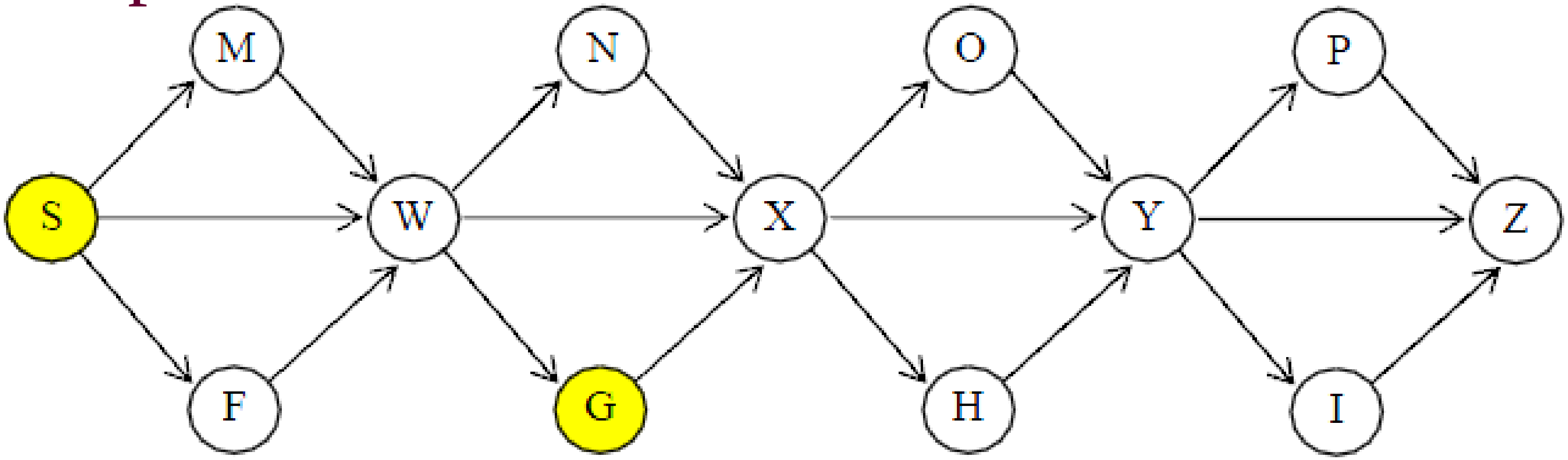
Example1



Your job is to find a path from the Start node, S, to the Goal node, G, using various algorithms under various conditions.

All streets are one-way, left to right.

In the event any search reaches a point where you need to break a tie, use this rule: a path that terminates in a node closer to the ***top of the page*** takes precedence over another that terminates in a node that is less close**;** if there is still a tie, a path that terminates in a node closer to the **left of the page** takes precedence over another that terminates in a node that is less close.

