Md. Siam Hossain Sarker
ID - 011192014
Assignment - 1
CSI - 341 | Sec - A

Fall - 19

2

a

3 variables are required here.
(x, y, z)

b Here,
x represents 4 litters,
$x = 0, 1, 2, 3, 4$

y represents 5 litters,
$y = 0, 1, 2, 3, 4, 5$

z represents 6 litters.
$z = 0, 1, 2, 3, 4, 5, 6$

$\therefore$ size of state space $= {}^{210}C_3$

$= 1521520$

(c) list of 30 goal states,

4, 4, 0
4, 2, 2
4, 0, 4
0, 4, 4
2, 2, 4
2, 4, 2
4, 3, 1
1, 3, 4
1, 4, 3
5, 3, 0

5, 0, 3
0, 5, 3
5, 2, 1
5, 1, 2
1, 2, 5
2, 2, 5
2, 5, 2
5, 2, 2
5, 3, 1
5, 3, 2

5, 1, 3
5, 2, 3
5, 2, 4
4, 1, 4
1, 4, 4
3, 3, 2
3, 2, 3
2, 3, 3
1, 4, 5
1, 6, 2

(d) For, DFS and BFS none of them are optimal. But I'll choose DFS not BFS. Because, DFS will find the solution by applying depest node that has consumed less memory than BFS.

$$O(b^m) > O(bm).$$

3|

PEAS description for self driving car

Performance Measure - Fast response, ensure safety, fast emergency call, comfortable, cheap.

Environment - Road, car, passenger, traffic light.

Actuator - steering, breakes, accelerators, gear, horn, indicator light

Sensors - Camera, gps, health scanner, Auto caller.

This self-driving car is in sequential and single environment.

5| (a) $T_K = T_{K-1}(1-\alpha)$

$\alpha = 0.8$
$\alpha = 0.9$
α = rate of exchange

let, $T_0 = 1000$

$T_1 = 1000 * (1-0.8)$

$= 200$

or,

$T_2 = 1000 * (1-0.9)$

$= 100$

From my side, I'll take 0.8 because in simulated annealing we try to decrease value slowly 0.8 drecreases the value much slower than 0.9

(b) (i) $f(x) = (a+b) - (c+d) + (e+f) - (g+h)$

$f(x_1) = (6+5) - (4+1) + (3+5) - (3+2)$

$= 9$

$f(x_2) = (8+7) - (1+2) + (6+6) - (6+1)$

$= 23$

$f(x_3) = (2+3) - (9+2) + (1+2) - (8+5)$

$= -16$

$f(n_4) = (4+1) - (8+5) + (2+0) - (9+4)$

$= -19$

(ii) here,

$f(n_1)$ and $f(n_2)$ are fittest crossover

$n_1 = 6541 \mid 6601$

$n_2 = 8712 \mid 3532$

$\boxed{\text{Spring - 2020}}$

2/ (a) Here,

total number of nodes in Iterative Deeping

Depth First search $= b^d$

$= 8^4$

$= 4096$

branching factor, $b = 8$

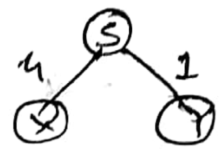
optimal depth, $d = 4$

(b)

