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A star

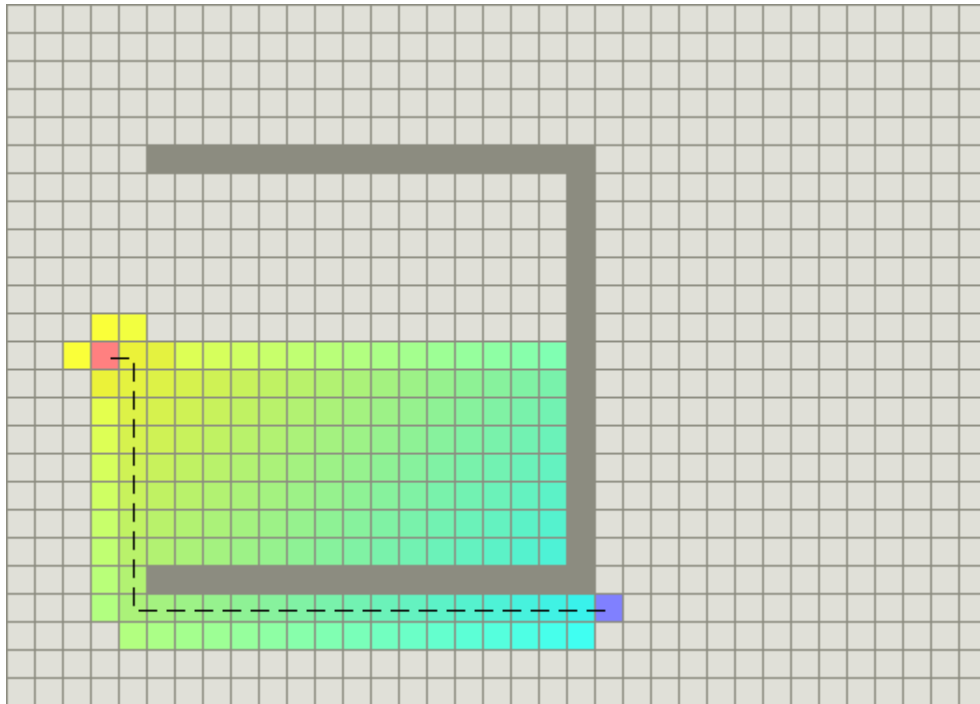
A* (pronounced ".A-star") is a graph traversal and path search algorithm, which is used in many fields of computer science due to its completeness, optimality, and optimal efficiency.

We defined here the next **metrics**:

$$f(n) = g(n) + h(n)$$

$g(n)$: Cost from the start to the node n.

$h(n)$: Cost from the node n to the end.



Algorithm

OPEN = The set of nodes to be evaluated.

CLOSED = The set of nodes already evaluated.

Add the start node to open

loop

 current = node in OPEN with the lowest f - cost

 remove current from OPEN

 add current to CLOSED

 if current is the target node:

 finish

 for each neighbour of the current node:

 if neighbour is not traversable or neighbour is in closed

 skip to the next neighbour

 if new_path to neighbour (g) is shorter or neighbour is not open:

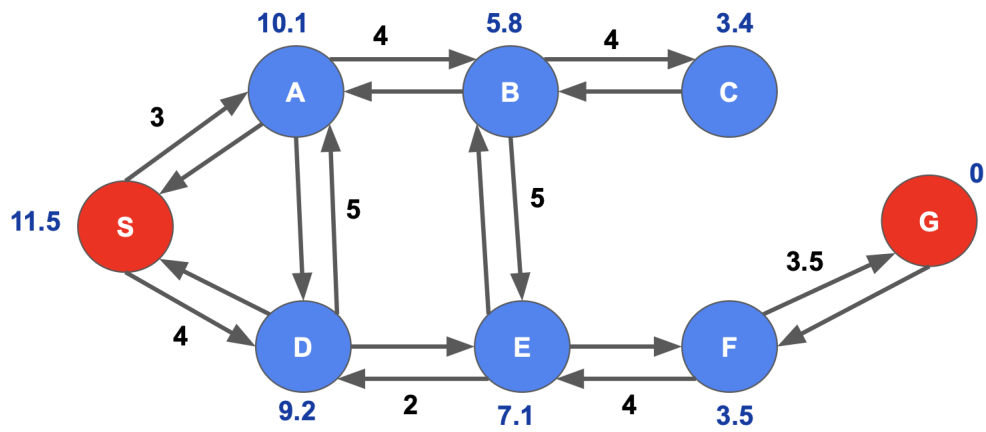
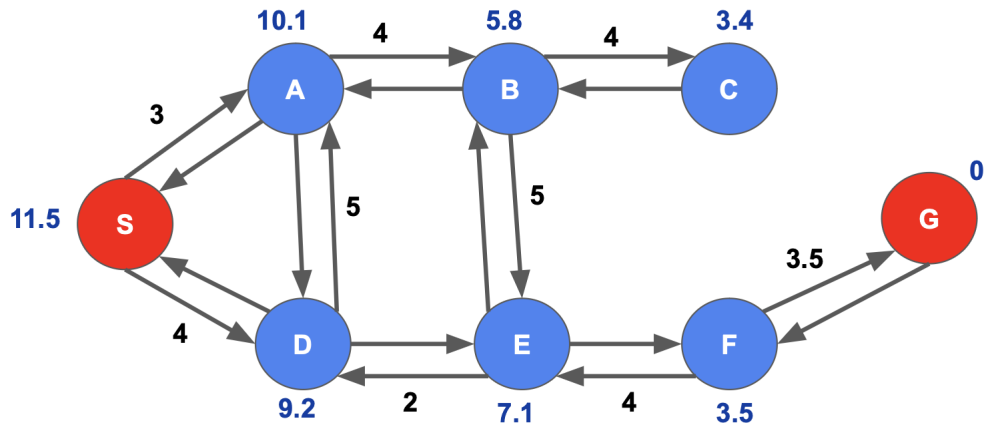
 set f_cost of neighbour