Breadth first search

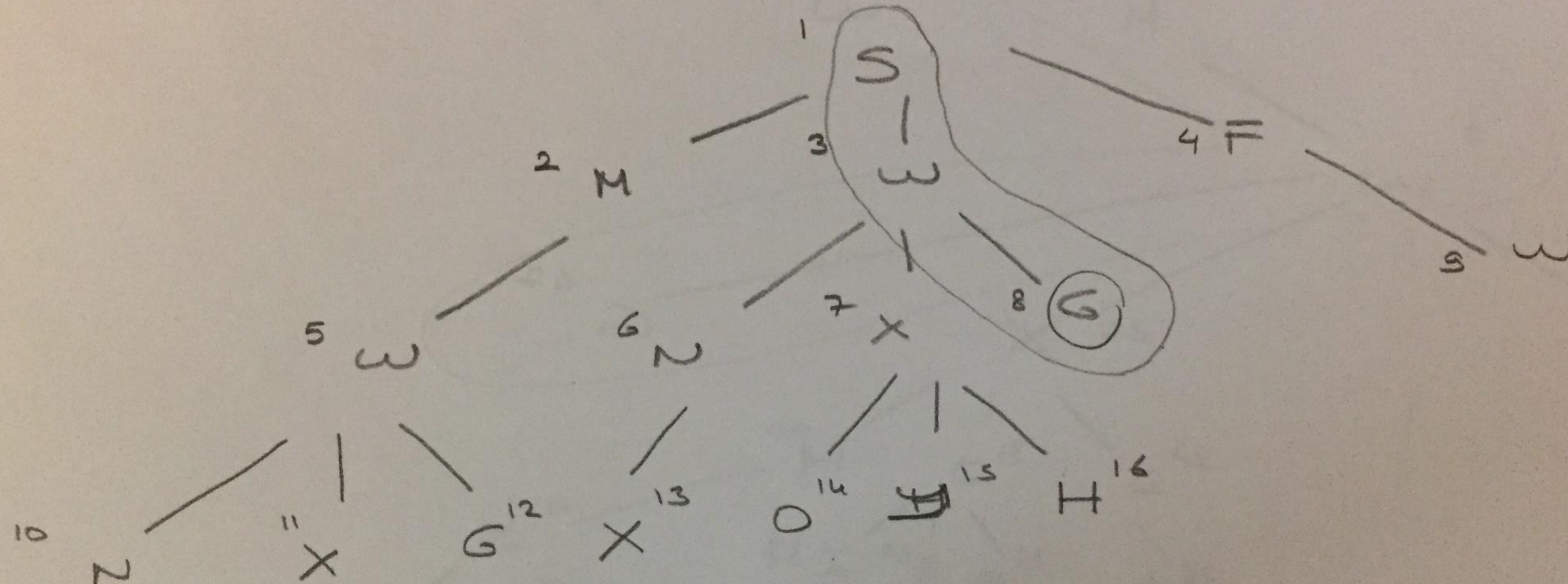
You are to perform **breadth-first-search**.
Do not use a visited list.
Do not extend any partial path to a node that it already contains.
Use the convention that a path to the goal is only returned when the goal node is expanded, not as soon as it appears in the queue.

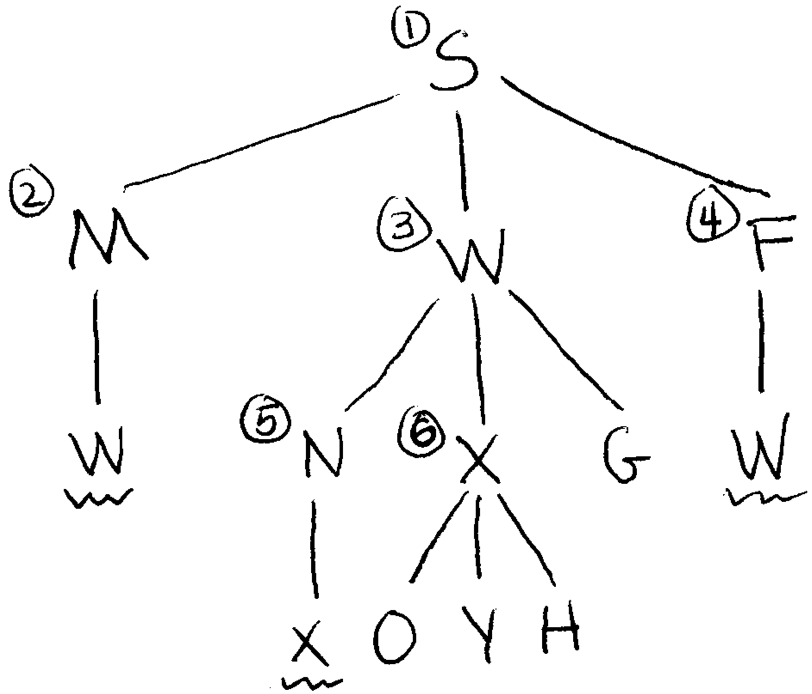
-Write down all the nodes expanded, in the order in they are expanded.

-Give the full path that is returned.

Example 1

Breadth-First Search





-Write down all the nodes expanded, in the order in they are expanded.

S M W F (W) N X G (W) (X) O Y H G

-Give the full path that is returned.

