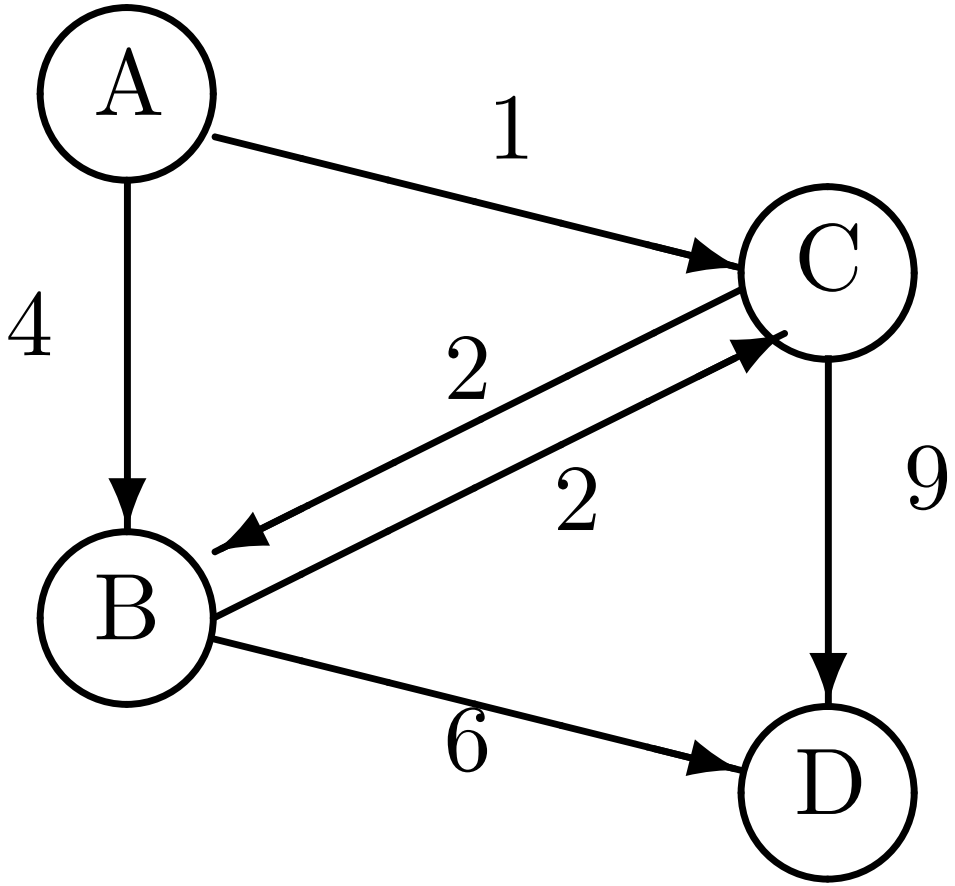
A* Example

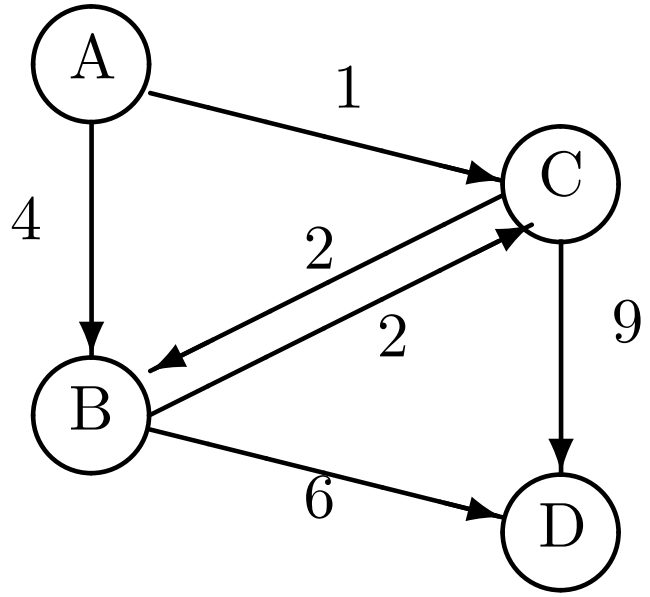


$$h(A) = 8$$
$$h(B) = 3$$
$$h(C) = 7$$
$$h(D) = 0$$

START = A
GOAL = D

A*

- Successive states of OPEN:
  Items on OPEN are <Node, g-val+h-val = f-val>
  Where Node = [s0, s2 …] a sequence of states representing the path.



