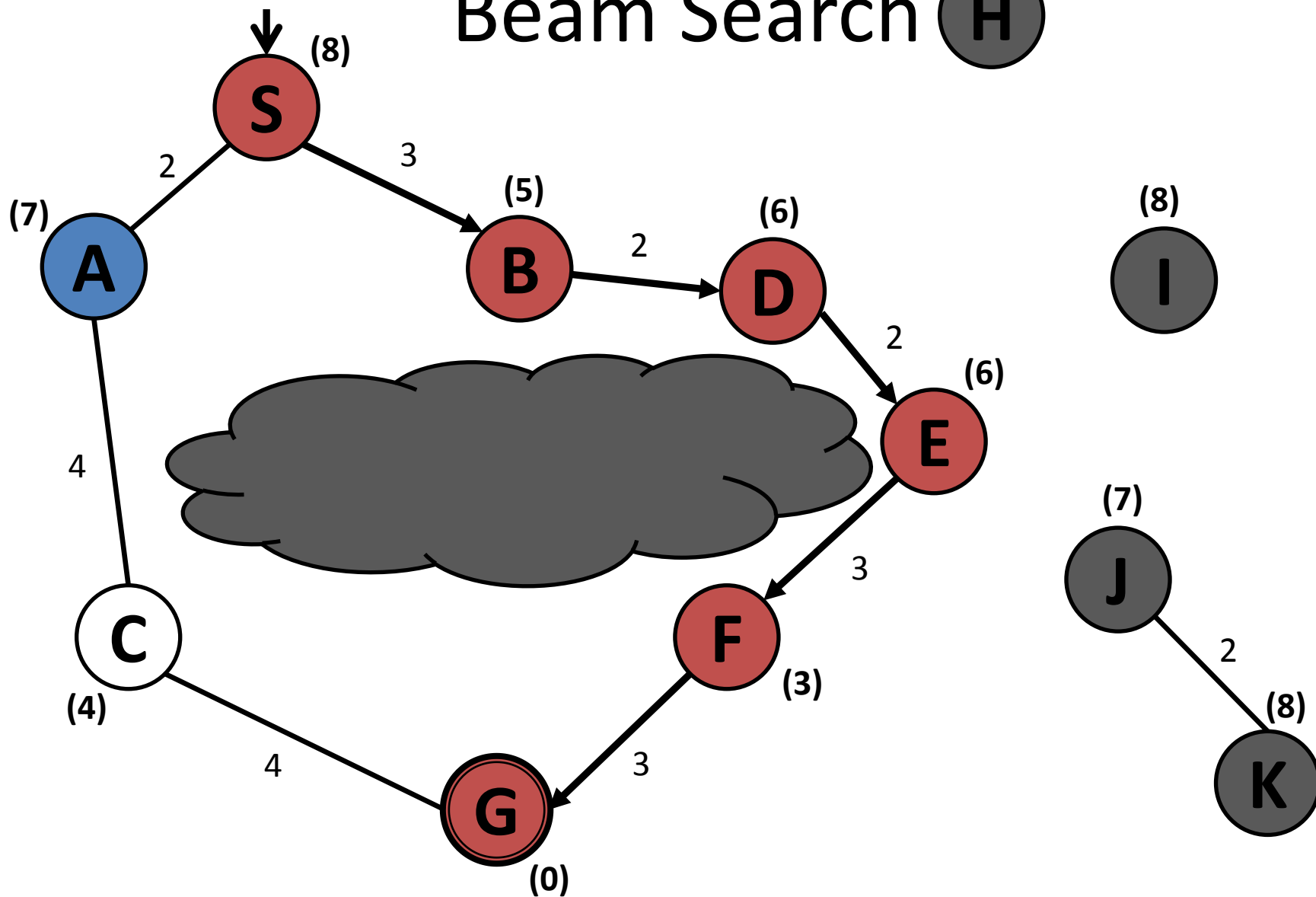
Z (11)

Beam Search **H** (9)

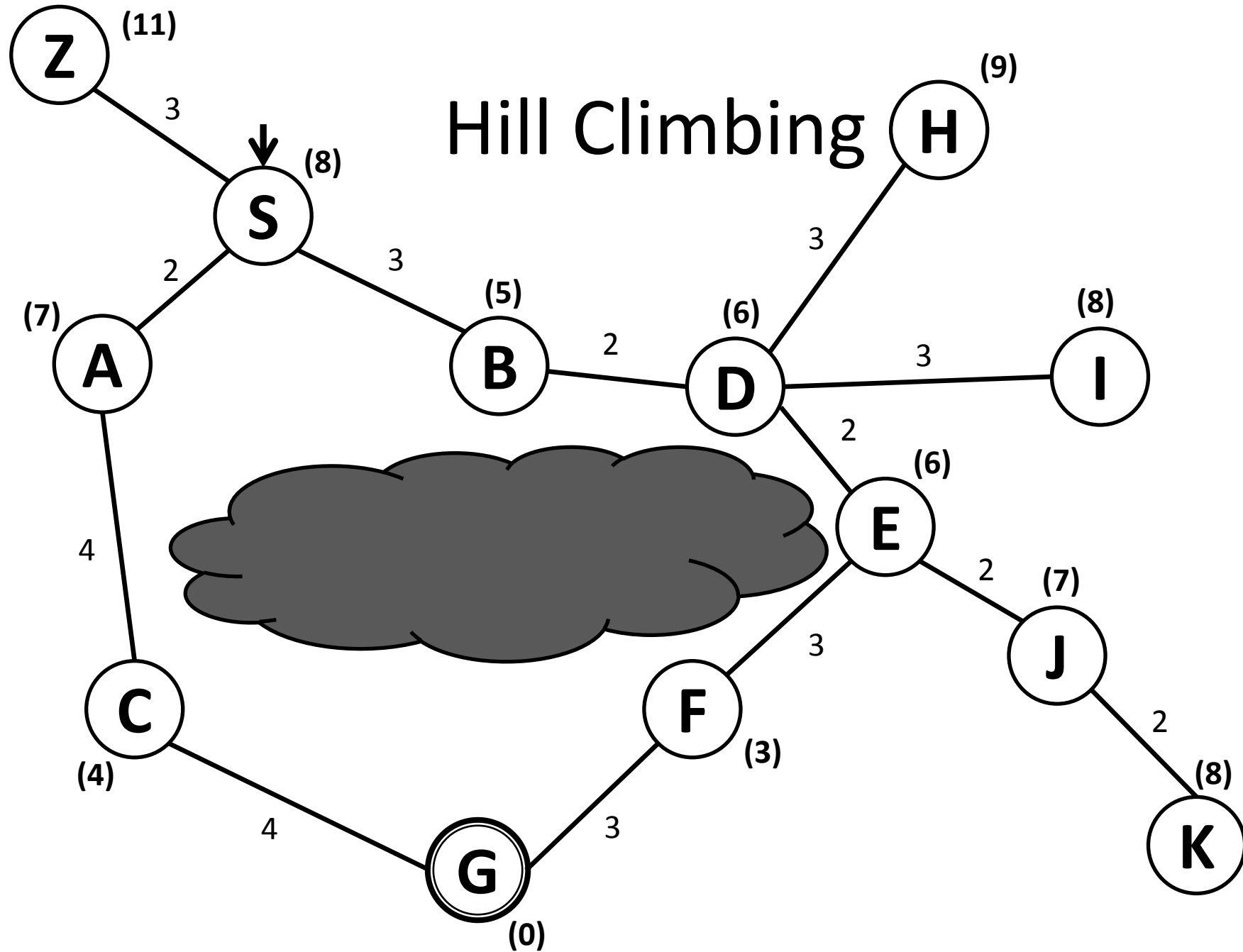


Z (11)

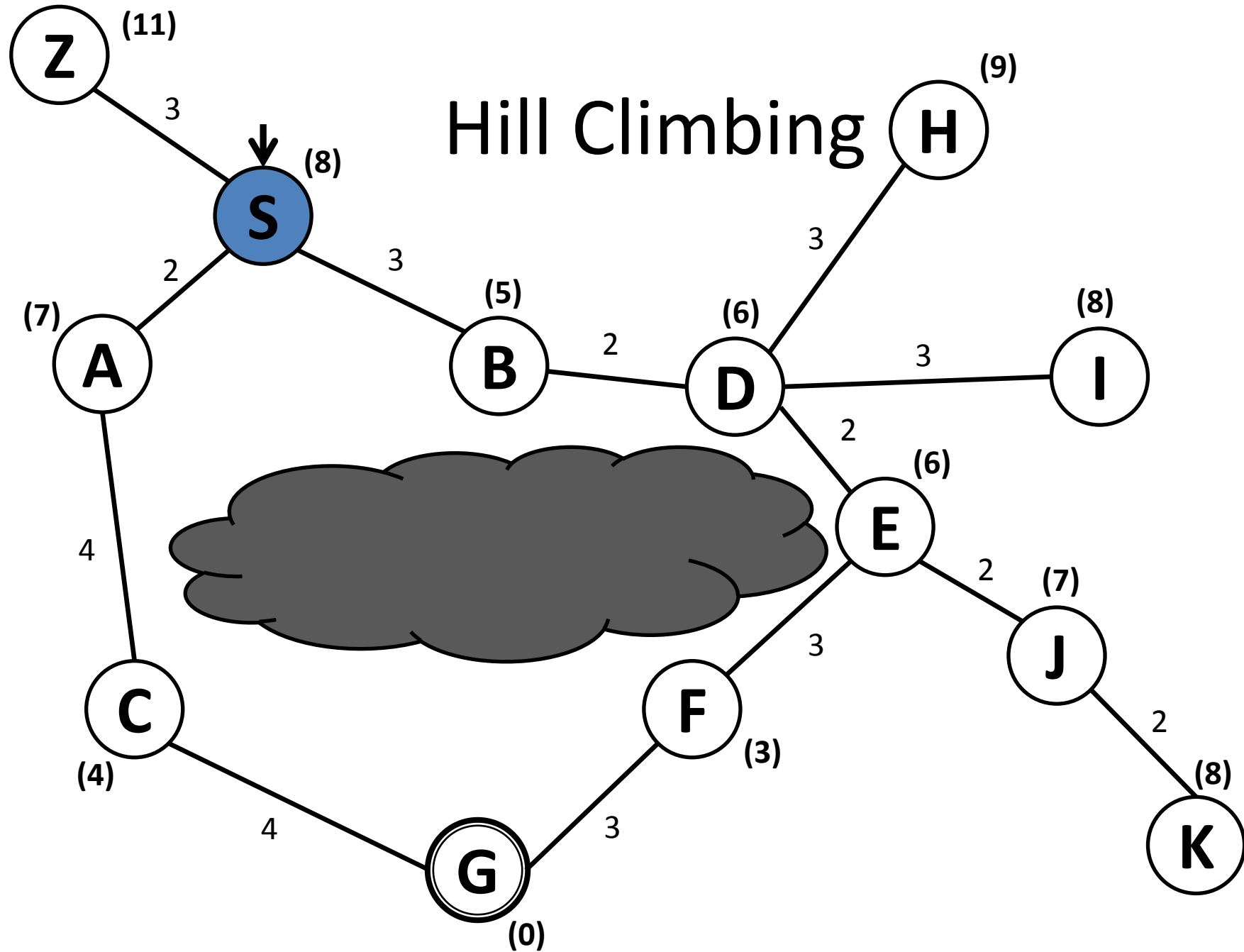
Beam Search **H** (9)



