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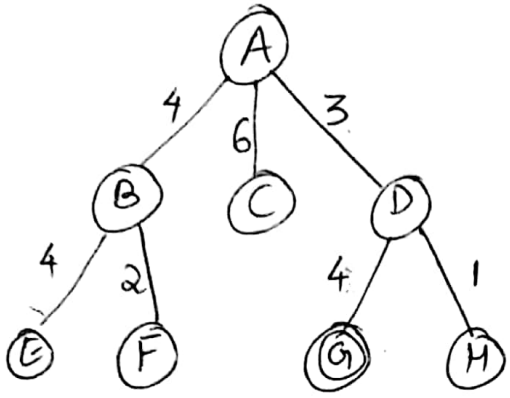
Artificial Intelligence
Assignment-2

Q1



- Breadth first search:

A → B → C → D → E → F → G

- Depth first search:

A → B → E → F → C → D → G

- IDS:

Iteration 1: A
Iteration 2: A, B, C, D
Iteration 3: A, B, E, F, C, D, G

- Uniform cost search:

Iteration	Visited Node	Fringe	Sorted List
0	None	A_0	A
1	A	$B_4\ C_6\ D_3$	$D_3\ B_4\ C_6$
2	A → D	$B_4\ C_6\ G_7\ H_4$	$B_4\ H_4\ C_6\ G_7$
3	A → D → B	$H_4\ C_6\ G_7\ E_8\ F_6$	$H_4\ C_6\ F_6\ G_7\ E_8$
4	A → D → B → H	$C_6\ F_6\ G_7\ E_8$	$C_6\ F_6\ G_7\ E_8$
5	A → D → B → H → C	$F_6\ G_7\ E_8$	$F_6\ G_7\ E_8$
6	A → D → B → H → C → F	$G_7\ E_8$	$G_7\ E_8$
7	A → D → B → H → C → F → G	E_8	E_8

Result: A → D → B → H → C → F → G

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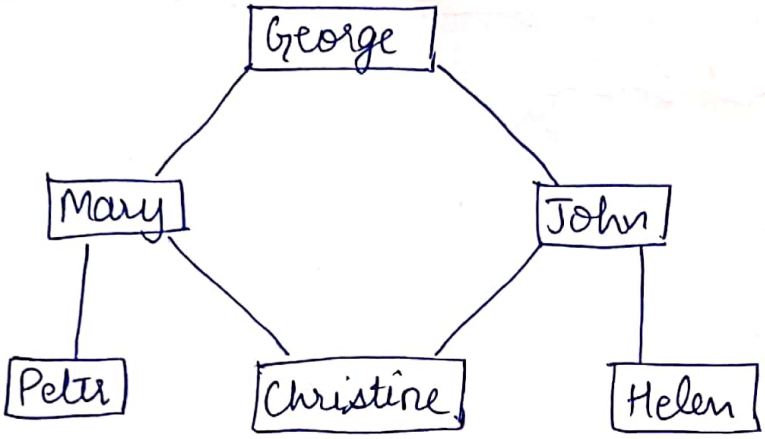
Q2