S W G

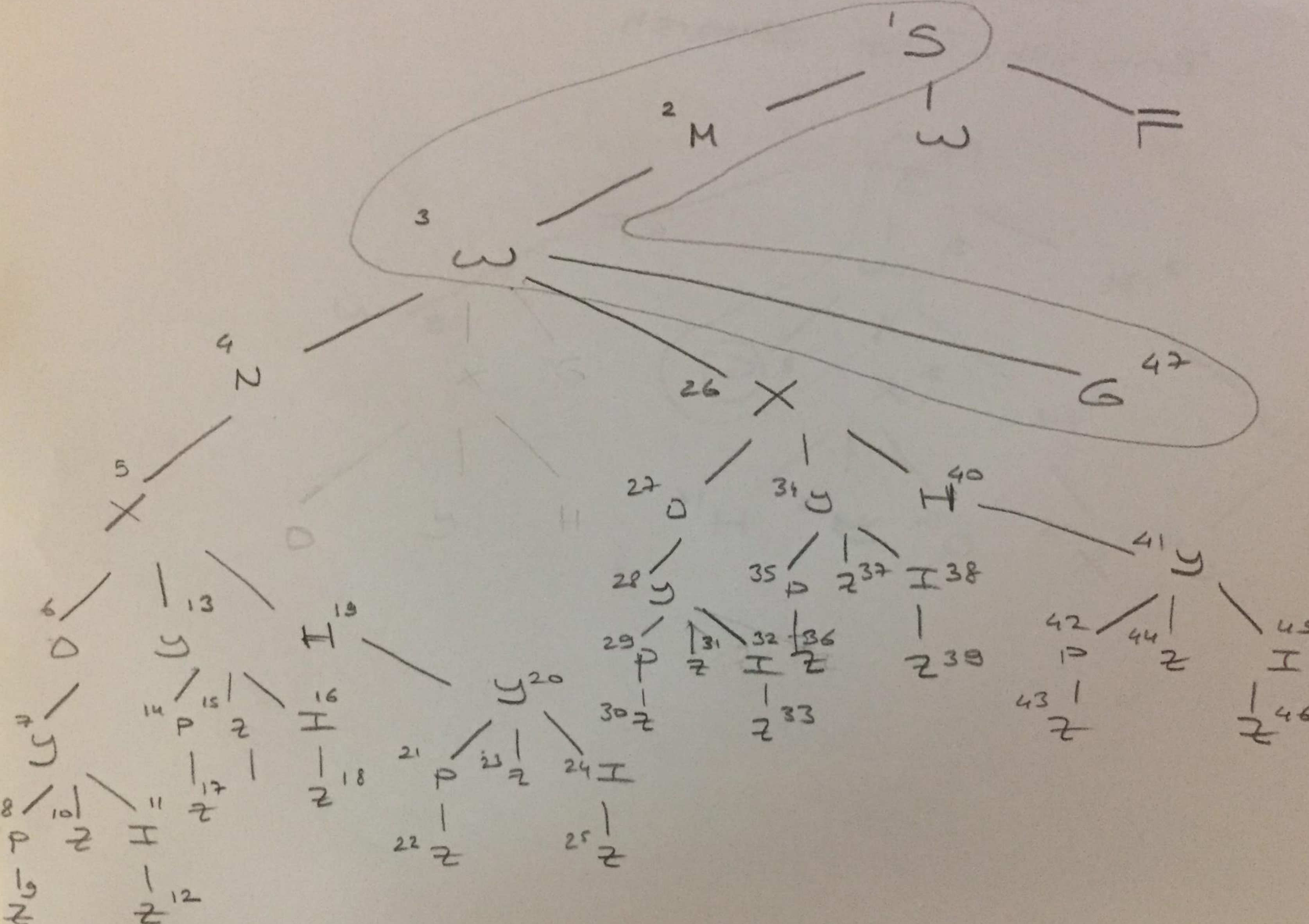
Depth first search

Perform **depth-first-search**. Do not use a visited list.
Do not expand any partial path to a node that it already contains.
Use the convention that a path to the goal is only returned when the goal node is expanded, not as soon as it appears in the queue.

- Write down all the nodes expanded, in the order in they are expanded

- Give the full path that is returned.