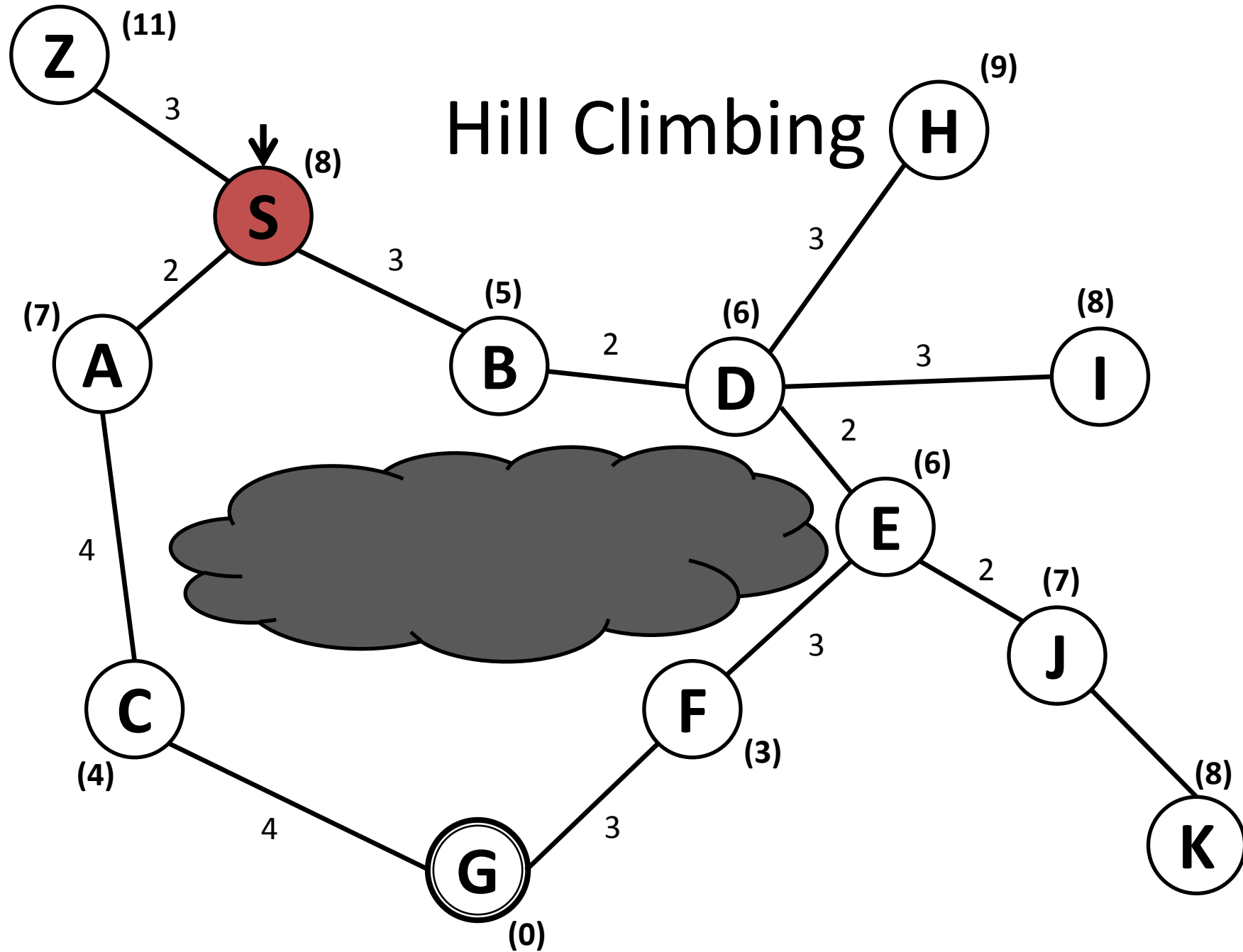
Hill Climbing



Hill Climbing

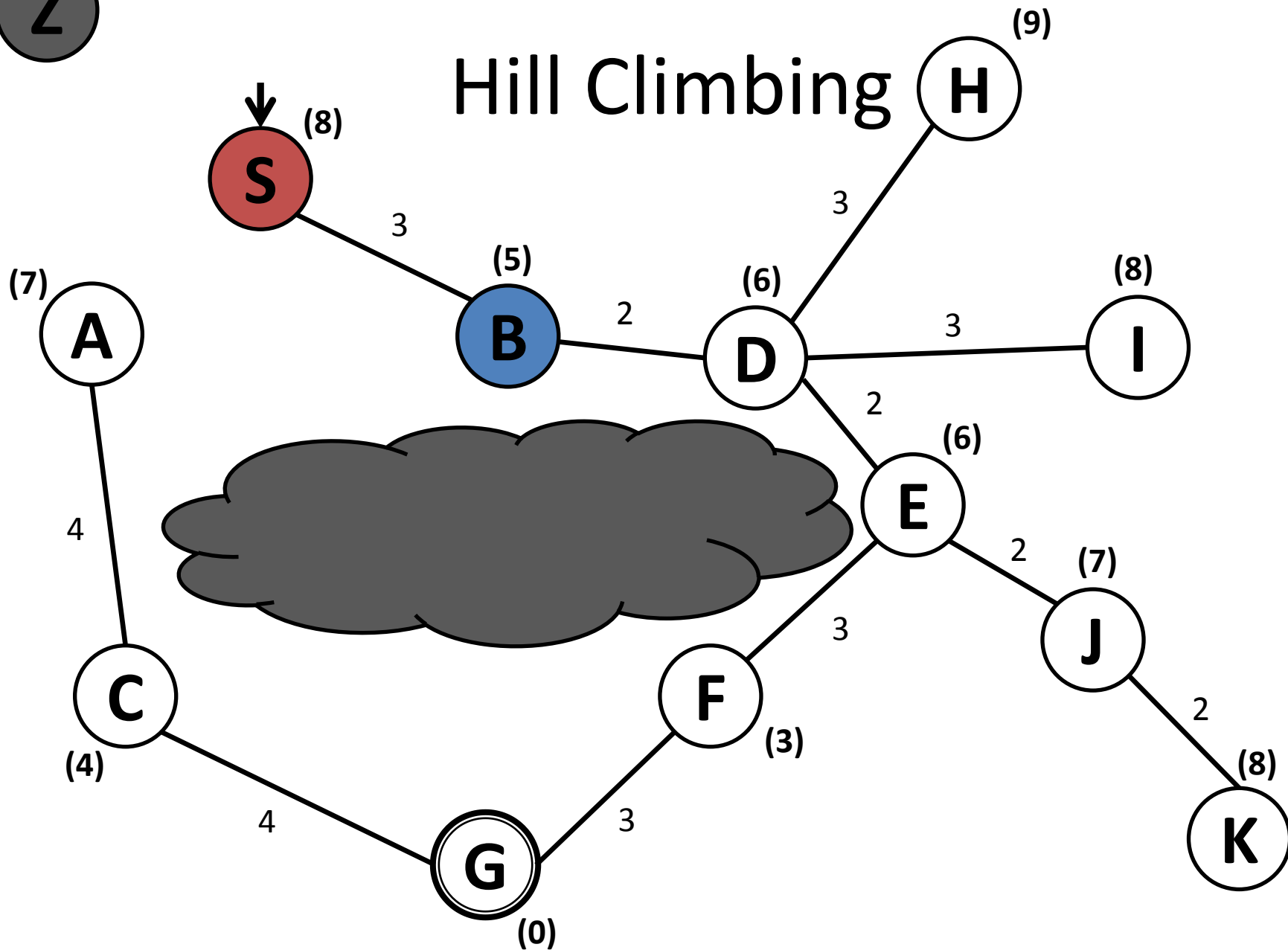


Hill Climbing



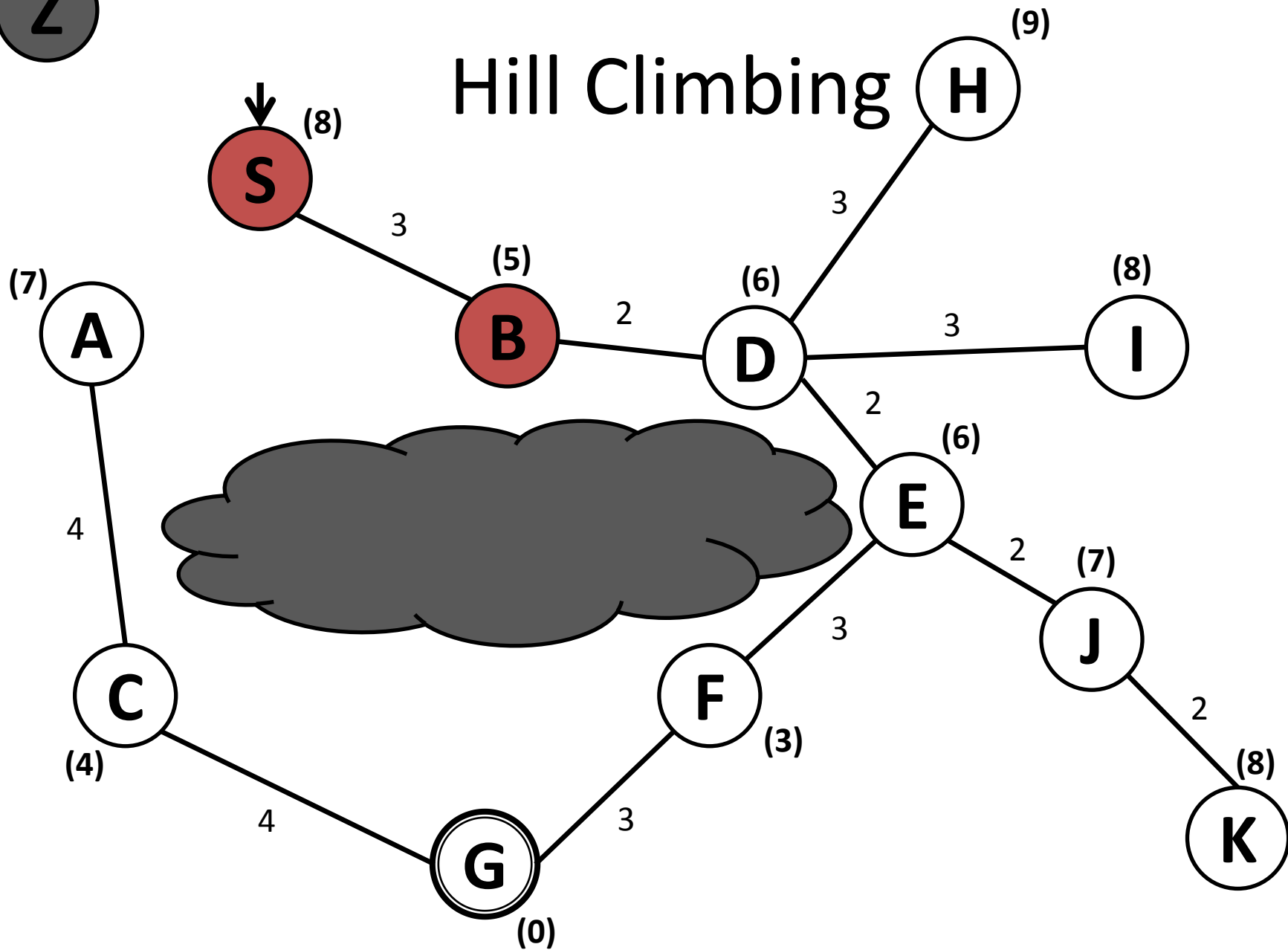
Z (11)