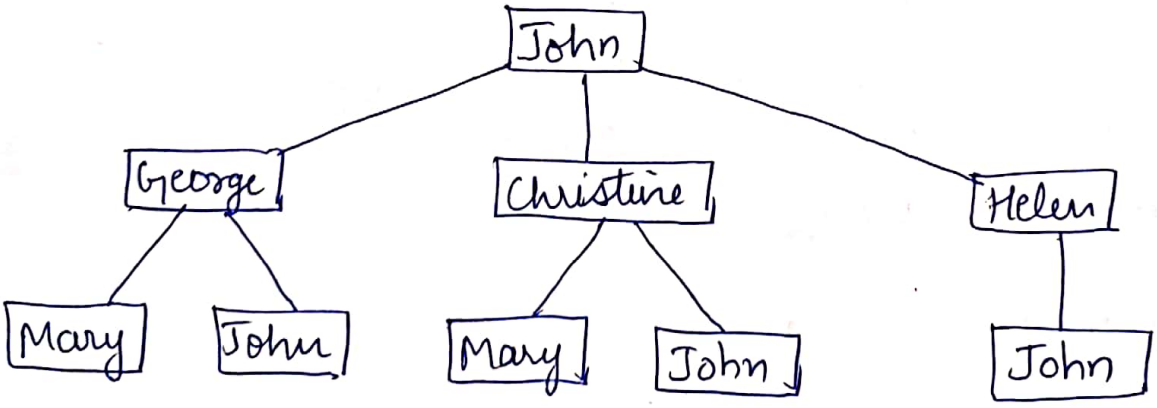


(i) BFS and DFS will generate same results. Moreover, they will also provide the same degrees of freedom.

DFS can possibly not terminate even if it finds a solution, there is no confirmation that it will be the right answer.

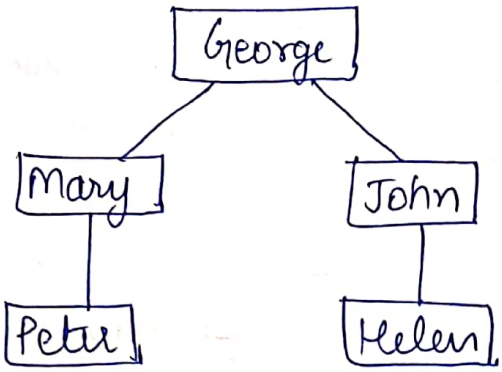
IDS will provide the correct answer if nodes are first expanded in a DFS method and iterated.

(ii)



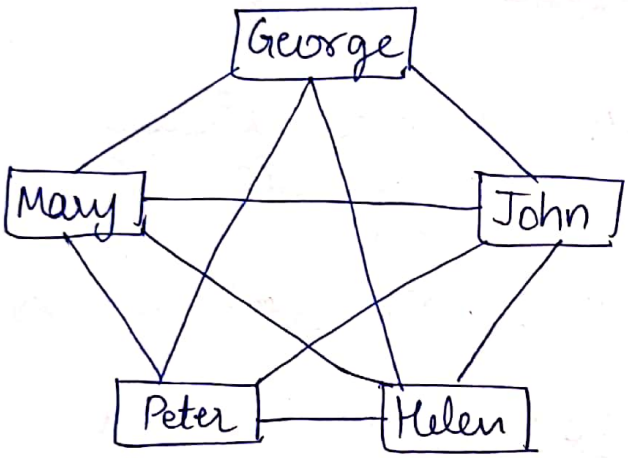
The vertex John in the graph corresponds to multiple vertices in the tree, so there is no one to one correspondence between the 2 nodes.

(iii)



Peter and Helen have 4 degrees of seperation

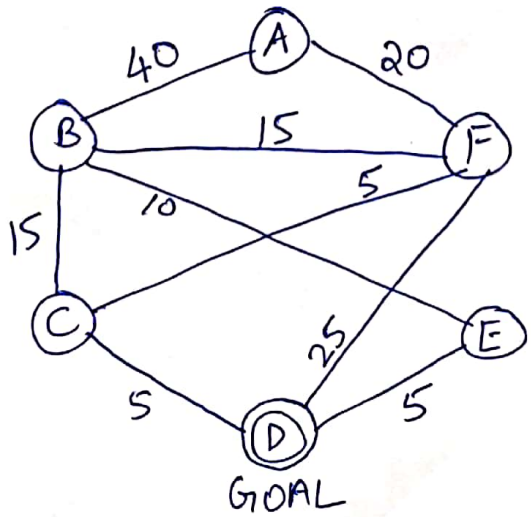
(iv)



Each person having 1 degree of seperation between them.

(v) ~~We~~ We can achieve this by converting the tree search into a graph search or maintain a list of visited states. Do not generate successor nodes for nodes which are present in the visited states list.