 set parent of neighbour to current

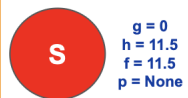
 if neighbour is not open

 add neighbour to OPEN

Example



OPEN



CLOSED

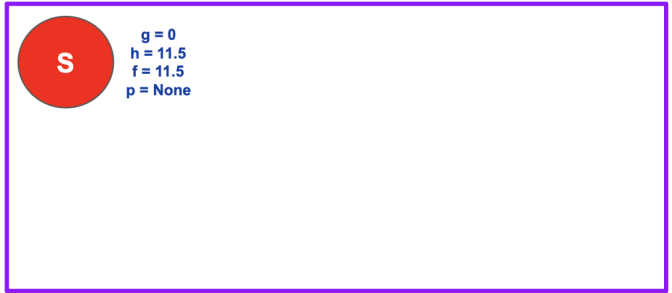
SELECT FROM OPEN SET



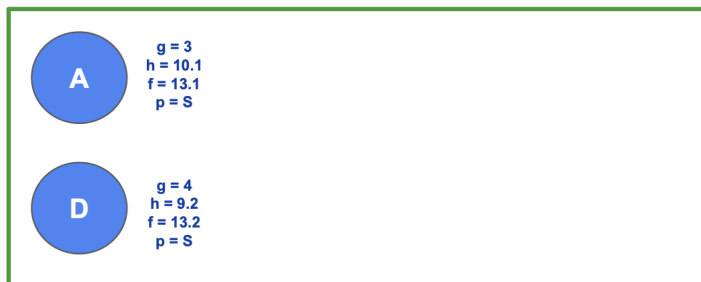
OPEN



CLOSED



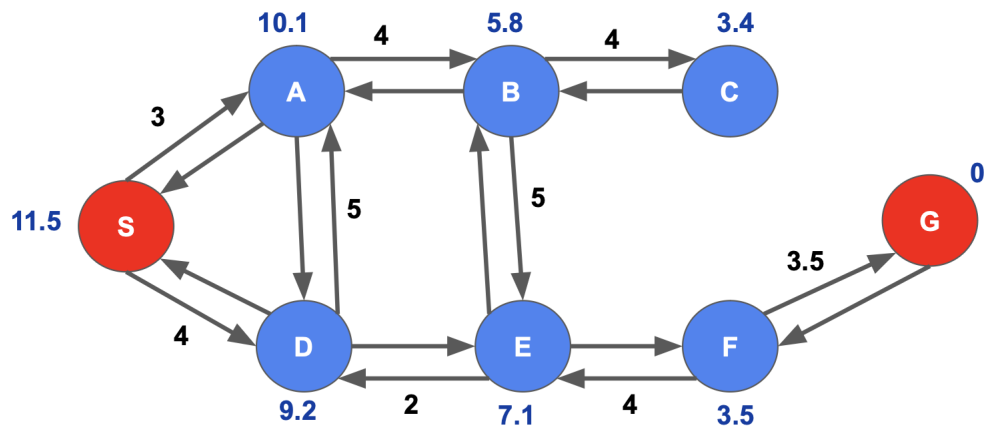
NEIGHBOURS



- A it wasn't visited. Add to Open.
- D it wasn't visited. Add to Open.