Example 1
Depth First Search



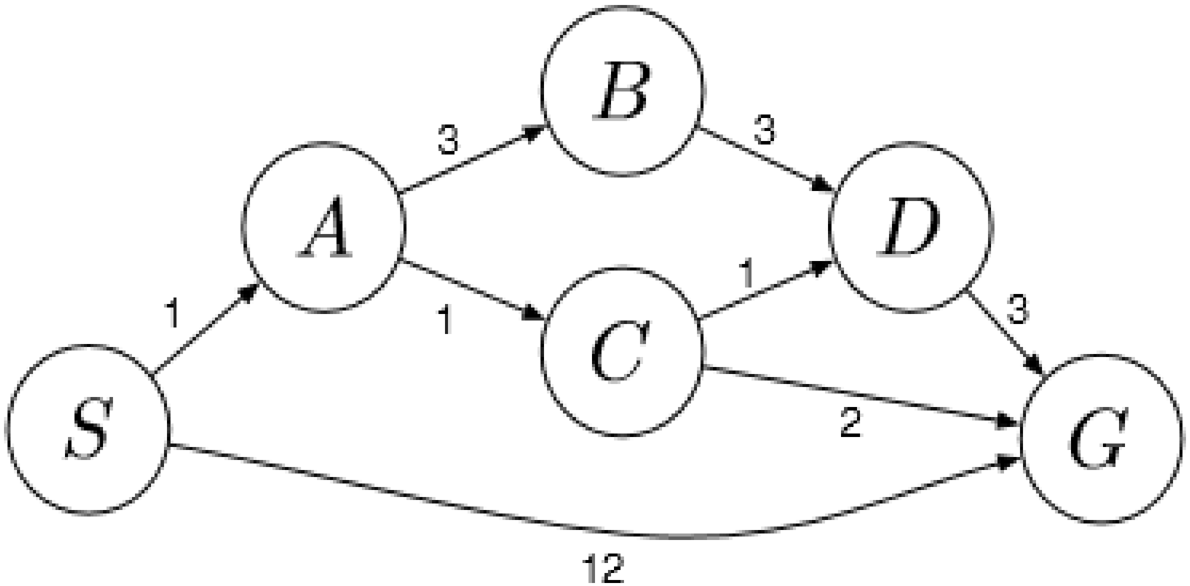
- Write down all the nodes expanded, in the order in they are expanded

S M W N X O Y P Z (Z) I (Z) (Y) H (Y) (X) G

- Give the full path that is returned.

