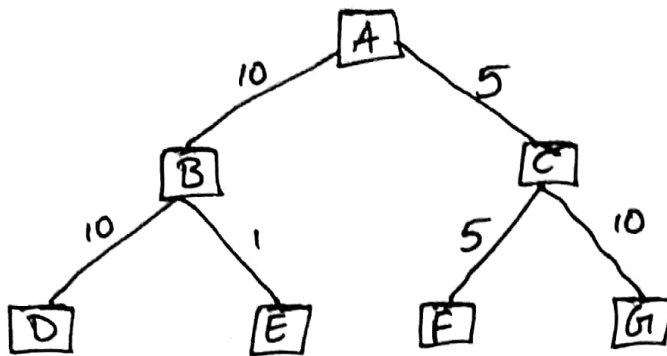


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Assignment - 2

①



(i) BFS: ABCDEFG (or) ACBG

(ii) DFS: ABDECFG (or) ACFG

(iii) IDS: ~~ABDECFG~~

- A

- ABC

- ABDECFG

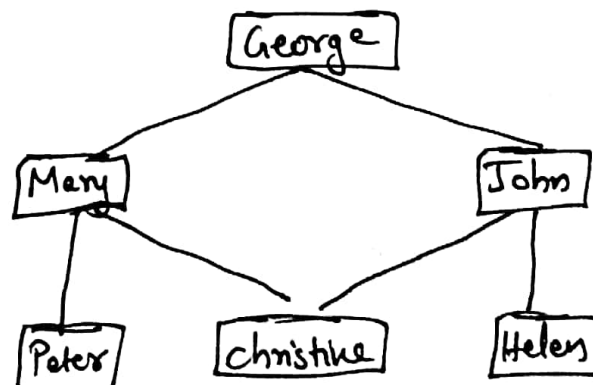
(iv) Uniform Cost Search:

A(0) C(5) B(10) F(10) E(11) G(15)

(or)

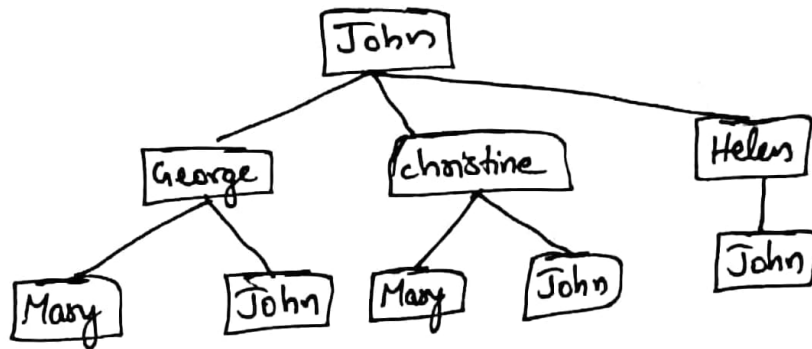
A(0) C(5) F(10) B(10) E(11) G(15)

②



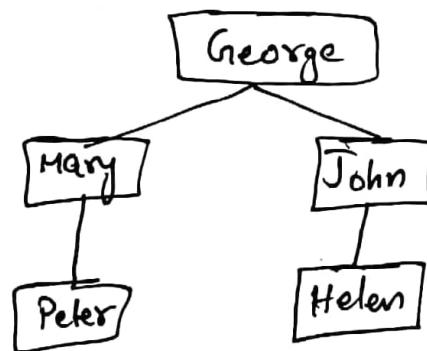
- (i) BFS and UCS finds correct numbers of degrees between any two people in the graph. IDS doesn't find it if it starts at large initial depths. DFS won't find because it searches on the basis of depth.

(ii)



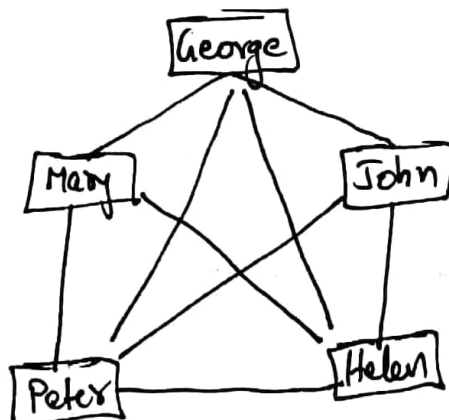
There is no one to one correspondence between the nodes and vertices because there is a chance of loops getting formed. For ex: John corresponds to multiple nodes in the search tree.

(iii)



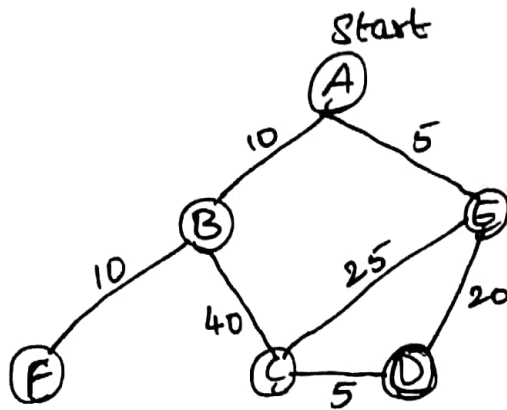
Peter and Helen have four degrees of separation.

(iv)



- ② (V) Maintain a list of visited nodes (or) people, so there will be no need to generate successor nodes when revisiting nodes corresponding to that person.