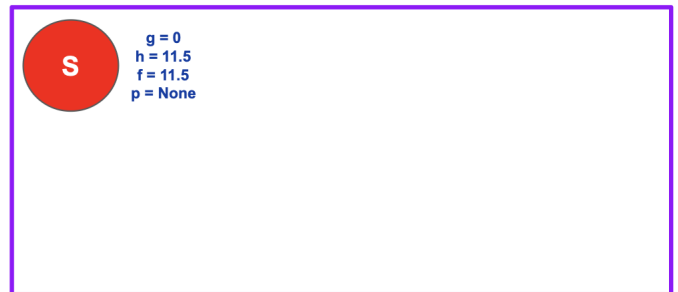
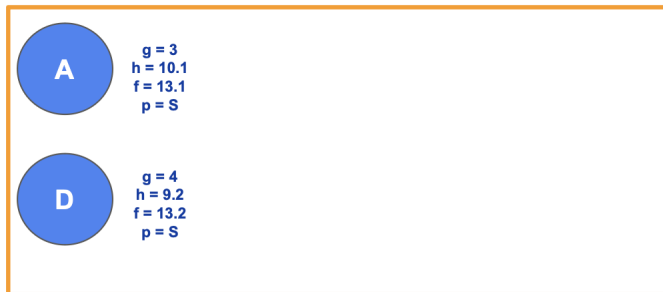
OPEN





OPEN

CLOSED

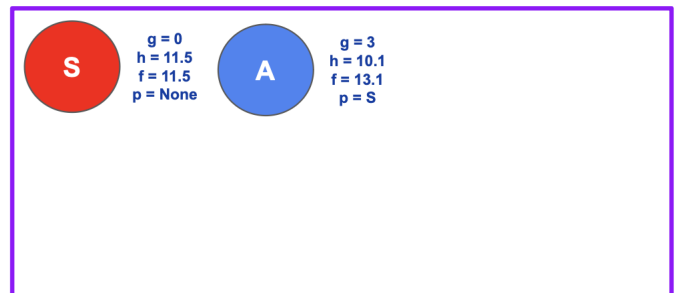
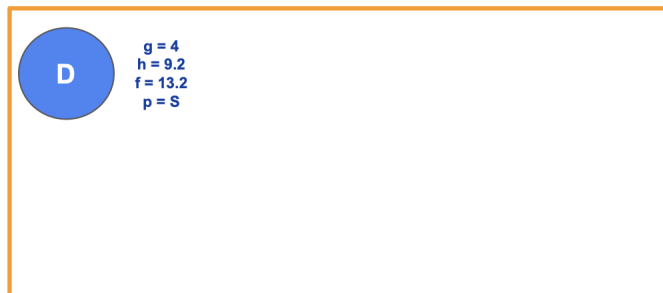


SELECT FROM OPEN

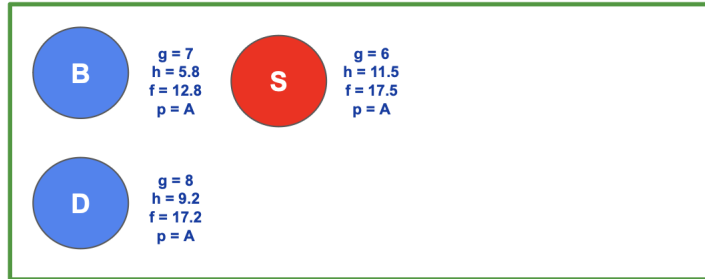
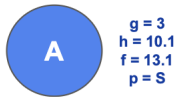


OPEN

CLOSED

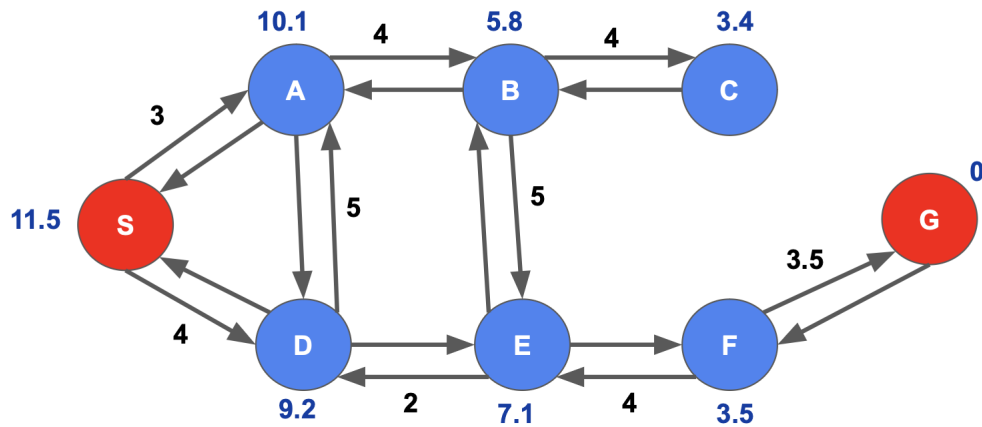


NEIGHBOURS



- S is in closed set. Not consider S.
- D is in open, but his g now is greater. Not consider D.
- B it wasn't visited. Add to Open.

