Solutions to Problem 1 of Homework 1 (3 Points)

Name: Kumar Prasun (kp2692)   *Due: September 20*

Collaborators:

Show the order of nodes visited using Breadth First Search (BFS), and the final path selected. Is this optimal? Why or why not?

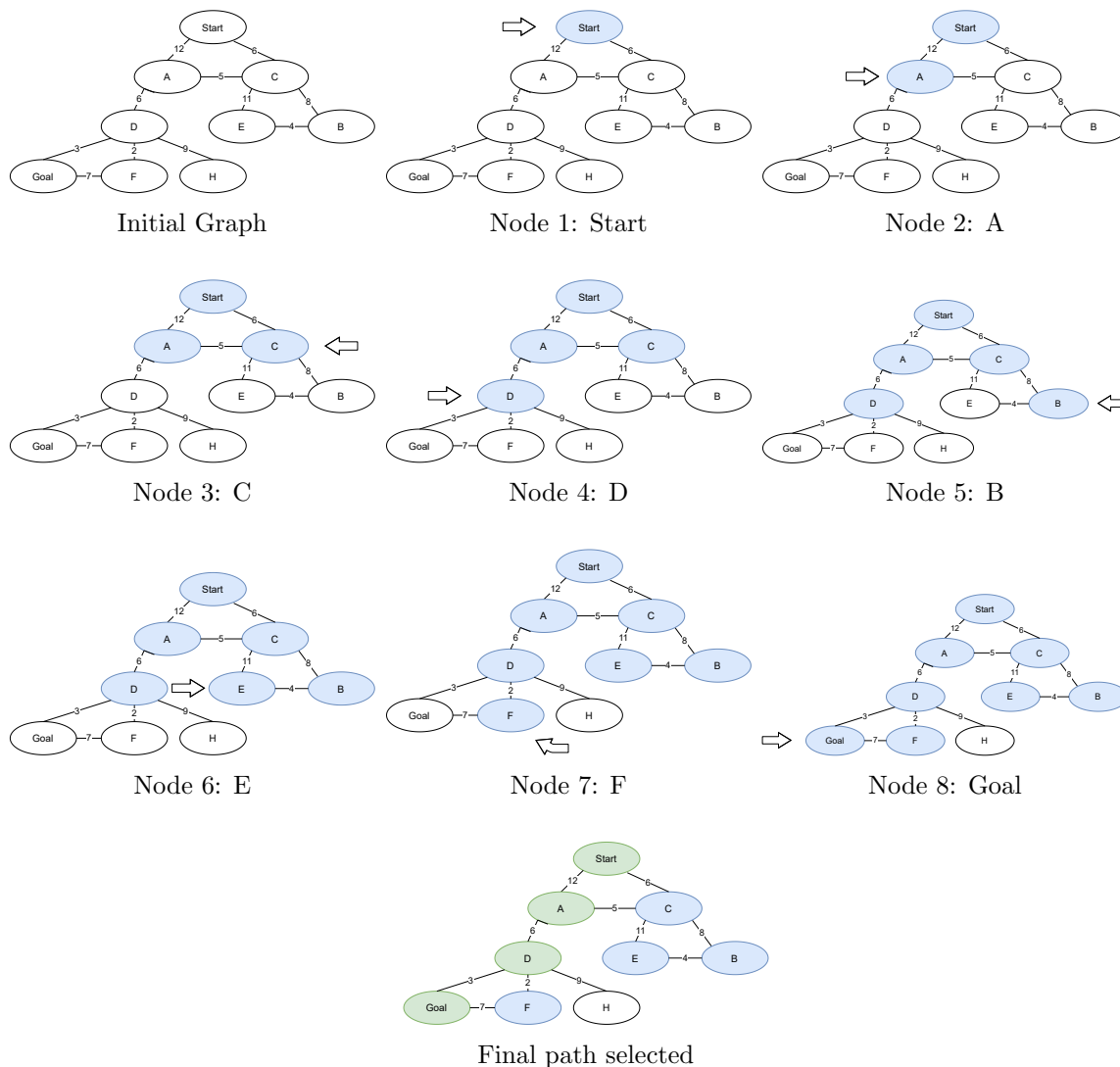**Solution:**

The order of nodes visited is:

Figure 1: Order of node visits

Diagram	Current Path	Queue	Visited Nodes	Explanation
Initial Graph	-	{Start}	{}	Since queue has Start, we pop and visit that node.
Node 1: Start	Start	{C,A}	{Start}	A is before C in queue due to alphabetical priority. So visit node A next
Node 2: A	Start->A	{D,C}	{Start,A}	We visit C as it's first in queue.
Node 3: C	Start->C	{E,B,D}	{Start, A, C}	We visit D as it's first in queue.
Node 4: D	Start->A->D	{H,Goal,F, E,B}	{Start, A, C, D}	We visit B as it's first in queue.
Node 5: B	Start->C->B	{H,Goal,F, E}	{Start, A, C, B}	We visit E as it's first in queue.
Node 6: E	Start->C->E	{H,Goal,F}	{Start, A, C, B, E}	We visit F as it's first in queue.
Node 7: F	Start->A->D ->F	{H,Goal}	{Start, A, C, B, E}	We visit Goal as it's first in queue.
Node 8: Goal	Start->A->D ->Goal	{H}	{Start, A, C, B, E, F}	We've visited Goal node. Terminate program.

The green nodes highlighted in the final graph of Figure 1, are the nodes visited in the final selected path. The path is not optimal as it's path cost is $12+6+3 = 21$. The optimal path among all possible paths is from $Start \rightarrow C \rightarrow A \rightarrow D \rightarrow Goal$ with a path cost of $6+5+6+3 = 20$. $\square$

Solutions to Problem 2 of Homework 1 (3 Points)

Name: Kumar Prasun (kp2692)   *Due: September 20*

Collaborators:

Show the order of nodes visited using Iterative Deepening (initial depth of 2, increasing depth by 1), and the final path selected. Is this optimal

Solution:

    The order of nodes visited is:
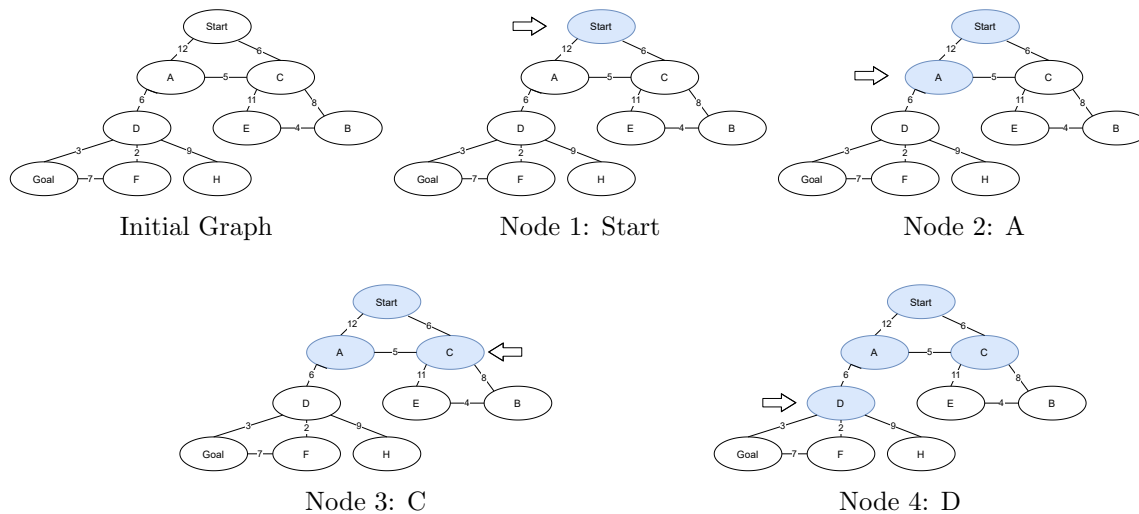
For Depth = 2

Figure 2: Order of node visits for depth = 2

EXPLANATION: The IDS algorithm tries to go to the deepest level of the tree till it reaches the goal or depth limit. The order in which the children nodes are traversed is based on alphabetical priority.