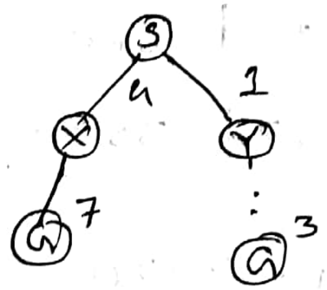
let,

iteration - 0

iteration - 1

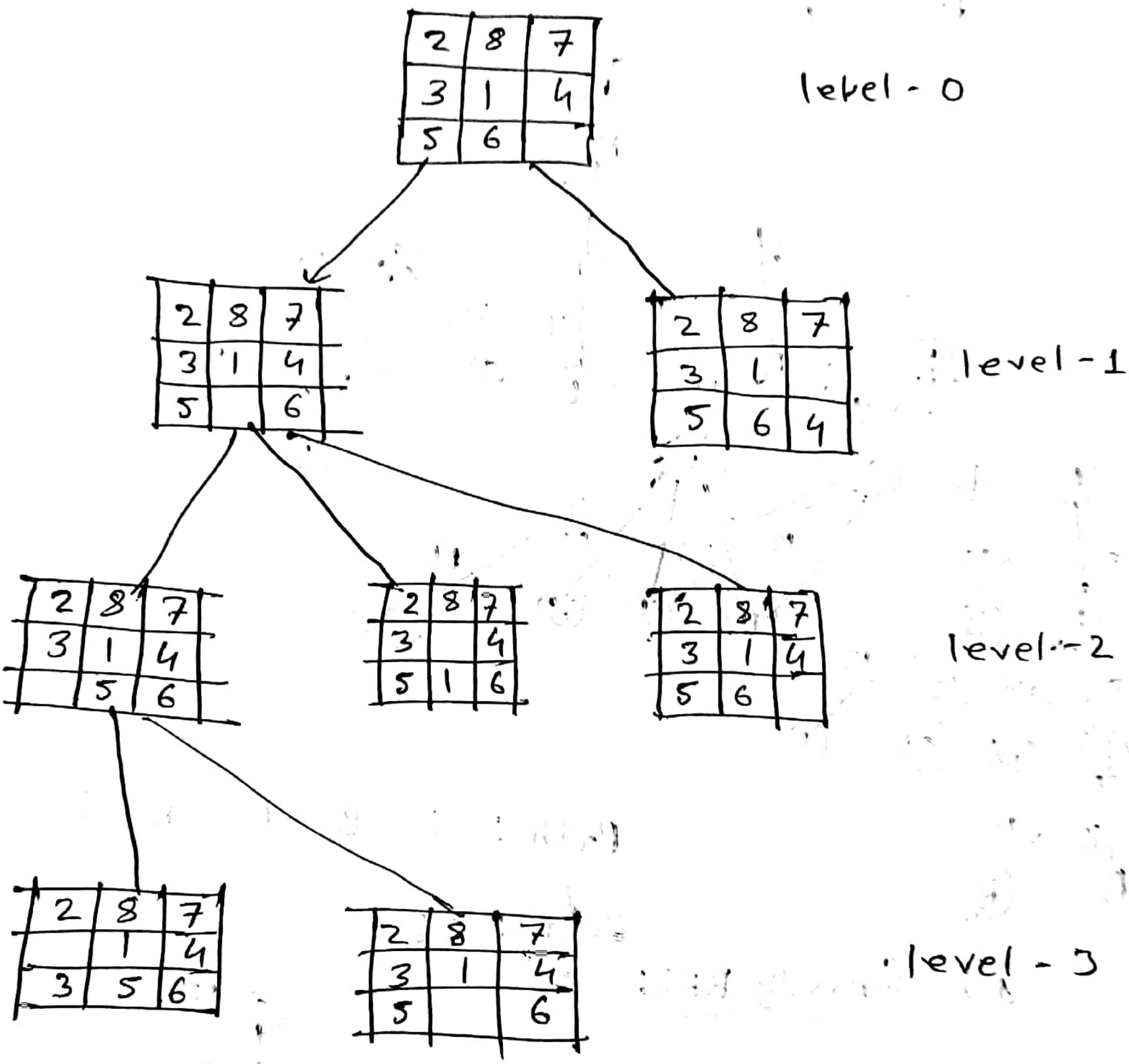


iteration - 2

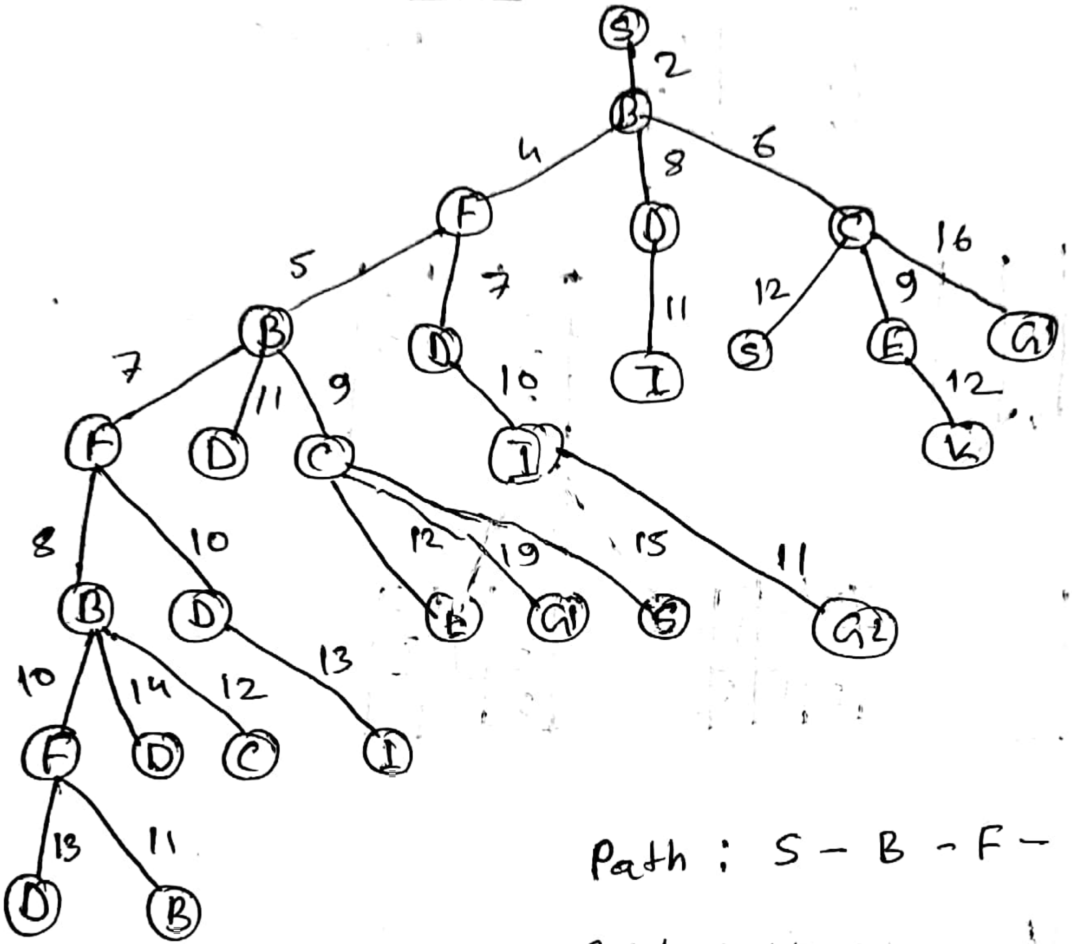


so from tree we can write iterative deeping DFS is not optimal when all the step costs are not identical.

e