Hill Climbing



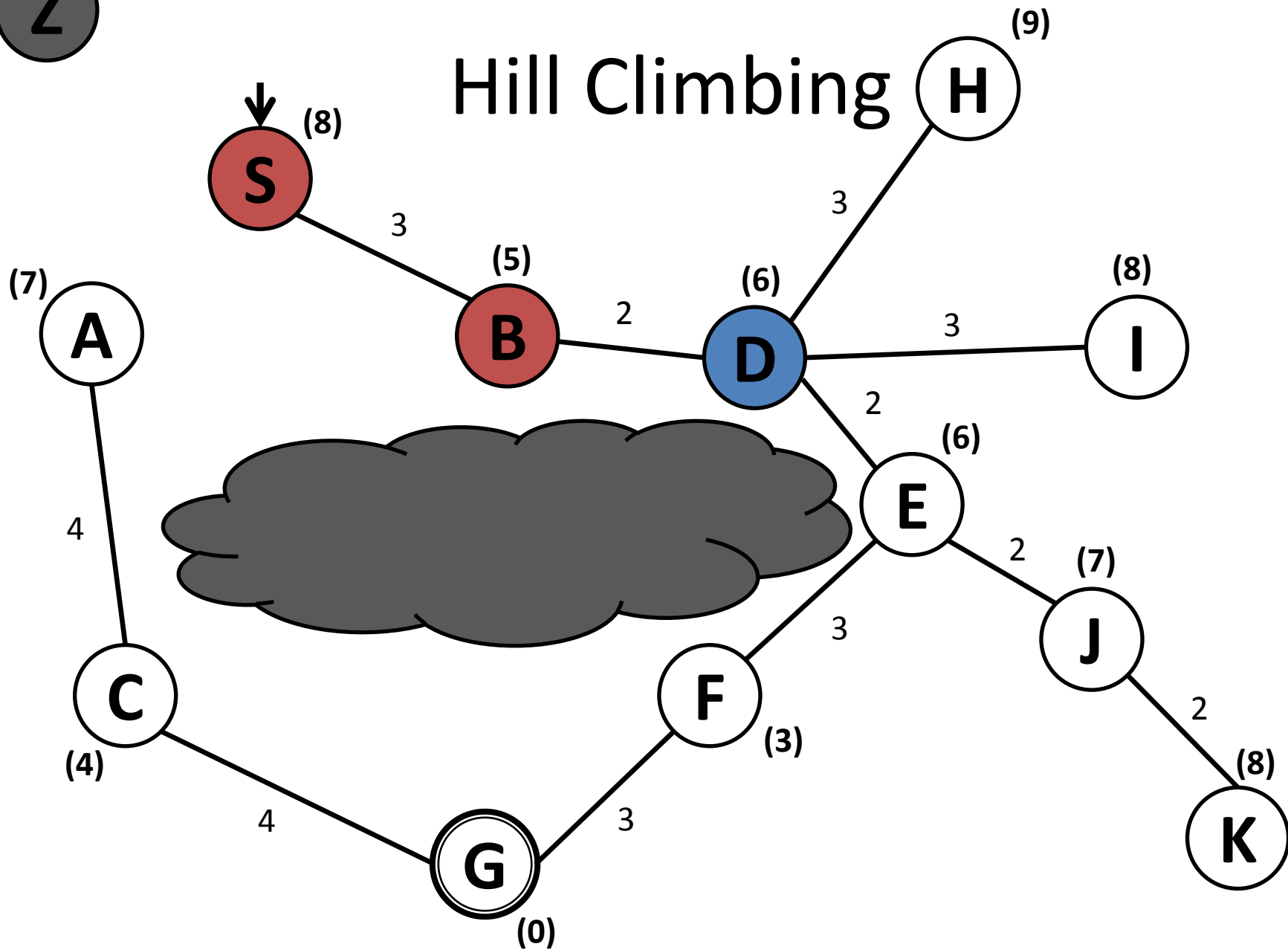
Z (11)

Hill Climbing



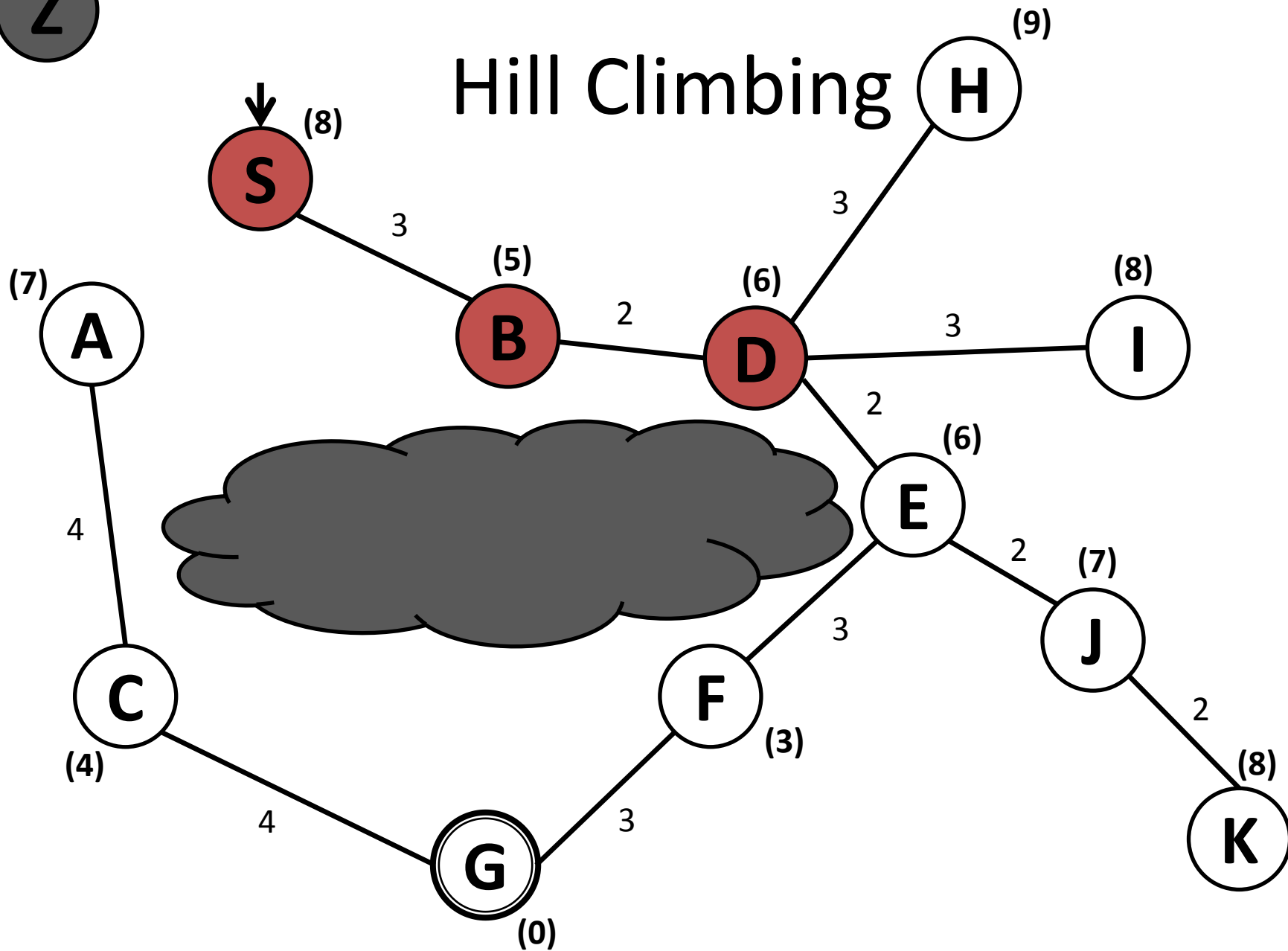
Z (11)

Hill Climbing



Z (11)

Hill Climbing



Z (11)

Hill Climbing **H** (9)

S (8)

3

B (5)

2

D (6)

2

E (6)

I (8)

A (7)

4

C (4)

4

G (0)

3

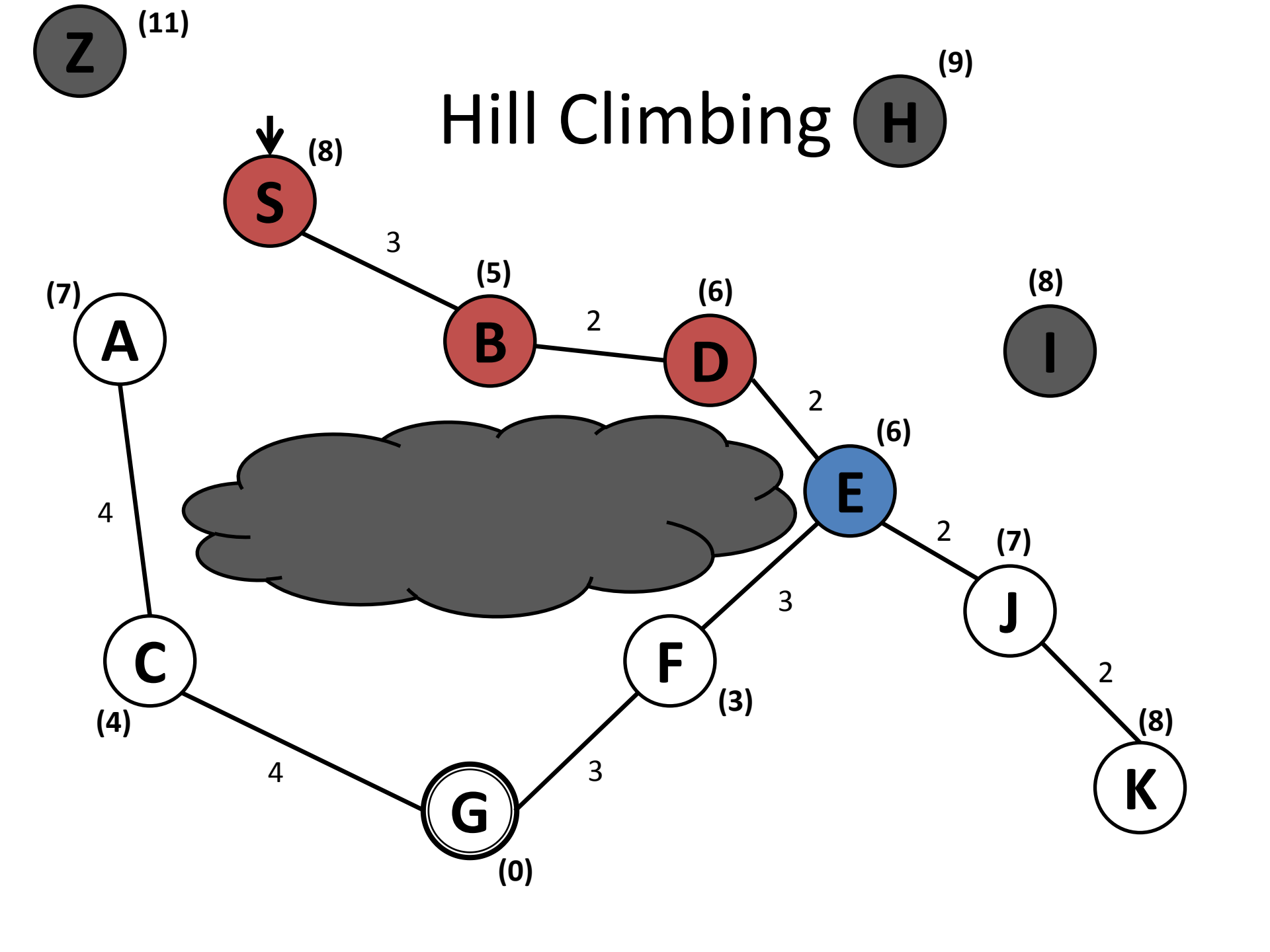
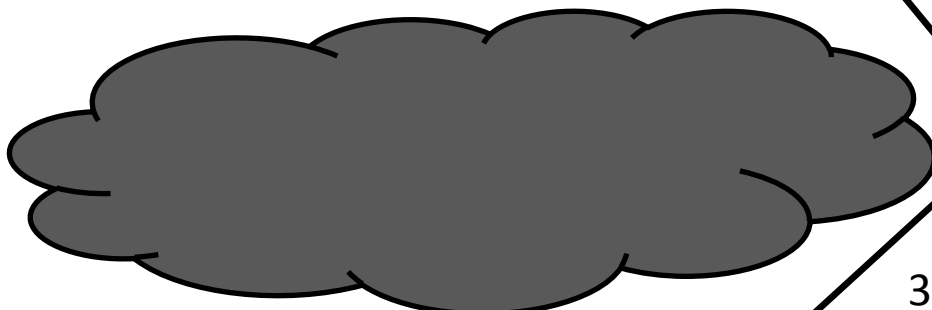
F (3)