. S M W G

Example 2

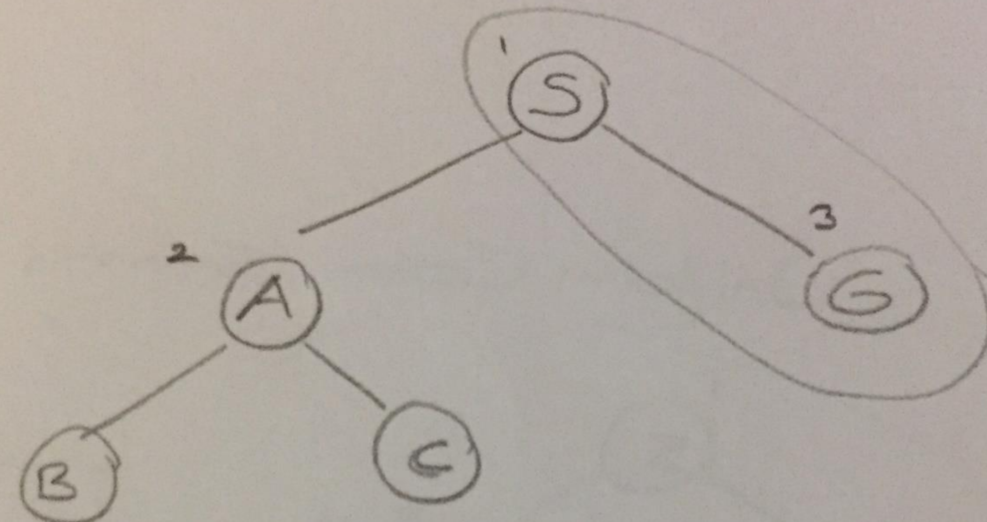


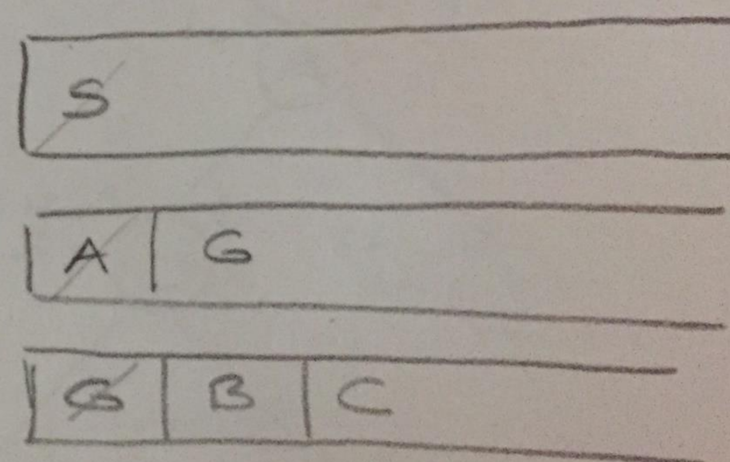
What path would **breadth-first** graph search return for this problem?