    Nodes E and B will be not be visited since they are can only be reached from path $Start->A->C$, but the depth limit (of 2) has been reached.

    They cannot be reached from path $Start->C$ as Node C has already been visited via path $Start->A->C$ and so the former path will be ignored by IDS due to Node C already being in the visited set.

For Depth = 3

Initial Graph

Node 1: Start

Node 2: A

Node 3: C

Node 4: B

Node 5: E

Node 6: C

Node 7: F

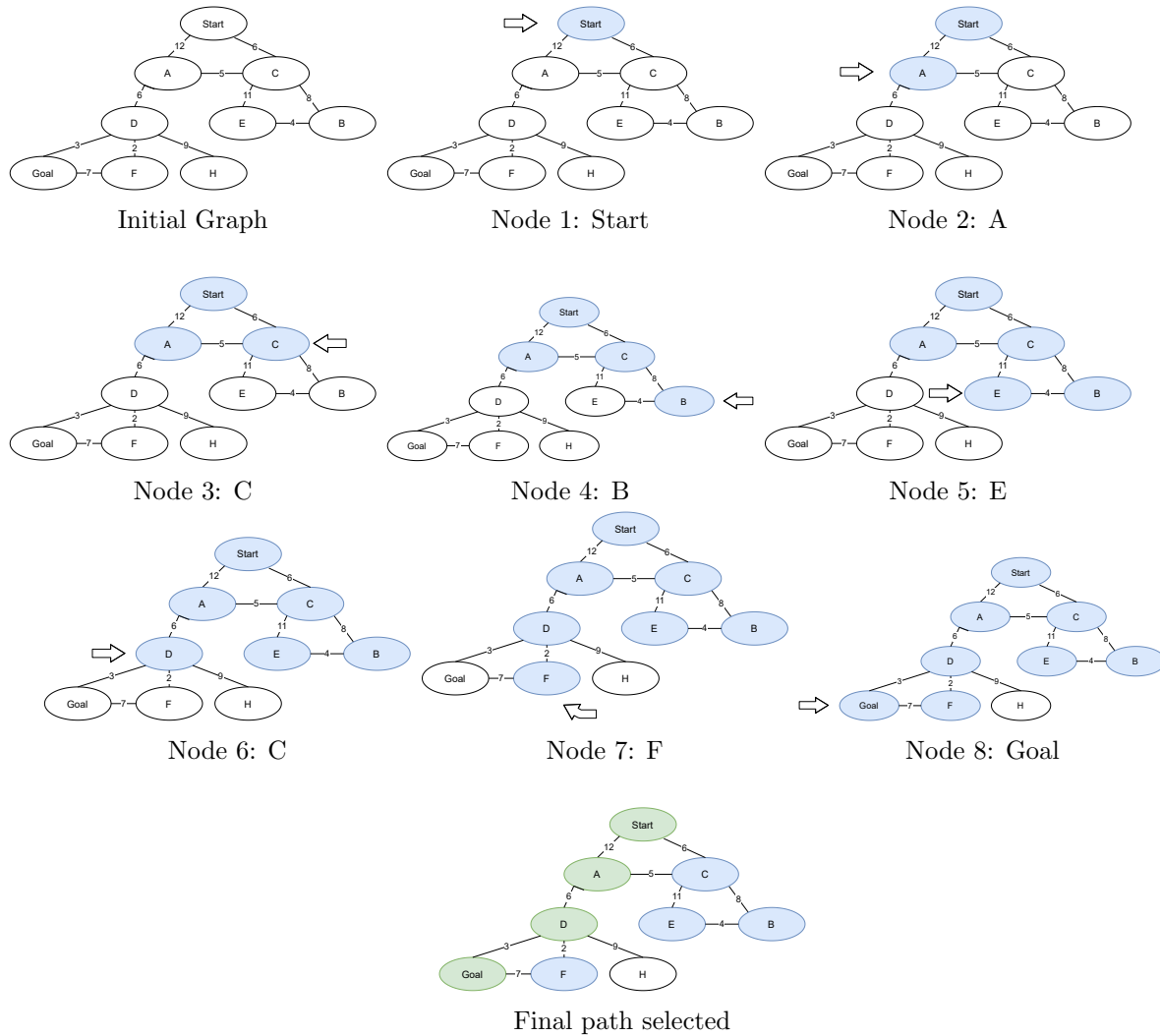Node 8: Goal

Final path selected

Figure 3: Order of node visits for depth = 3

The green nodes highlighted in the final graph of Figure 3, are the nodes visited in the final selected path. The path is not optimal as it's path cost is $12 + 6 + 3 = 21$. The optimal path among all possible paths is from $Start \rightarrow C \rightarrow A \rightarrow D \rightarrow Goal$ with a path cost of $6 + 5 + 6 + 3 = 20$. $\qquad\square$

Solutions to Problem 3 of Homework 1 (4 Points)