3

J (7)

2

K (8)



Z (11)

Hill Climbing **H** (9)

S (8)
↓

3

B (5)

2

D (6)

2

E (6)

2

J (7)

2

K (8)

3

F (3)

3

G (0)

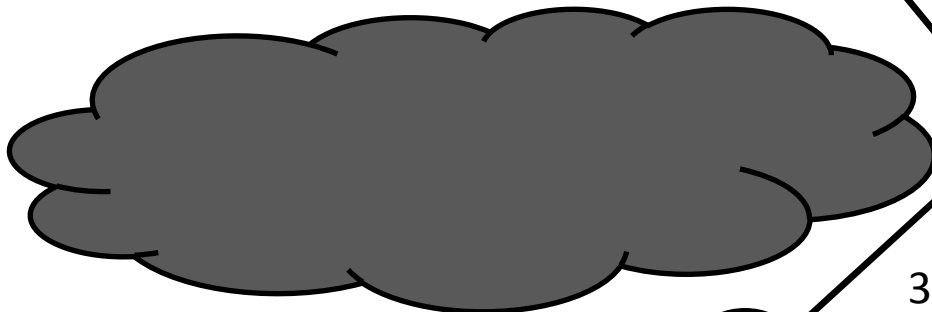
4

C (4)

4

A (7)

I (8)



(7)

(5)

(6)

(6)

(7)

(8)

(3)

(0)

(4)

(11)

(9)

(8)

Z (11)

Hill Climbing **H** (9)

S (8)

3

B (5)

2

D (6)

2

E (6)

3

F (3)

3

G (0)

4

C (4)

4

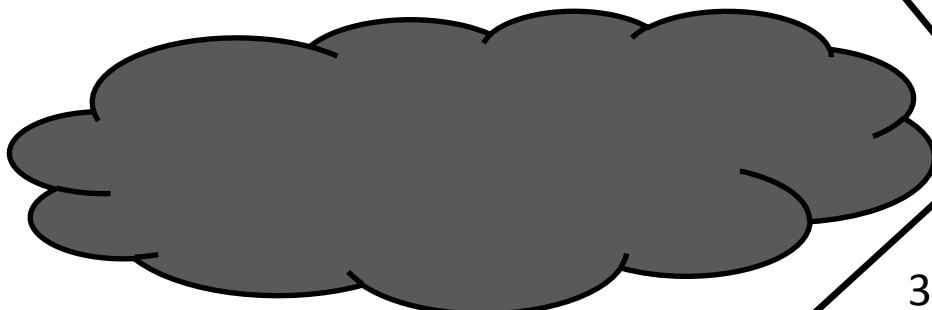
A (7)

I (8)

J (7)

2

K (8)



Z (11)

Hill Climbing **H** (9)

S (8)

3

B (5)

2

D (6)

2

E (6)

3

F (3)

3

G (0)

4

C (4)

4

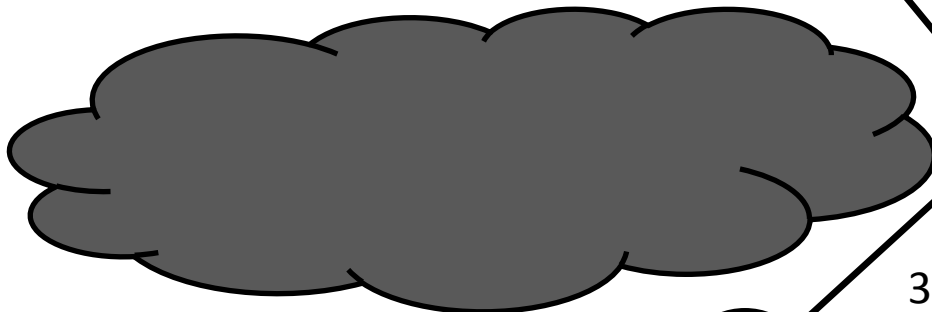
A (7)

I (8)

J (7)

2

K (8)



Z (11)

Hill Climbing **H** (9)

S (8)

3

B (5)

2

D (6)

2

E (6)

3

F (3)

3

G (0)

4

C (4)

4

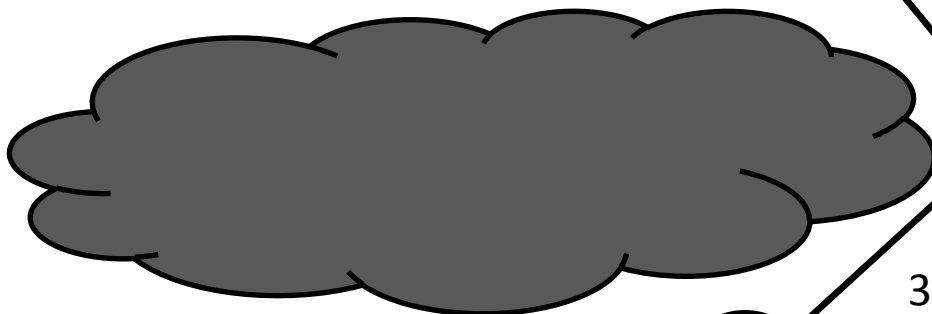
A (7)

I (8)

J (7)

2

K (8)



Z (11)

Hill Climbing **H** (9)

S (8)

3

B (5)

2

D (6)

2

E (6)

3

F (3)

3

G (0)

4

C (4)

4

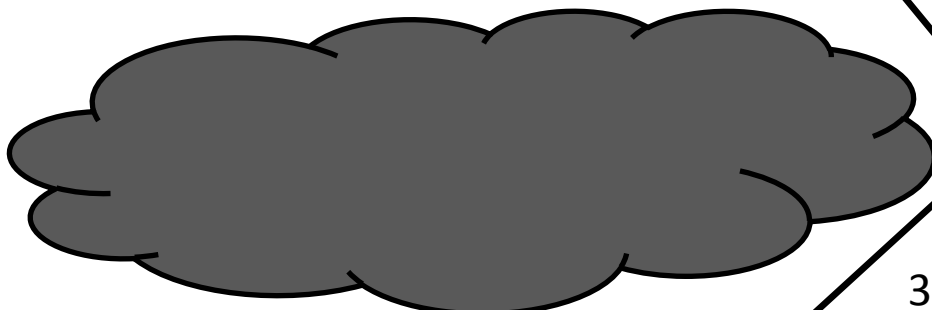
A (7)

I (8)

J (7)

2

K (8)



Z (11)

Hill Climbing **H** (9)

S (8)

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B (5)

2

D (6)

2

E (6)

3

F (3)

3

G (0)

4

C (4)

4

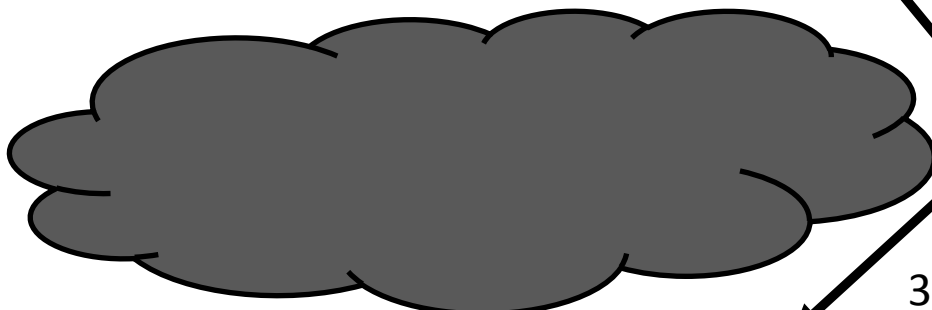
A (7)

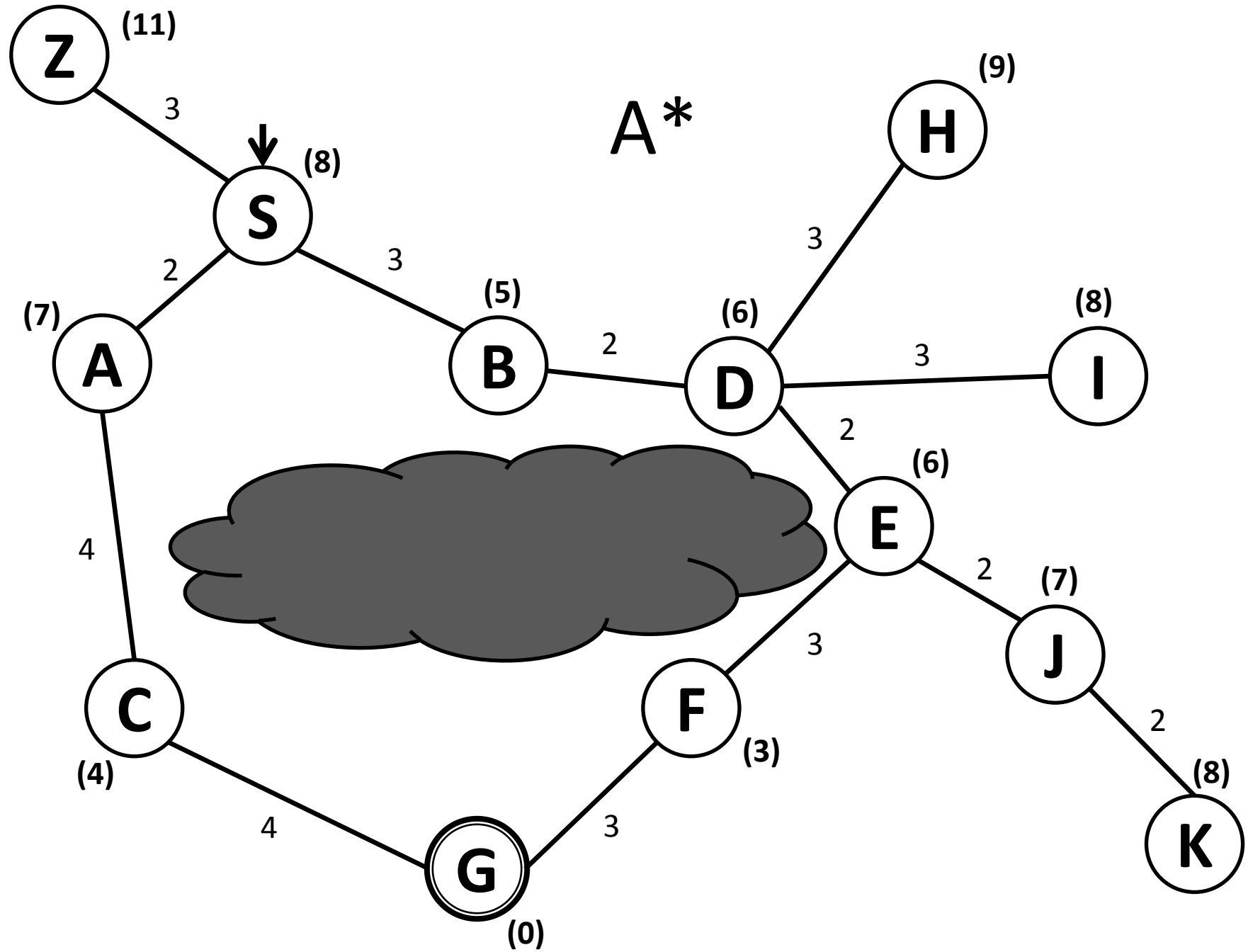
I (8)