What path would **uniform cost** graph search return for this problem?

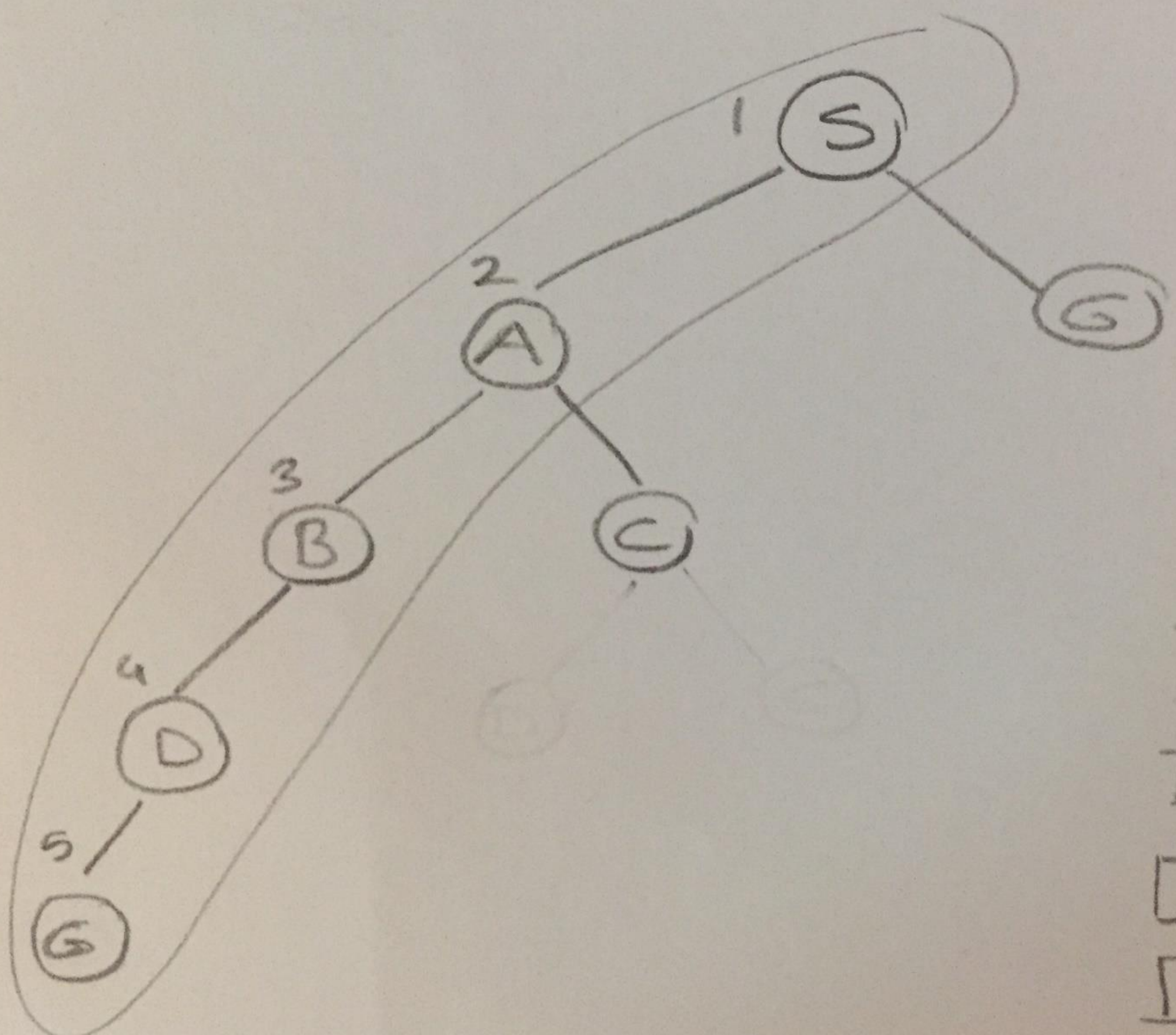
What path would **depth-first** graph search return for this problem?