③



True distances to the goal state:

$$h(A) = 25$$

$$h(B) = 35$$

$$h(C) = 5$$

$$h(D) = 0$$

$$h(E) = 20$$

$$h(F) = 45$$

The heuristic value should be less than true value to be admissible

Heuristic 1:

$$h(A) = 5$$

$$h(B) = 40 \text{ (change to 35 or less)}$$

$$h(C) = 10 \text{ (change to 5 or less)}$$

$$h(D) = 0$$

$$h(E) = 10$$

$$h(F) = 0$$

Heuristic 2:

$$h(A) = 8$$

$$h(B) = 5$$

$$h(C) = 3$$

$$h(D) = 5 \text{ (change to 0)}$$

$$h(E) = 5$$

$$h(F) = 0$$

Heuristic 3:

$$h(A) = 35 \text{ (should be } \cancel{25} \text{ 25 or less)}$$

$$h(B) = 30$$

$$h(C) = 20 \text{ (should be 5 or less)}$$

$$h(D) = 0$$

$$h(E) = 0$$

$$h(F) = 50 \text{ (Should be 45 or less)}$$

Heuristic 4:

$$h(A) = 50 \text{ (should be 25 or less)}$$

$$h(B) = 50 \text{ (should be 35 or less)}$$

$$h(C) = 50 \text{ (should be 5 or less)}$$

$$h(D) = 50 \text{ (should be 0)}$$

$$h(E) = 50 \text{ (should be 20 or less)}$$

$$h(F) = 50 \text{ (should be 45 or less)}$$

Heuristic 5:

$$h(A) = 0$$

$$h(B) = 0$$

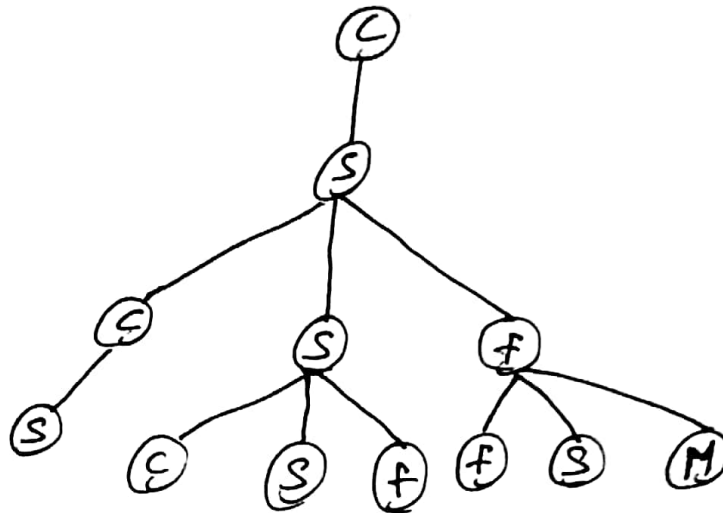
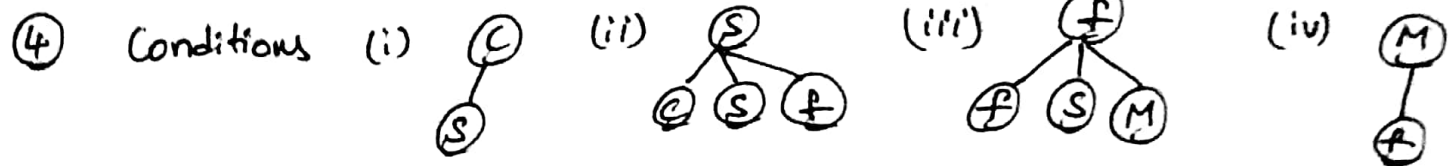
$$h(C) = 0$$

$$h(D) = 0$$

$$h(E) = 0$$

$$h(F) = 0$$

Heuristic 5 is admissible as it is.



Heuristics

$$h(C) = 3 \quad C \rightarrow S \rightarrow f \rightarrow M$$

$$h(S) = 2 \quad S \rightarrow f \rightarrow M$$

$$h(f) = 1 \quad f \rightarrow M$$

$$h(M) = 0 \quad M$$

(5) Branching factor for corner nodes is $4 \times 2 = 8$
 Branching factor for nodes with 3 branches is $12 \times 3 = 36$
 Branching factor for rest of the nodes is $9 \times 4 = 36$

Total branching factor is 80

$$\text{Average branching factor is } \frac{80}{25} = 3.2 \approx 4$$

Minimum depth is 100

Maximum depth is 208

$$80 \quad 100 < d < 208.$$

Q The space complexity of

$$\text{BFS} = O(b^d)$$

$$\text{DFS} = O(bm) \quad \text{where } m \text{ is maximum depth}$$

$$\text{UCS} = O(b^{1+LC*/E})$$

$$\text{IDS} = O(bd)$$

where b is branching factor

d is depth of the shallowest solution.

$$\text{BFS} = O(b^d)$$

$$= 4^{100} > 50 \text{ KB}$$

$$\text{DFS} = O(bm)$$

$$= 4 \times 200000$$

$$= 832 \text{ KB}$$

$$\text{UCS} = O(4^{1+LC*/E})$$

is exponential which will be more than 50 KB

$$\text{IDS} = O(bd)$$

$$= 4 \times 100$$

$$= 400 \text{ KB is least}$$

$$= 4 \times 208$$

$$= 832 \text{ is highest}$$

So none of them are less than 50 KB

Q Using above calculated information, IDS will never need more than 1200 KB since it needs only 832 KB.

Rest all ~~are~~ ~~more~~ ~~the~~ require more than 1200 KB.