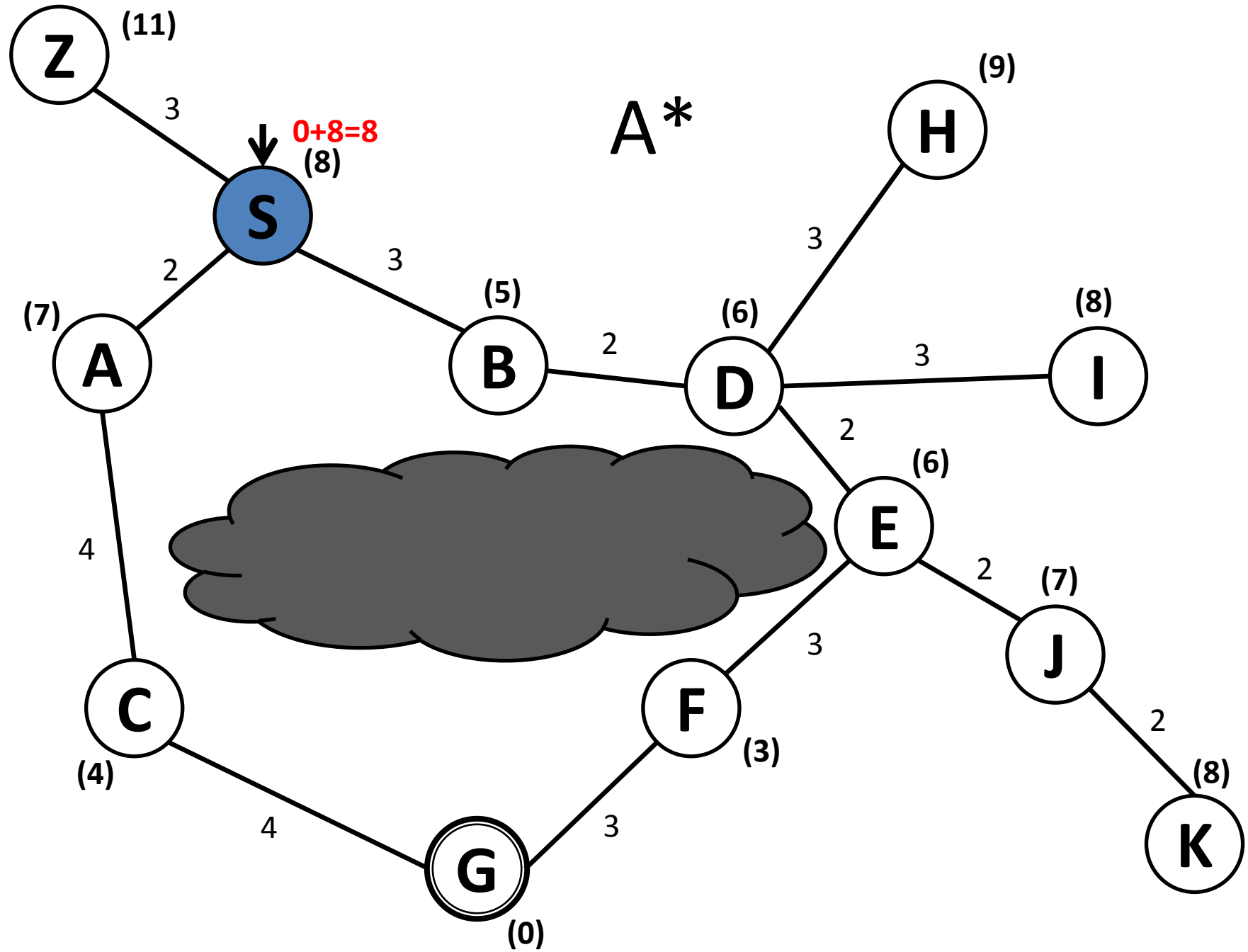
J (7)

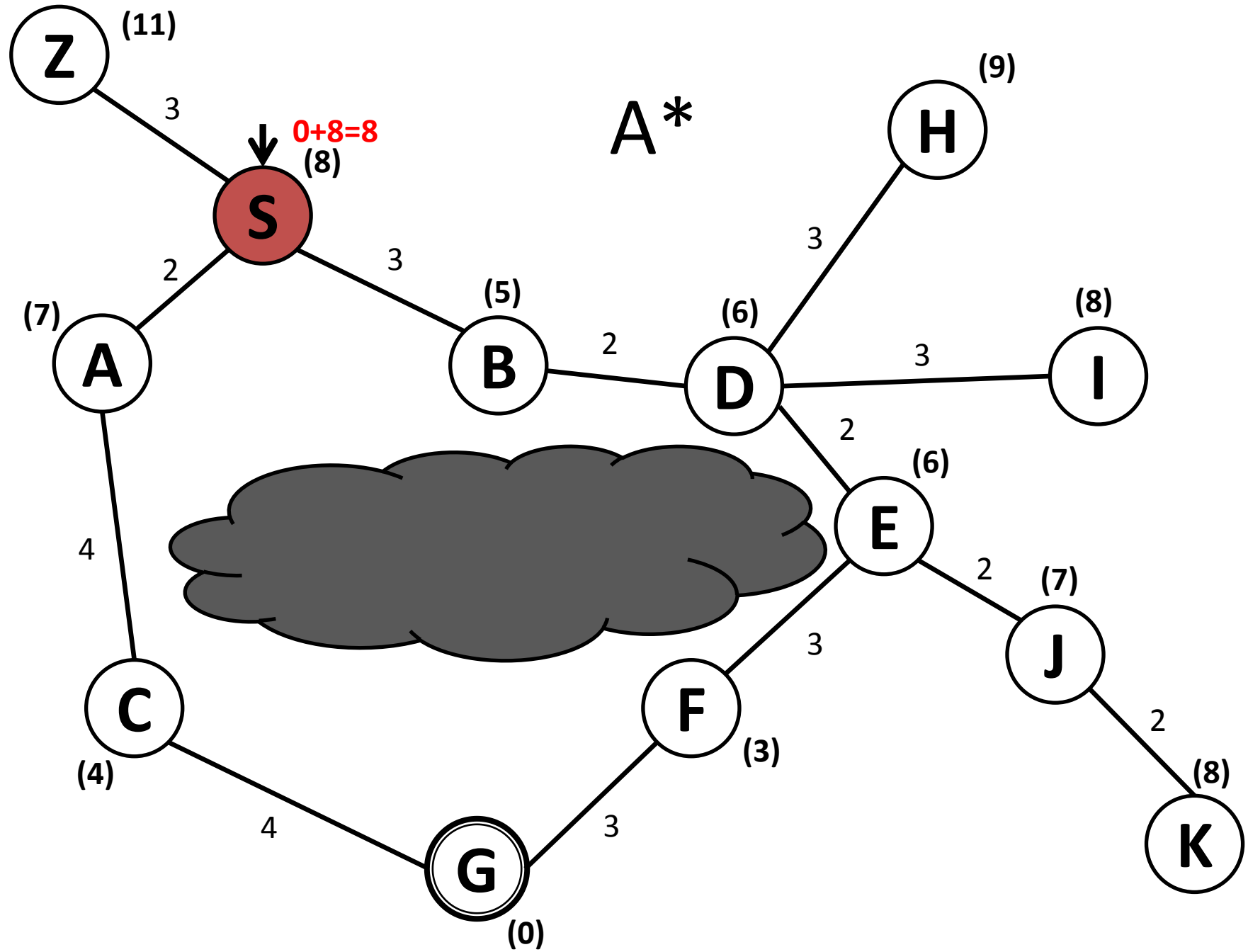
2

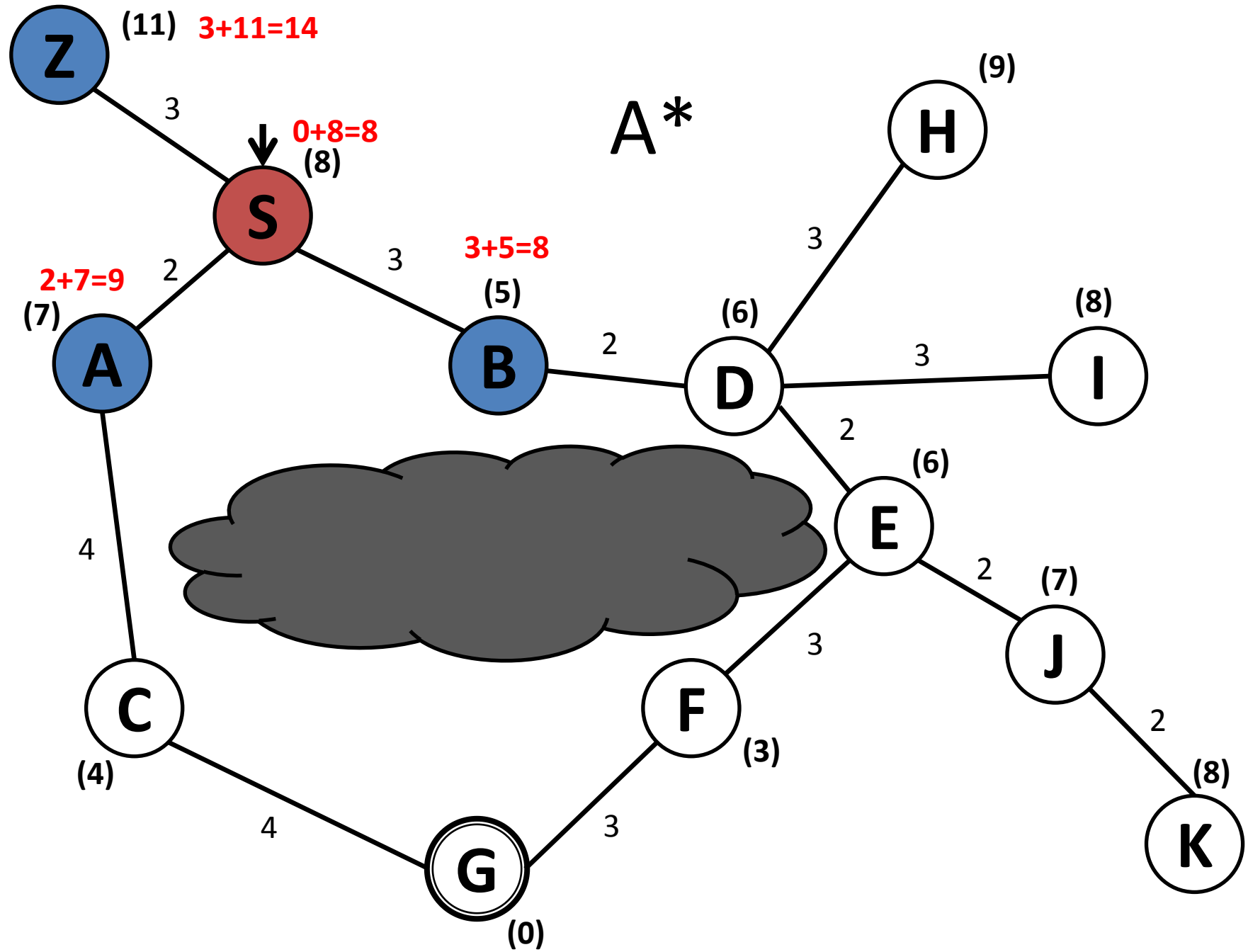
K (8)