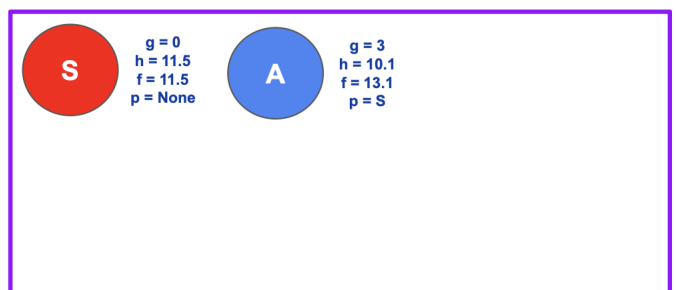
OPEN



OPEN



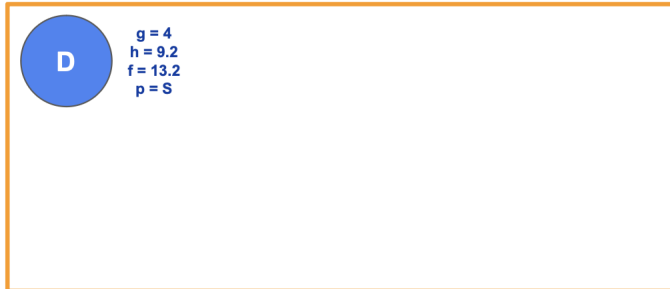
CLOSED



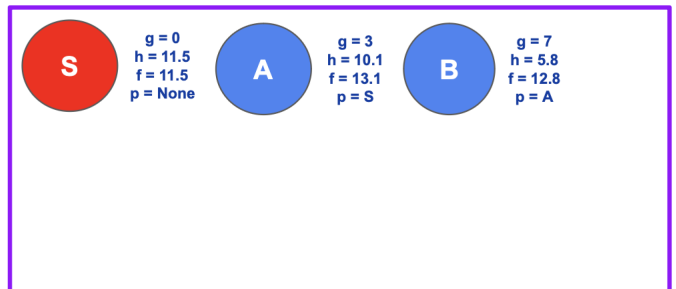
SELECT FROM OPEN



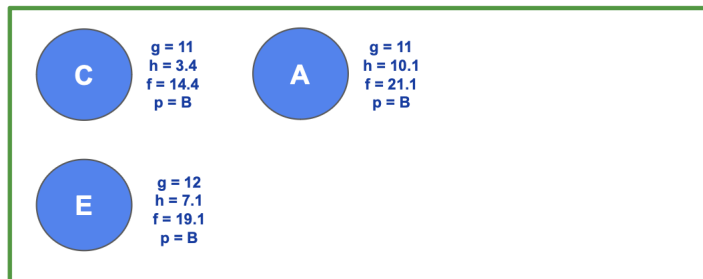
OPEN



CLOSED

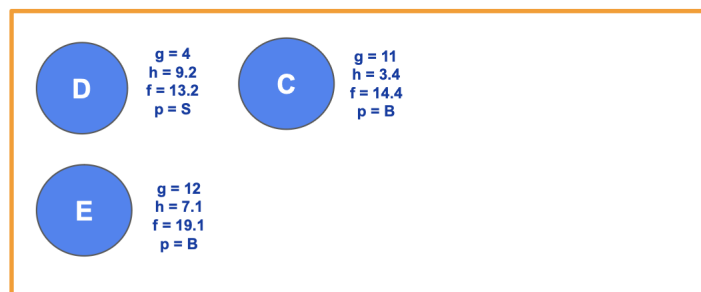


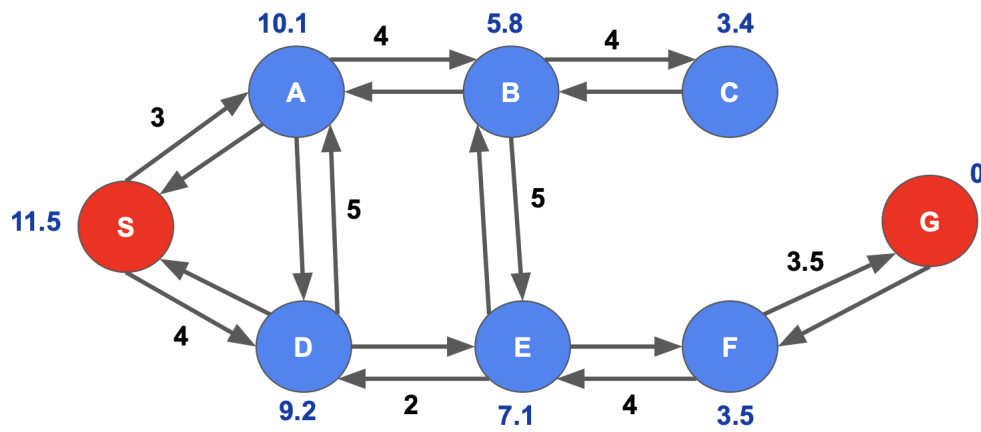