Q3



Heuristic 1

$h(A) = 50$
$h(B) = 35$
$h(C) = 5$
$h(D) = 0$
$h(E) = 45$
$h(F) = 10$

This heuristic is not admissible because the actual cost for travelling from E to D is 5 but the heuristic is $h(E) = 45$ which is greater.
For heuristic 1 to be admissible the value for $h(E)$ must be 5 or less than 5. New heuristic :-

$h(A) = 50$ $h(d) = 0$
$h(B) = 15$ $h(E) = 5$
$h(C) = 5$ $h(f) = 10$

Heuristic 2

$h(A) = 70$
$h(B) = 70$
$h(C) = 70$
$h(D) = 70$
$h(E) = 70$
$h(F) = 70$

This heuristic is not admissible because the values of $h(D)$ is not equal to 0 and $h(E)$, $H(F)$, $h(C)$, $h(B)$, $h(A)$ are all greater than the actual value.

New heuristic :-

$h(A) = 50$ $h(d) = 0$
$h(B) = 15$ $h(E) = 5$
$h(C) = 5$ $h(f) = 25$

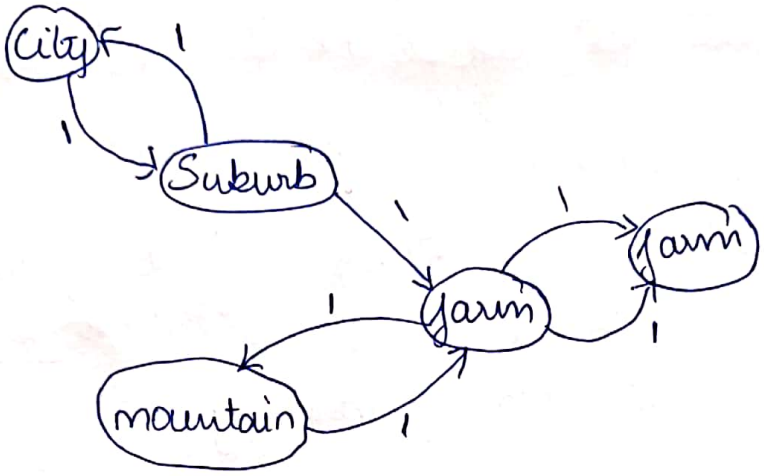
Heuristic 3

$h(A) = 40$
$h(B) = 20$
$h(C) = 5$
$h(d) = 0$
$h(E) = 5$
$h(f) = 20$

Admissible heuristic since all the values are lesser than or equal to the actual values.

Q4

Smallest possible sequence of states that is consistent with the rules is



From the above state diagram we can obtain the below mentioned heuristic values.

$h(m) = 0$

$h(f) = 1$

$h(s) = 2$

$h(c) = 3$

Q5

Given :- $b = 4$

$d = 101$ to 208

$C^* = 101$ to 208

$\epsilon = 1$

$m = \infty$

Space complexity :-

$$BFS = \left[4^{101+1} \text{ to } 4^{208+1}\right] \times 1KB \text{ memory}$$

DFS = $4 \times \infty \times 1$ KB memory

UCS = $\left[4^{101/1} \text{ to } 4^{208/1}\right] \times 1$ KB memory

IDS = $4\,[101 \text{ to } 208] \times 1$ KB memory

∴ DFS = ∞ KB of memory

BFS = 2.57×10^{61} KB to 6.77×10^{125} KB of memory

UCS = 6.43×10^{60} KB to 1.69×10^{125} KB of memory

IDS = 404 to 832 KB of memory.

a) None of above methods can run in less than 50 KB of memory

b) IDS will run in less than 1200 KB of memory

Q6

For figure 5 :-

→ In some cases Greedy search will perform the same as A^*, example from 0,0 to 0,8

→ However in some cases Greedy search will perform better than A^*, example from 0,0 to 8,8, A^* will visit both 0,1 and 1,0 but greedy will only visit one of them.

→ Hence, Greedy will perform better than or the same as A^* depending on the start and end states.

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For figure 6 :-

→ Sometimes Greedy perforns better than A^*, example 2,6 to 5,8.

→ Sometimes Greedy perforns worse than A^* example 2,0 to 2,2

→ Sometimes they perform the same example 2,2 to 2,7

→ Hence, Greedy may perform better than or the same or worse than A^* dependding on the start and end states.