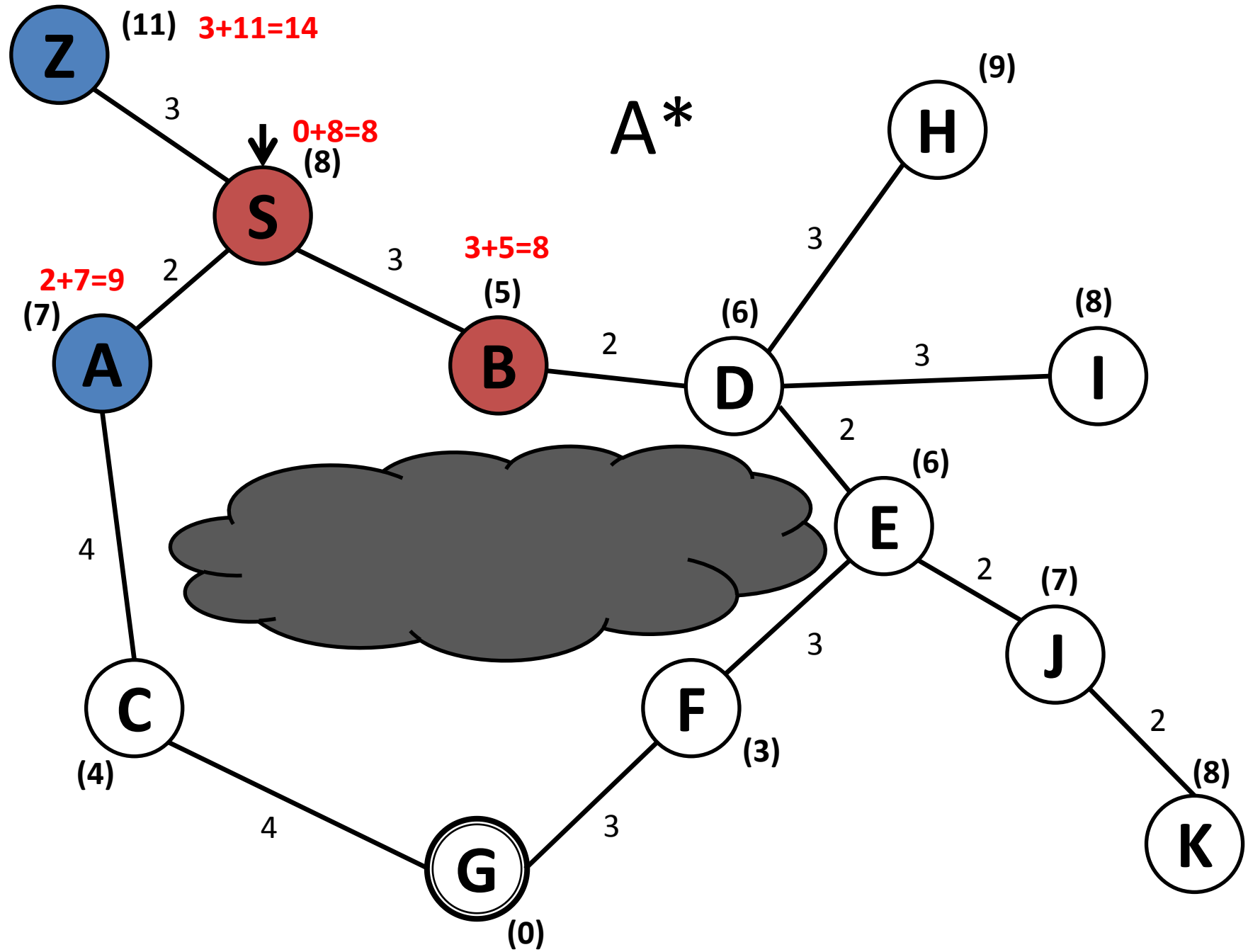


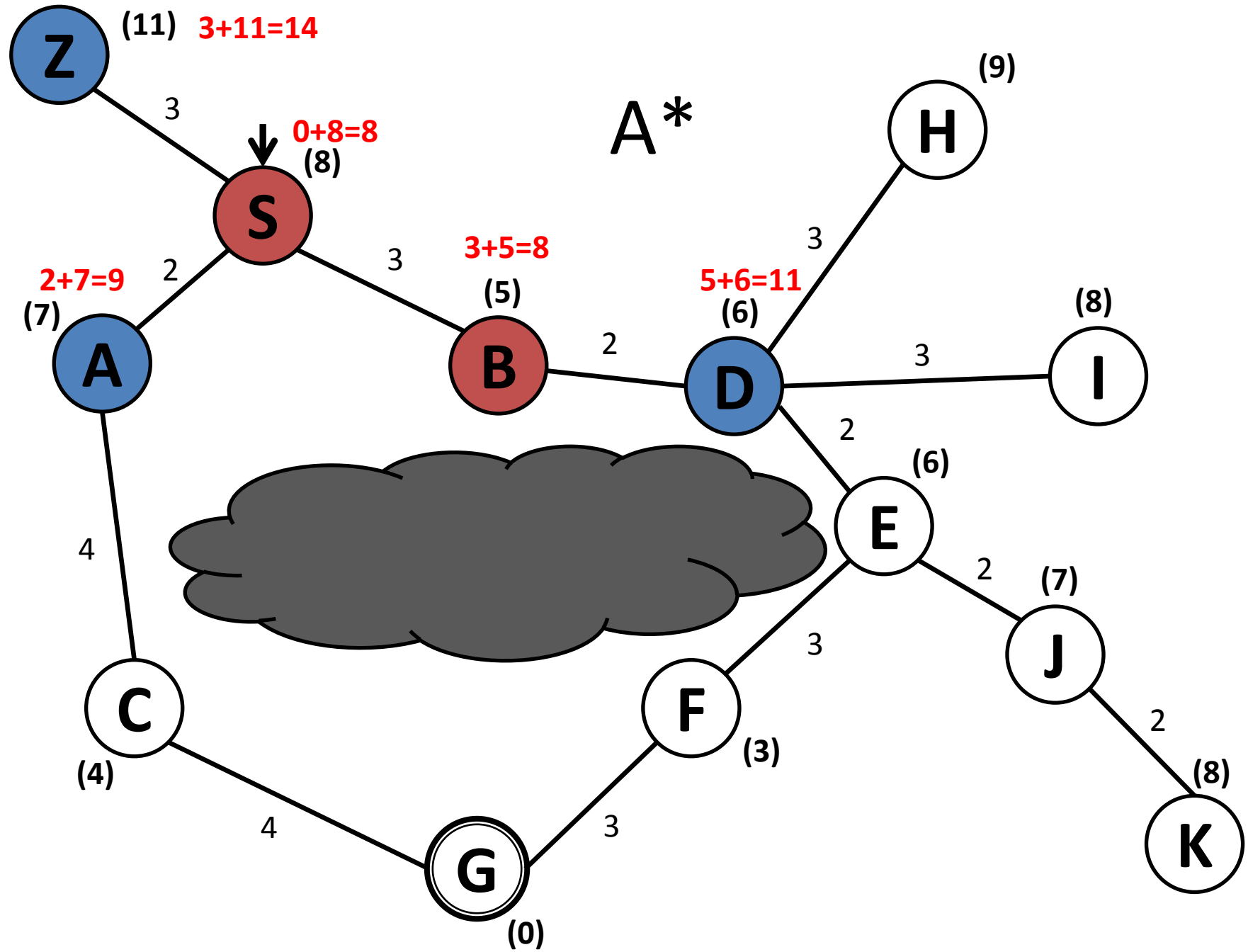


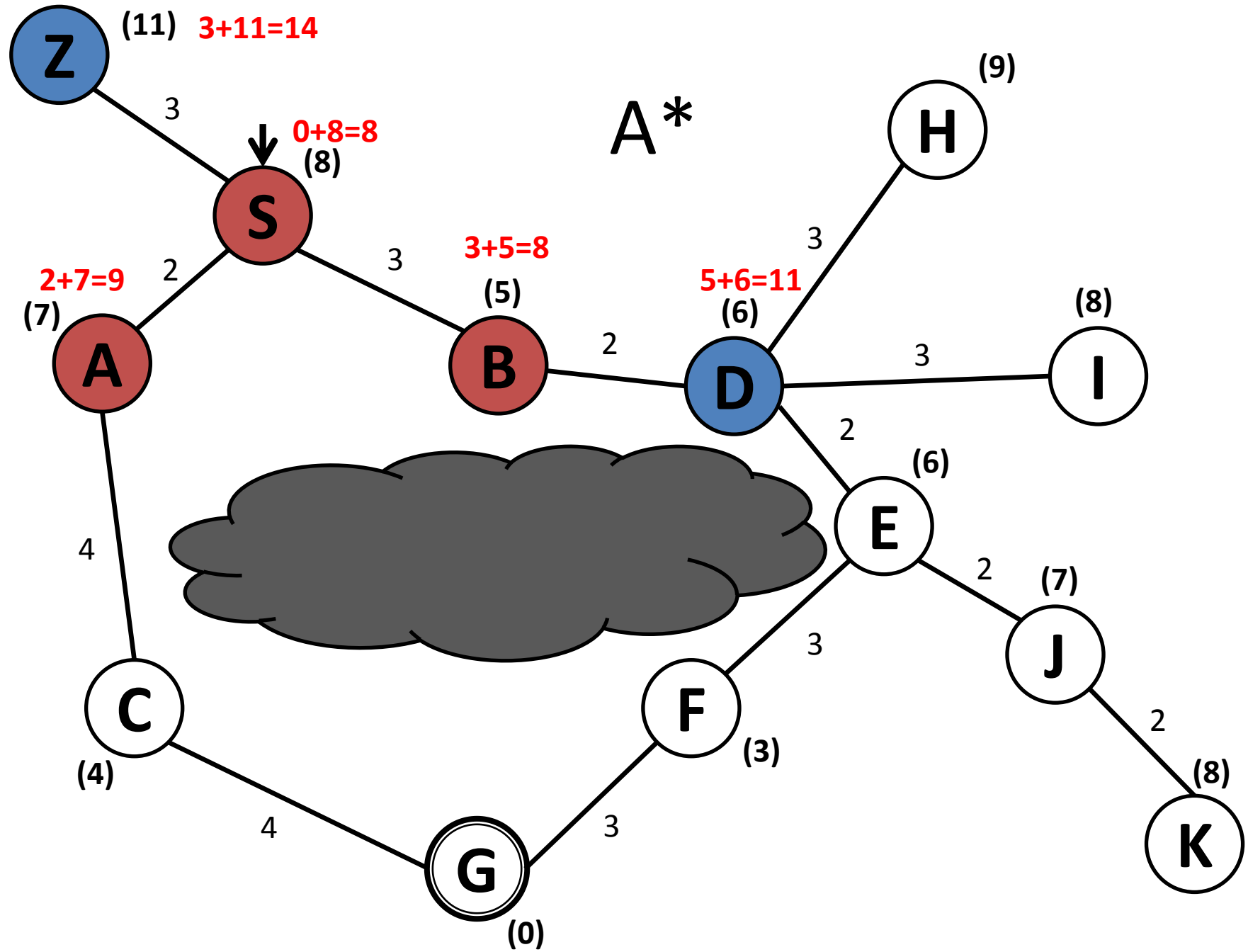


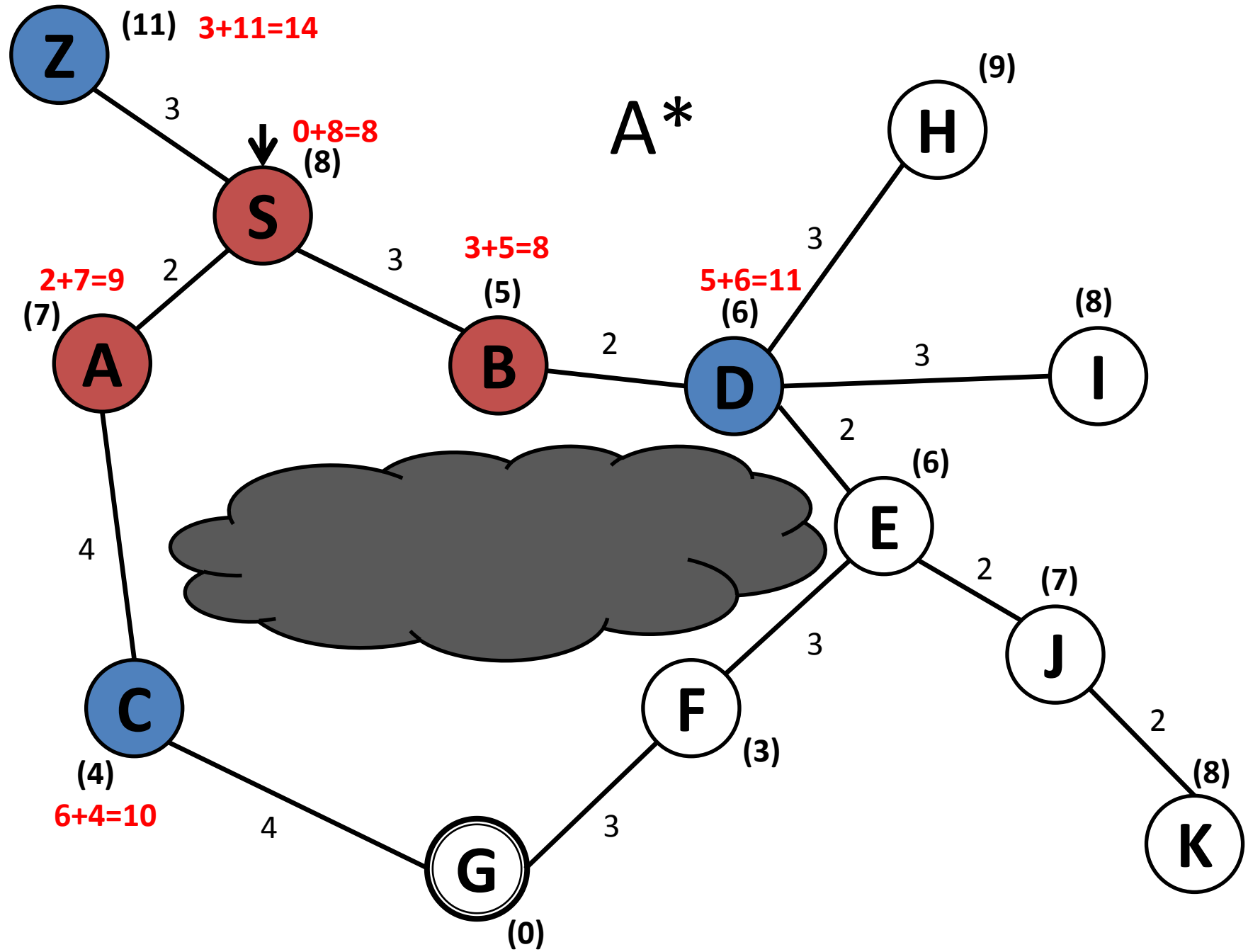