NEIGHBOURS



- A is in closed set. Not consider A.
- C it wasn't visited. Add to Open.
- E it wasn't visited. Add to Open.

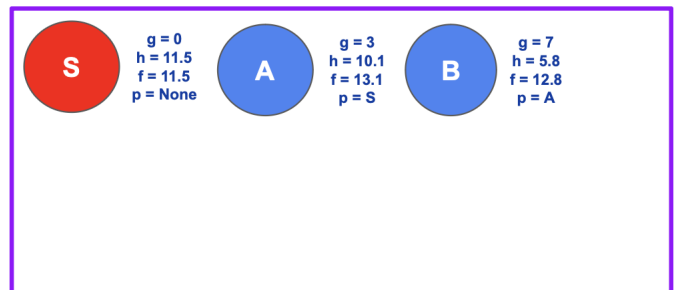
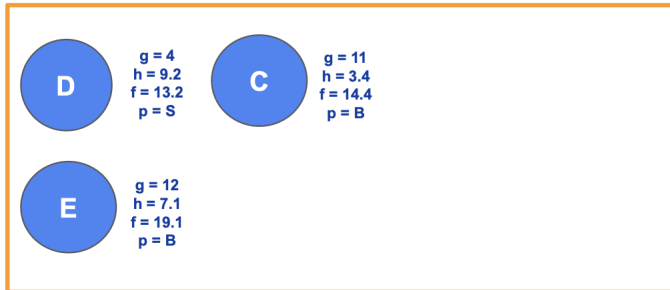
OPEN





OPEN

CLOSED

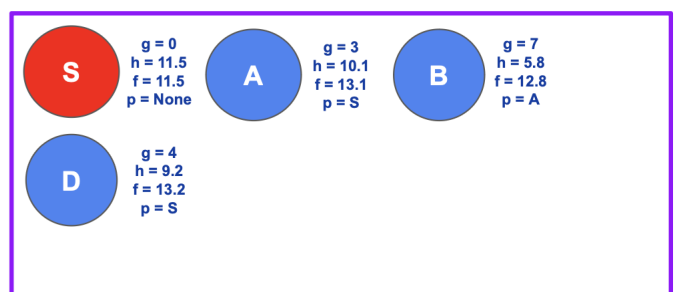
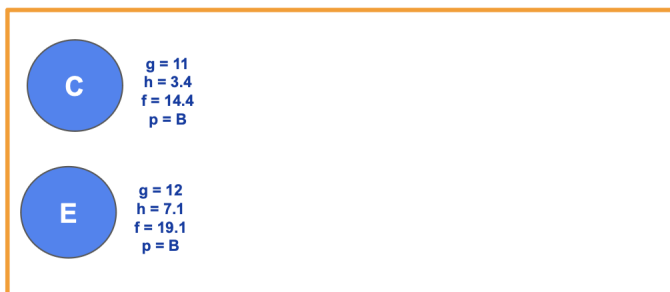