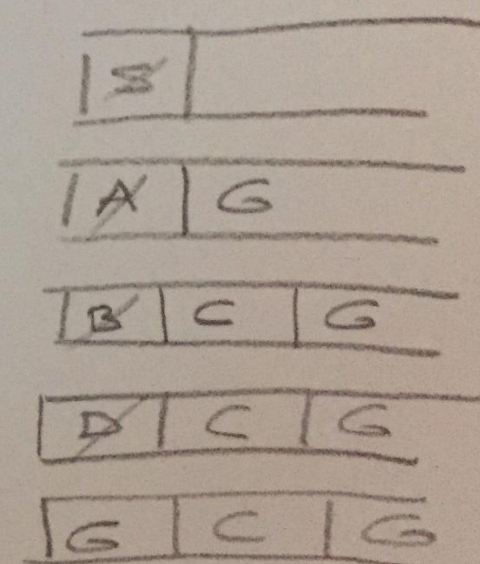
Example 2 Breadth-first search



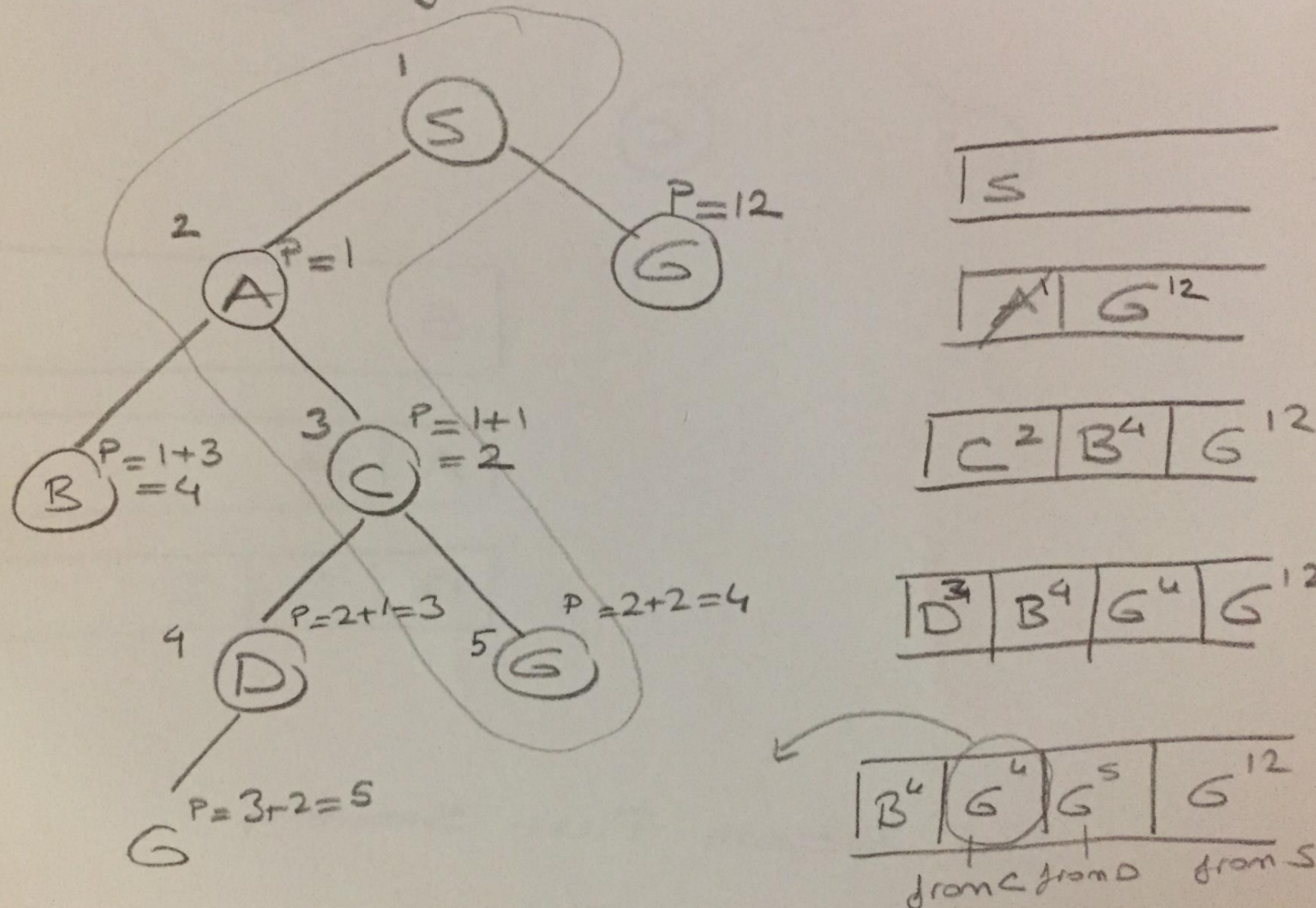


Depth First Search





Uniform Cost Search



What path would **breadth-first** graph search return for this problem?

S −G

What path would **uniform cost** graph search return for this problem?

S −A−C −G

What path would **depth-first** graph search return for this problem?