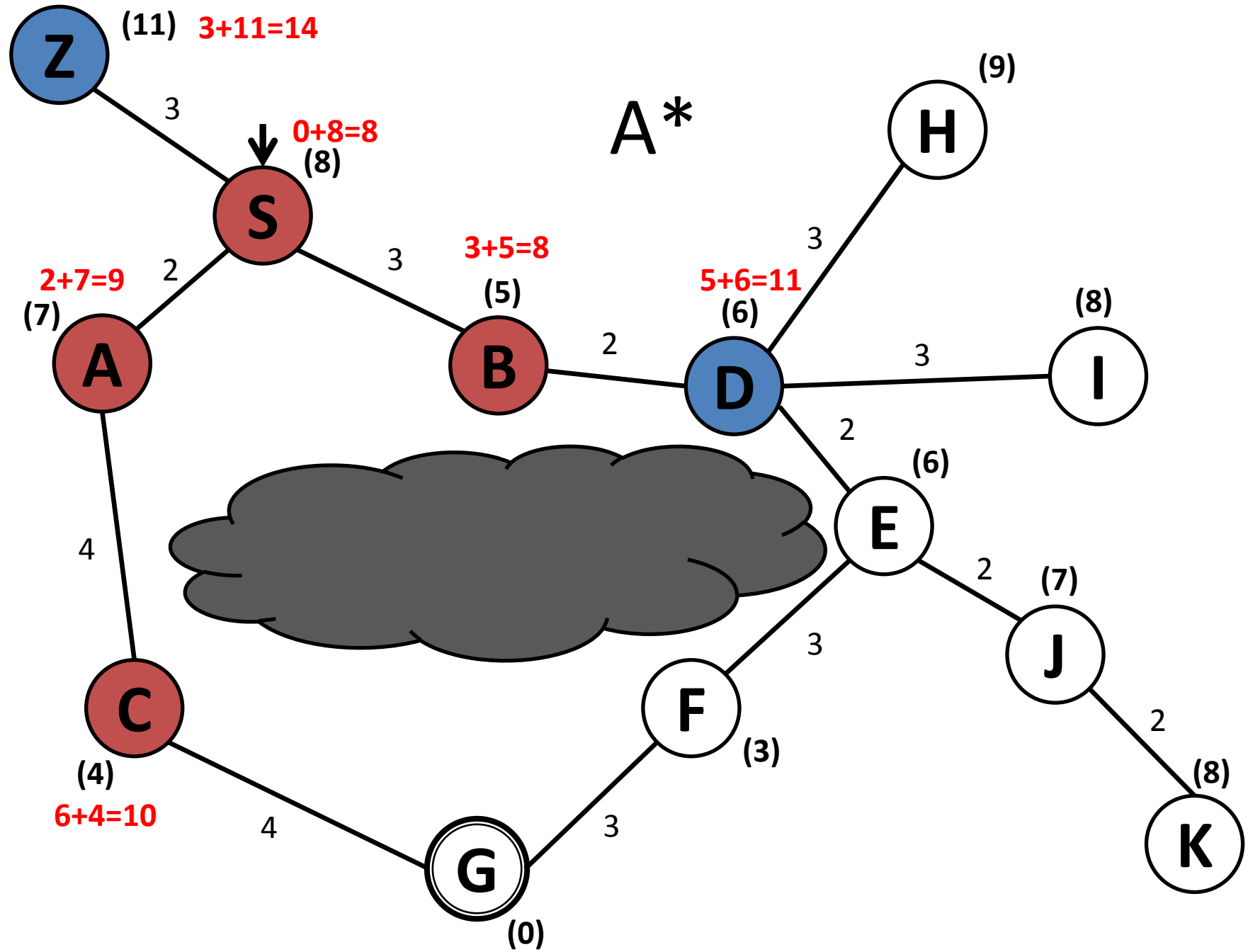


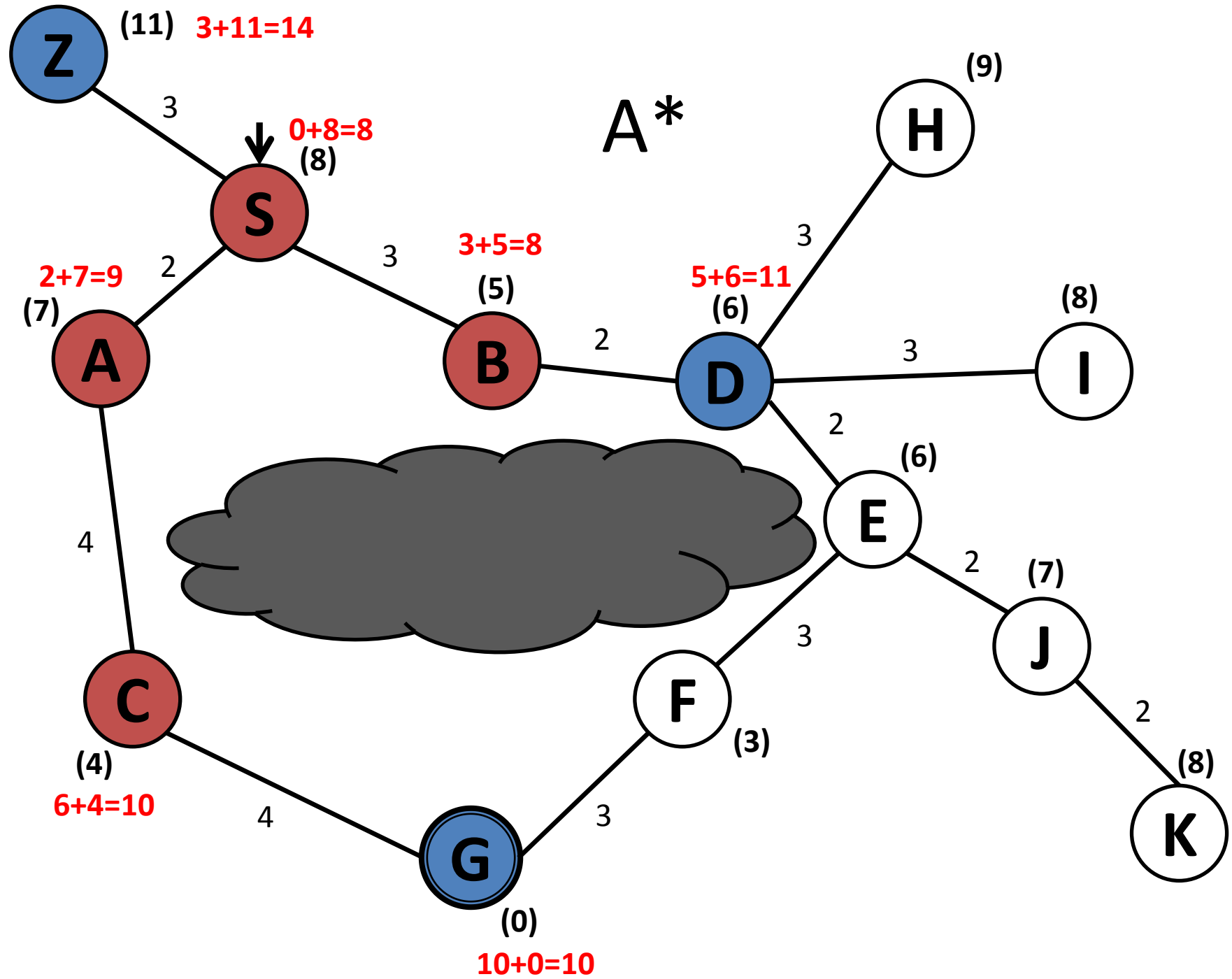


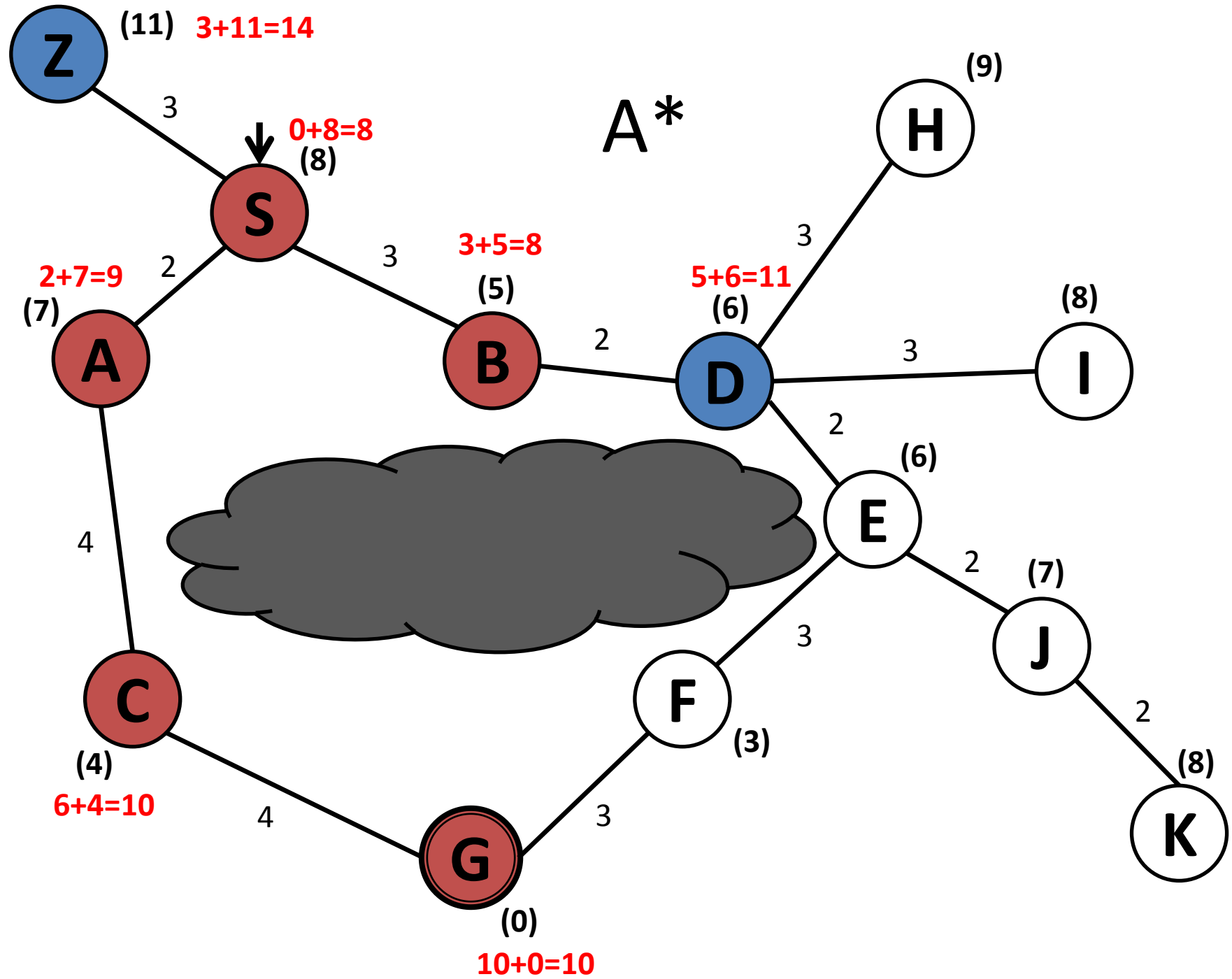


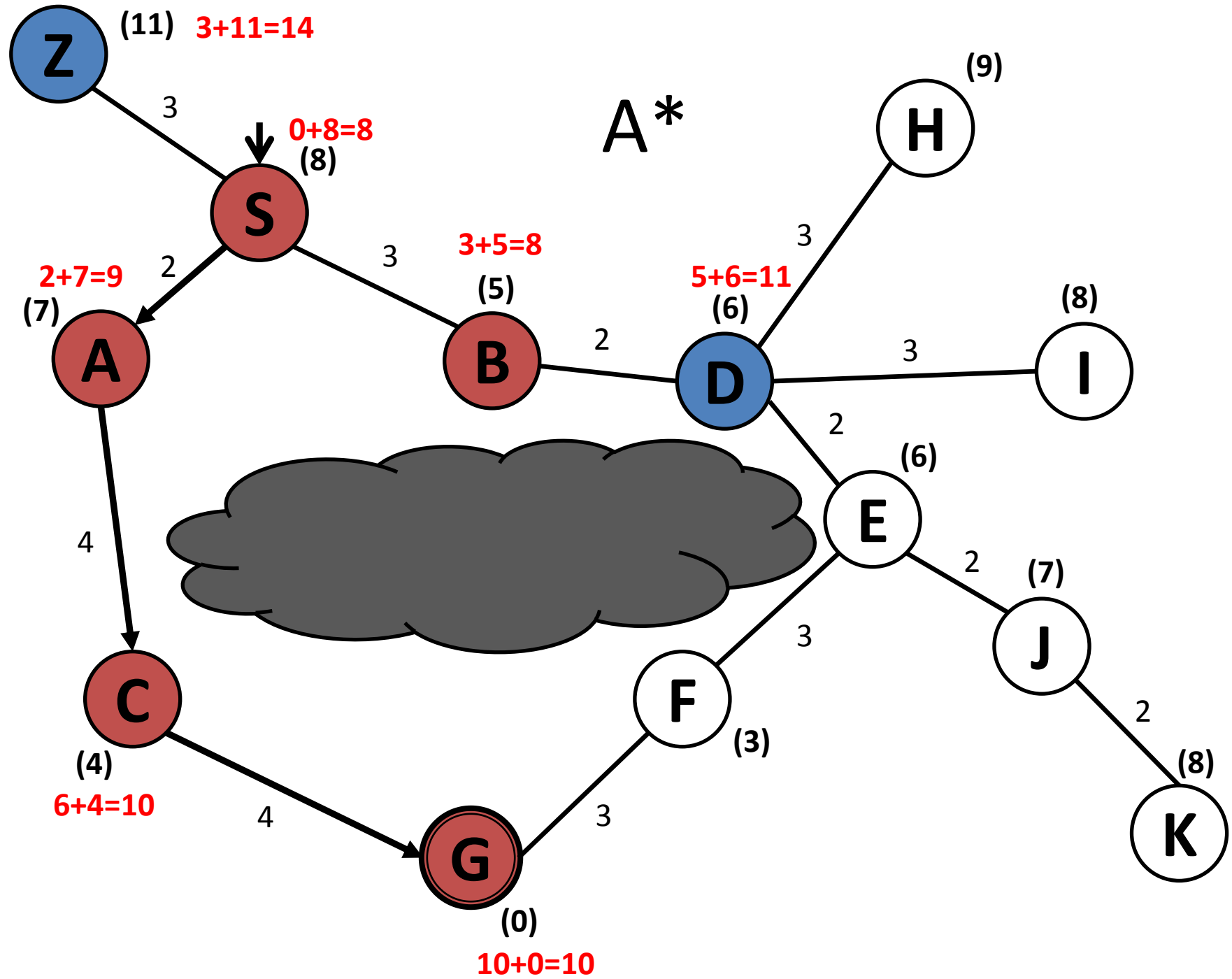