SELECT FROM OPEN

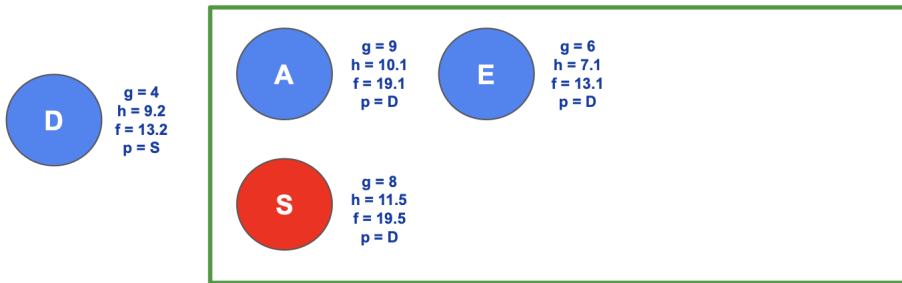


OPEN

CLOSED

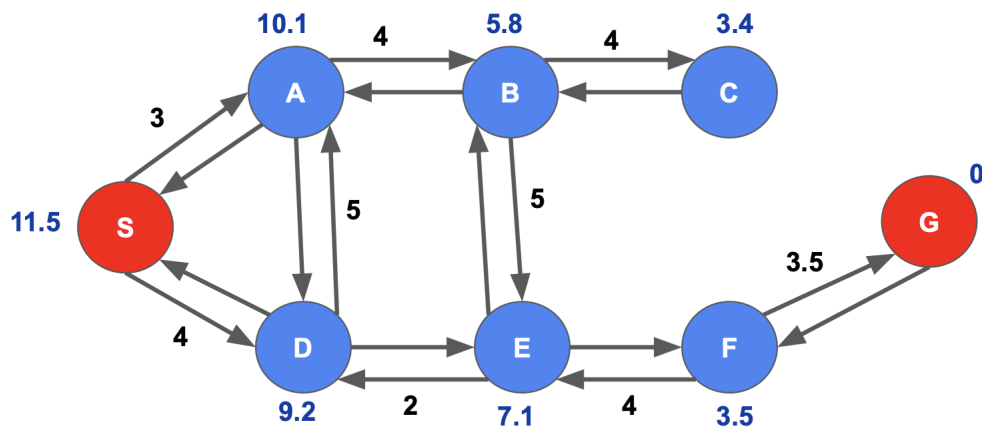
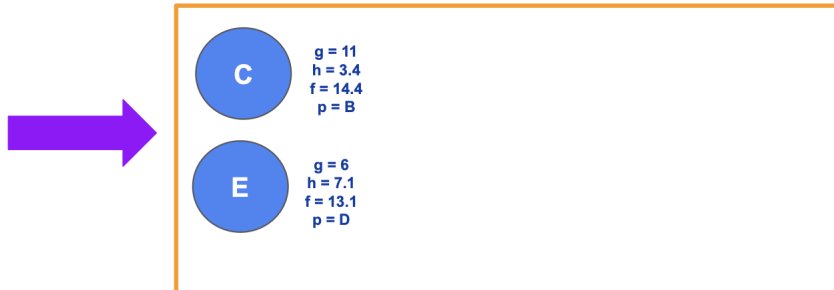


NEIGHBOURS

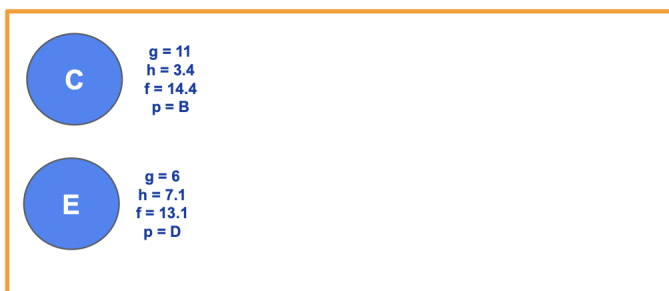


- A is in closed set. Not consider A.
- S is in closed set. Not consider S.
- E was visited but now his g is lower. Update in Open.