Name: Kumar Prasun (kp2692)   *Due: September 20*

Collaborators:

Using the above h-function, show the order of nodes visited using A*,and the final path selected. Is this optimal? Why or why not?

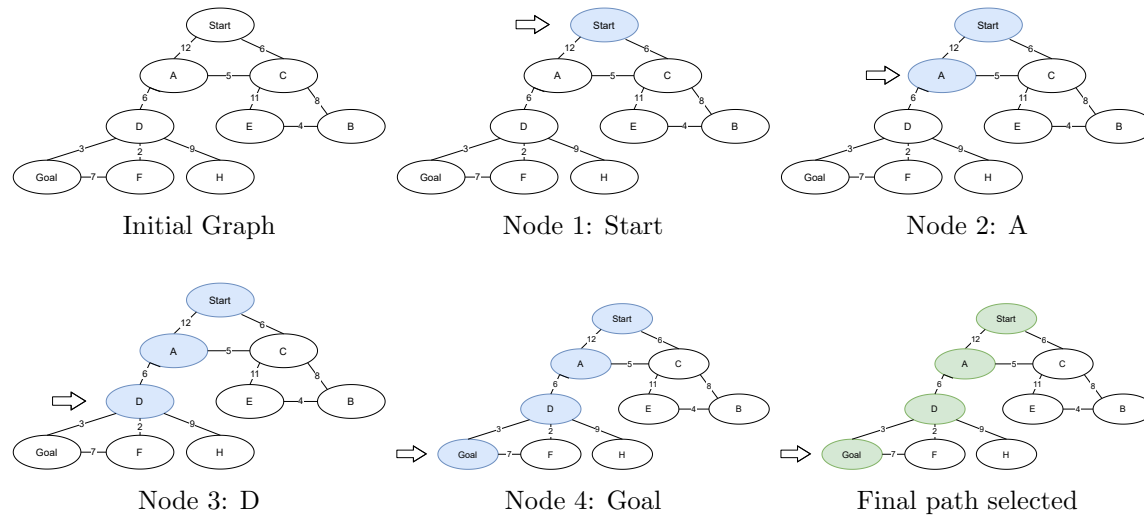**Solution:**

The order of nodes visited is:

Figure 4: Order of node visits for A*

Diagram	f(n) Value	Explanation
Node 2:A	= 12 + 9 =21	This is less than that of Node C, f(Start->C) = 22.
Node 3:D	= 18 + 2 =20	This is less than that of Node C, f(Start->C) = 22 & f(Start->A->C) = 33.
Node 4:Goal	= 21 + 0 =21	This is less than f(n) of all other nodes in the priority queue. Program terminates.

The green nodes highlighted in the final graph of Figure 4, are the nodes visited in the final selected path. The path is not optimal as it's path cost is $12 + 6 + 3 = 21$. The optimal path among all possible paths is from $Start \rightarrow C \rightarrow A \rightarrow D \rightarrow Goal$ with a path cost of $6 + 5 + 6 + 3 = 20$. $\square$