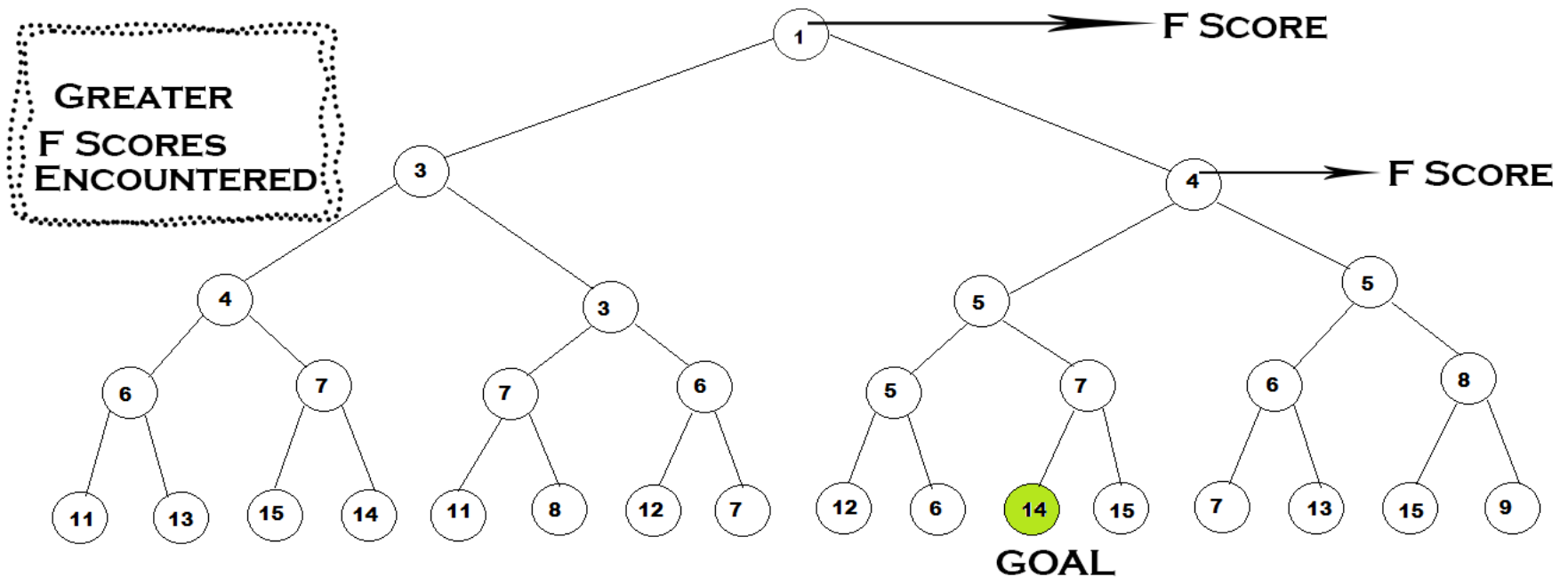






Memory-Based A*

Iterative Deepening A*



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