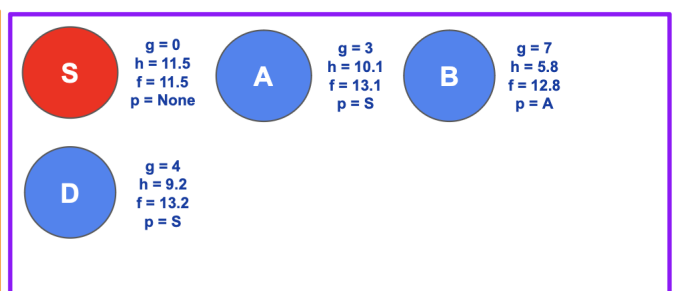
OPEN



OPEN



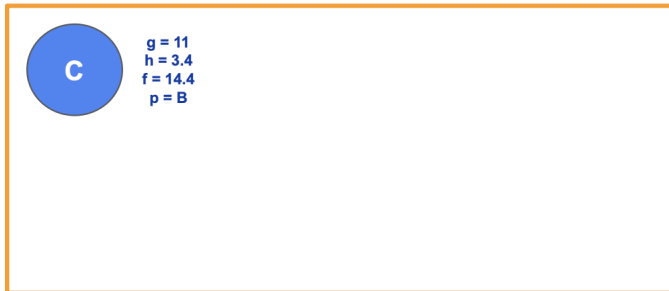
CLOSED



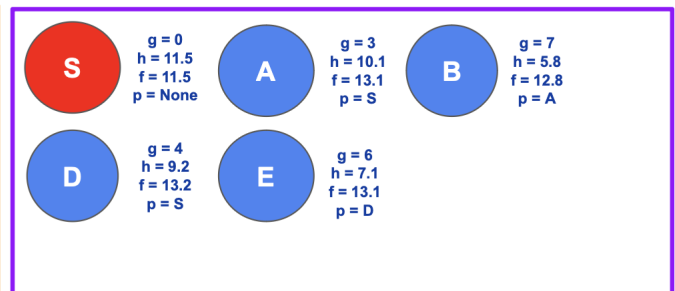
SELECT FROM OPEN



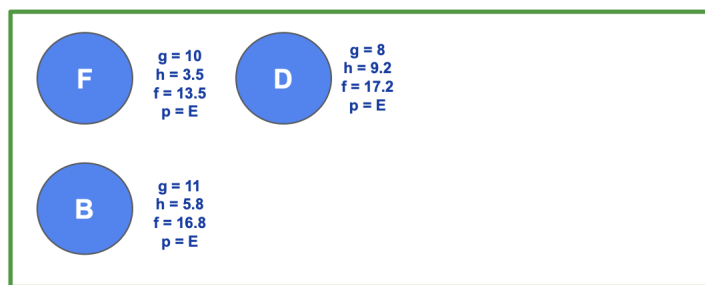
OPEN



CLOSED



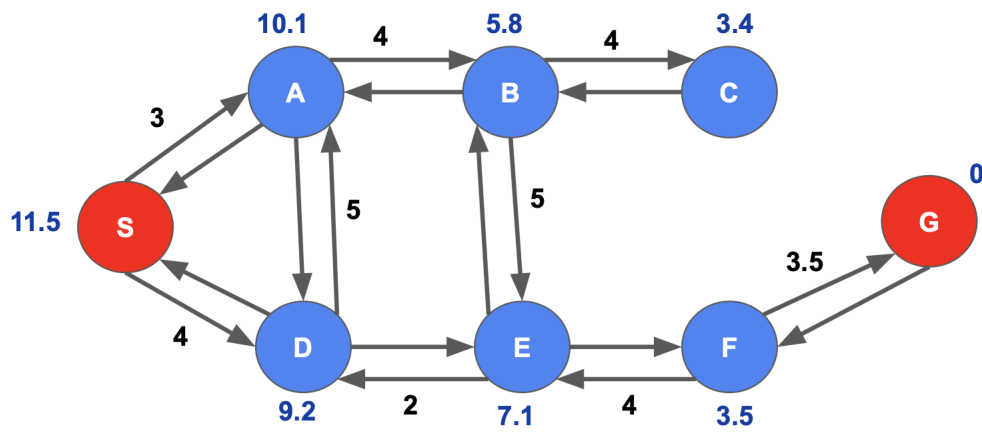
NEIGHBOURS



- B is in closed set. Not consider B.
- D is in closed set. Not consider D.
- F it wasn't visited. Add to Open.

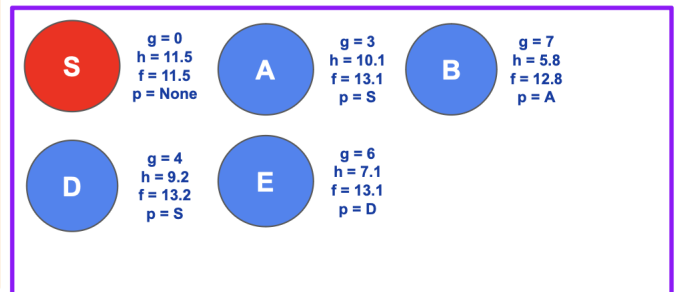
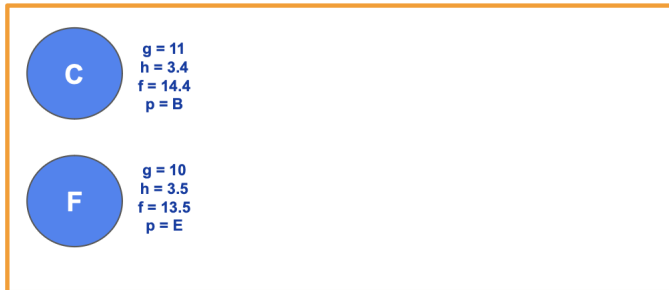
OPEN