S −A−B−D−G

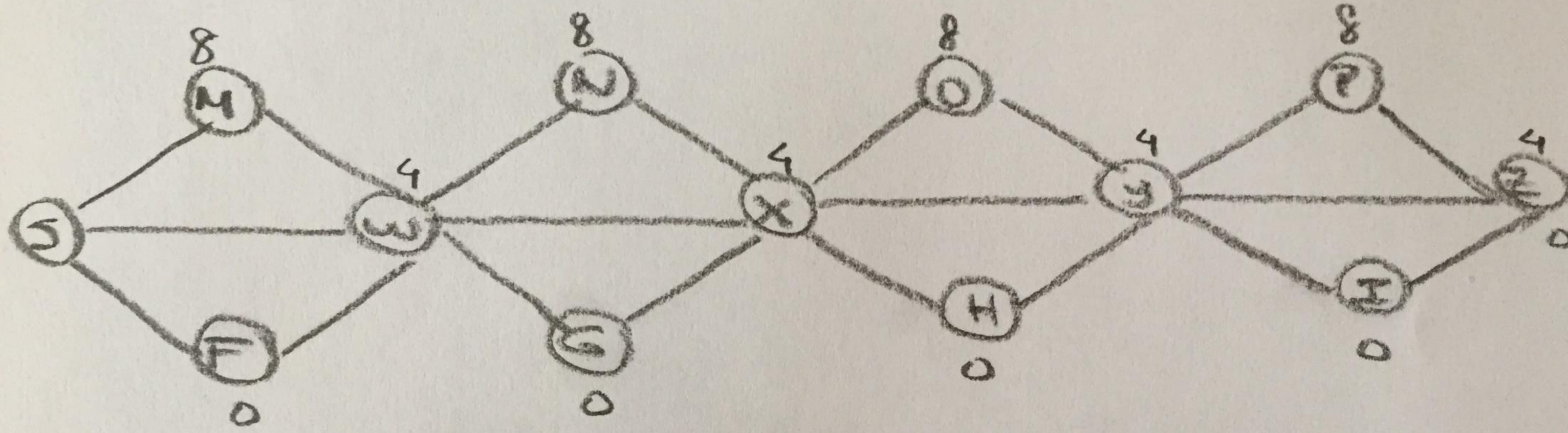
A* search

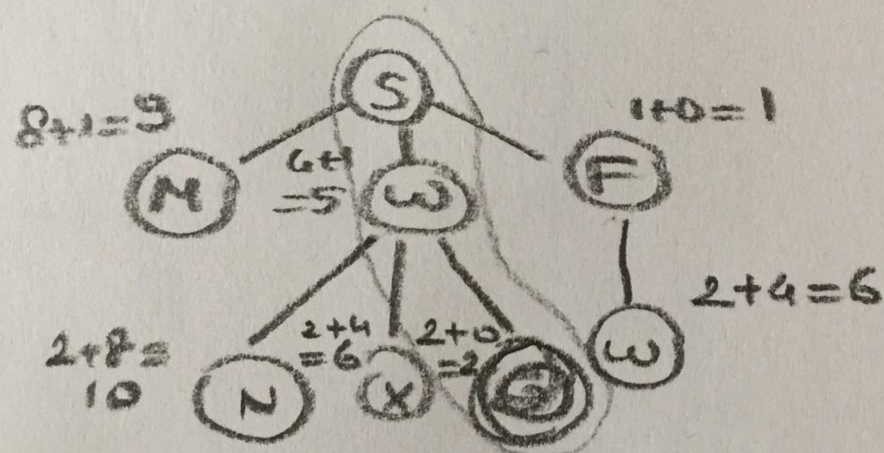
Find the optimal path using the A* algorithm, using the following heuristic

$h(n) = 8$ if n is M, N, O, P

4 if n is W, X, Y, Z

0 otherwise





expanded

S F W G

path

S W G

Solution

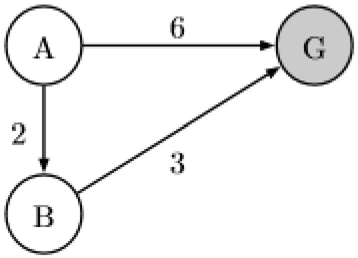
Write down all the nodes expanded, in the order they are expanded.

S F W G

Give the full path that is returned.

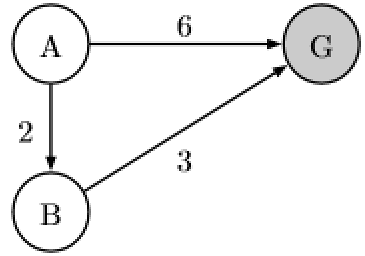
S W G

Consider the search problem shown on the left. It has only three states, and three directed edges. A is the start node and G is the goal node. To the right, four different heuristic functions are defined, numbered I through IV.



	h(A)	h(B)	h(G)
I	4	1	0
II	5	4	0
III	4	3	0
IV	5	2	0

For each heuristic function, circle whether it is admissible and whether it is consistent with respect to the search problem given above. Explain your reasons.



	h(A)	h(B)	h(G)
I	4	1	0
II	5	4	0
III	4	3	0
IV	5	2	0

	Admissible?		**Consistent?**	
I	Yes			No
II		No	Yes	
III	Yes		Yes	
IV	Yes			No

II is the only inadmissible heuristic, as it overestimates the cost from B: h(B) = 4, when the actual cost to G is 3. To check whether a heuristic is consistent, ensure that for all paths, $h(N)-h(L) \leq path(N \rightarrow L)$, where N and L stand in for the actual nodes. In this problem, h(G) is always 0, so making sure that the direct paths to the goal ($A \rightarrow G$ and $B \rightarrow G$) are consistent is the same as making sure that the heuristic is admissible.

The path from A to B is a different story.
Heuristic I is not consistent: $h(A)-h(B) = 4-1 = 3$ is not $\leq path(A \rightarrow B) = 2$.
Heuristic III is consistent: $h(A)-h(B) = 4-3 = 1 \leq 2$
Heuristic IV is not consistent: $h(A)-h(B) = 5-2 = 3$ is not ≤ 2

State whether the following sentences are true or not. Explain your reasons

(True or False) Heuristic function IV dominates III. no
Reason:

(True or False) Heuristic function IV dominates I. yes

Reason:
For one heuristic to dominate another, all of its values must be greater than or equal to the corresponding values of the other heuristic. Simply make sure that this is the case. If it is not, the two heuristics have no dominance relationship.