$$h(A) = 8$$
$$h(B) = 3$$
$$h(C) = 7$$
$$h(D) = 0$$

A*

{<[A],0+8=8>}

{<[A,C], 1+7=8>, <[A,B] = 4+3 = 7>}

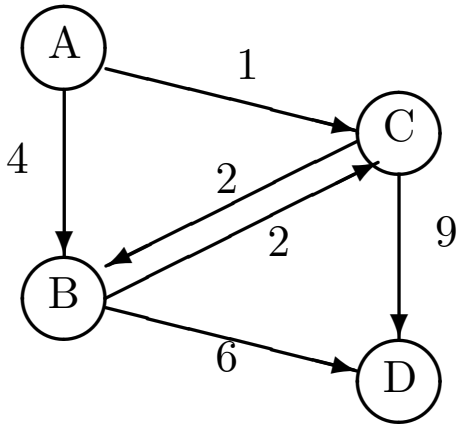
{<[A,C], 1+7=8>, <[A,B,C] = 6+7=13>, <[A,B,D] = 10+0=10>}

{<[A,C,B], 3+3=6>, <[A,C,D], 10+0=10>, <[A,B,C] = 6+7=13>,
<[A,B,D] = 10+0=10>}

{<[A,C,B,C] = 5+7=12>, <[A,C,B,D] = 9+0= 9>,
<[A,C,D], 10+0=10>, <[A,B,C] = 6+7=13>,
<[A,B,D] = 10+0=10>}

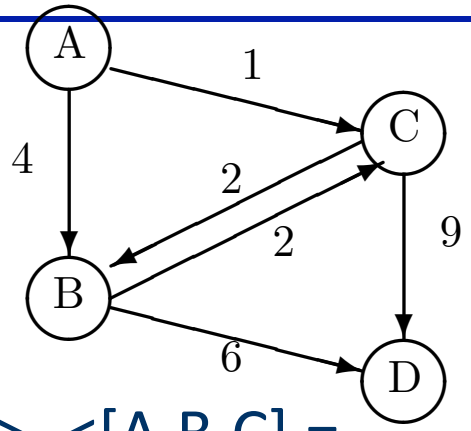
Node selected for expansion reaches a goal.

Green = next node expanded



$h(A) = 8$
$h(B) = 3$
$h(C) = 7$
$h(D) = 0$

A* Path Checking



$h(A) = 8$
$h(B) = 3$
$h(C) = 7$
$h(D) = 0$

{<[A],0+8=8>}

{<[A,C], 1+7=8, <[A,B] = 4+3 = 7>}

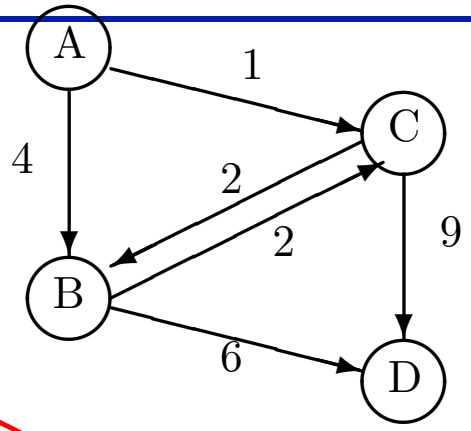
{<[A,C], 1+7=8, <[A,B,C] = 6+7=13>,
<[A,B,D] = 10+0=10>}

{<[A,C,B], 3+3=6>, <[A,C,D], 10+0=10>, <[A,B,C] = 6+7=13>,
<[A,B,D] = 10+0=10>}

{[A,C,B,C] = 5+7=12, [A,C,B,D] = 9+0= 9, <[A,C,D], 10+0=10>, <[A,B,C] = 6+7=13>,
<[A,B,D] = 10+0=10>}

Red pruned by cycle checking.

A* Full Cycle Checking



$h(A) = 8$
$h(B) = 3$
$h(C) = 7$
$h(D) = 0$

{<[A],0+8=8>}

{<[A,C], 1+7=8, <[A,B] = 4+3 = 7>}

{<[A,C], 1+7=8, <[A,B,C] = 6+7=13>,
<[A,B,D] = 10+0=10>}

{<[A,C,B], 3+3=6>, <[A,C,D], 10+0=10>,
<[A,B,C] = 6+7=13>, <[A,B,D] = 10+0=10>}

{[A,C,B,C] = 5+7=12, [A,C,B,D] = 9+0= 9, <[A,C,D], 10+0=10>, <[A,B,C] = 6+7=13>,
<[A,B,D] = 10+0=10>}

A* Short Questions

- If h(n) is admissible and s is the start node how is h(s) related to the cost of the solution eventually found by A*?
- If there is a solution, then during its operation A* always has at least one prefix of an optimal path to a goal on OPEN.
- What happens when h(n) = h*(n)
  a. A* only expands nodes that lie on an optimal path to the goal
  b. Does this mean that A* will find an solution in time linear in the length of an optimal solution?