OPEN

CLOSED

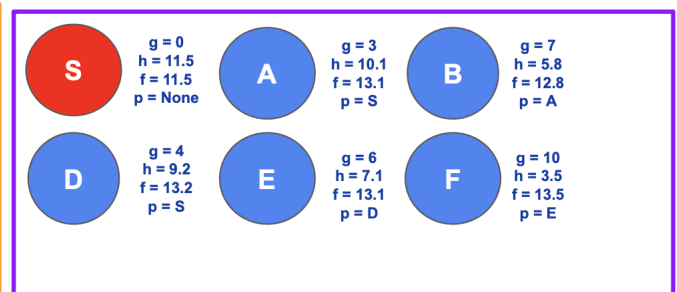


SELECT FROM OPEN

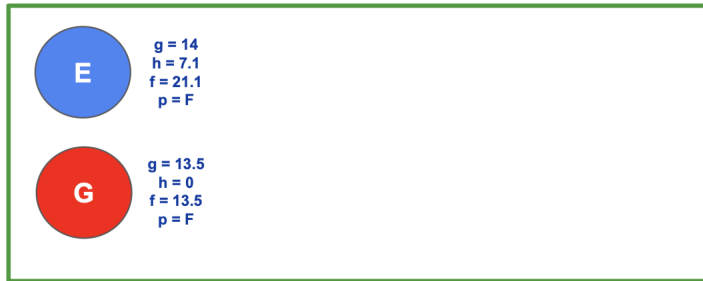


OPEN

CLOSED

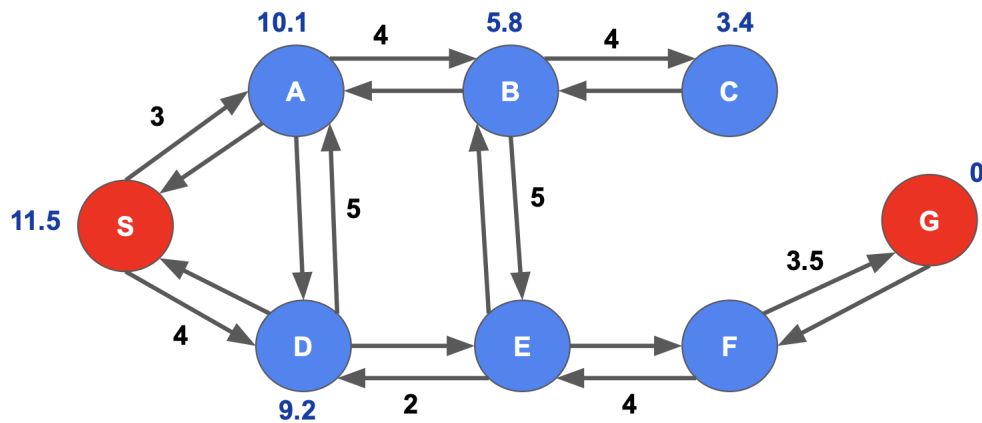
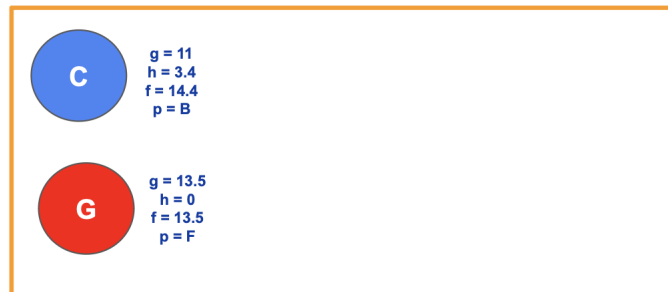


NEIGHBOURS



- E is in closed set. Not consider E.
- G wasn't visited. Add to Open.

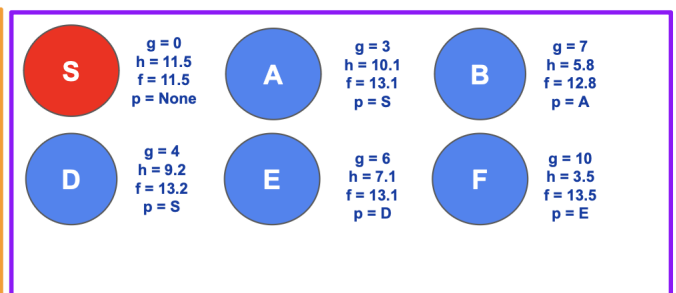
OPEN



OPEN



CLOSED



SELECT FROM OPEN



END

RECONSTRUCT THE PATH FROM THE CLOSED SET



PATH FOUNDED = S - D - E - F - G