level - 0
level - 1
level - 2
level - 3
2 8 7
3 1 4
5 6
2 8 7
3 1 4
5 6
2 8 7
3 1
5 6 4
2 8 7
3 1 4
5 6
2 8 7
3 4
5 1 6
2 8 7
3 1 4
5 6
2 8 7
1 4
3 5 6
2 8 7
3 1 4
5 6

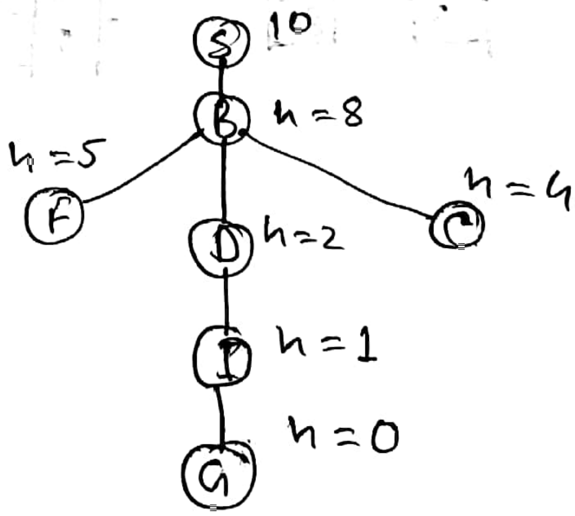
(d) (i) UCS:



Path : S - B - F - D - I - G2

Cost : 11

(ii) Greedy BFS:

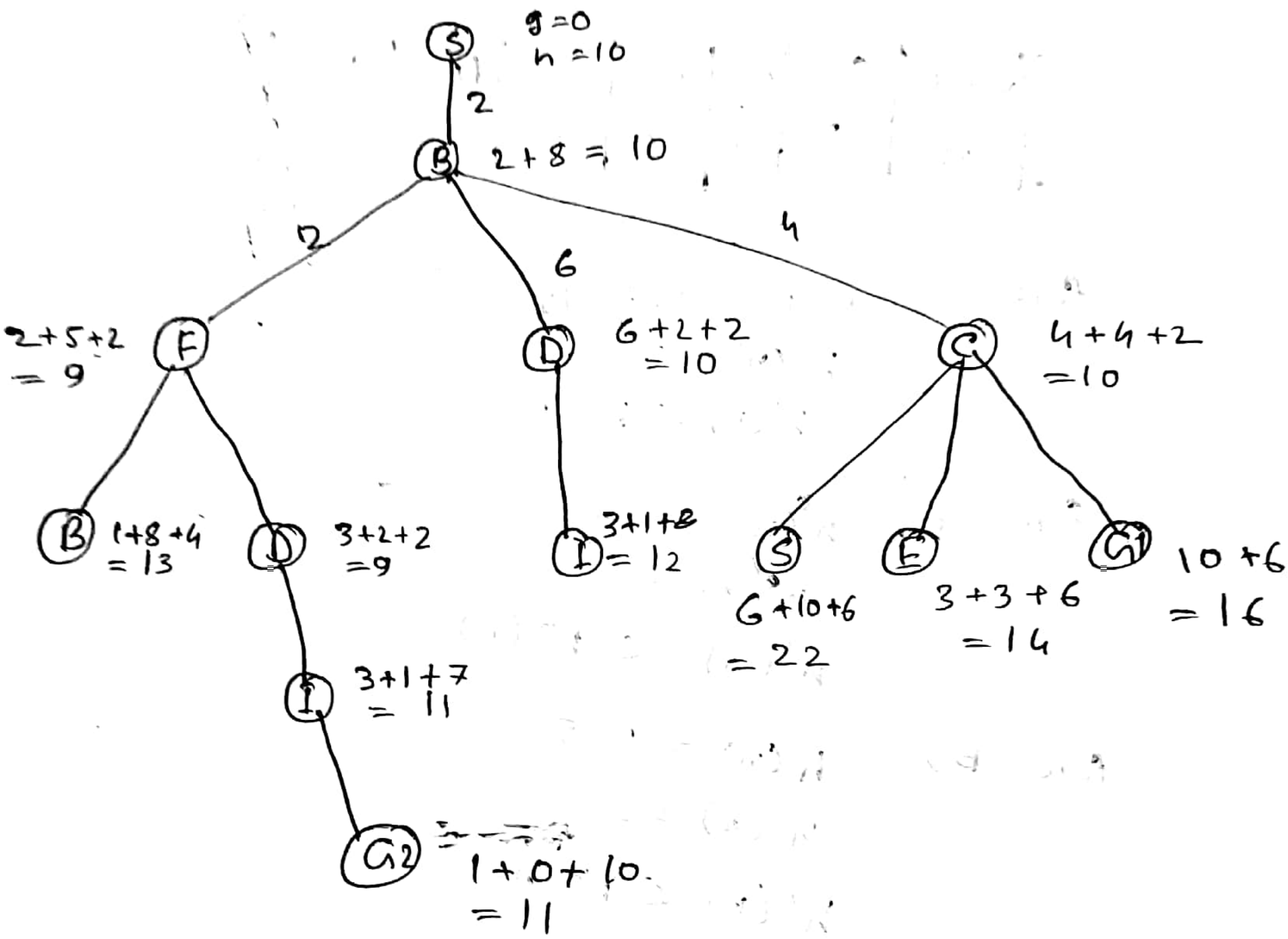


path: S - B - D - I - G2

Cost: $2+6+3+1$

$= 12$

(iii) A* Search



path : S - B - F - D - I - G2

cost : 11

3)

a)

node	S	A	B	C	D	G
n	3	2	2	3	2	0

for S,
$h(n) = 7, 7, 12$
$h'(n) = 3$
$h'(n) \leq h^*(n)$

for A,
$h(n) = 4, 6$
$h'(n) = 2$
$h'(n) < h^*(n)$

for B,
$h(n) = 2, 5$
$h'(n) = 2$
$h'(n) < h^*(A)$

for C,
$h(n) = 5$
$h'(n) = 3$
$h'(n) < h^*(n)$

for D,
$h(n) = 2$
$h'(n) = 2$
$h'(n) < h^*(n)$

So, it is admissible and consistent.

b)

(i) h_2 has all the heuristic value 0. So h_2 will expand the maximum number of nodes.

(ii) h_1 has all the actual values, so h_1 will expand the minimum number of nodes.

(iii) h_3 will give the non-optimal solution cause the value of $h_3 = 7$ bigger then actual value 6.

Fall - 19

Q1 (b)

(a) Straight line is the minimum distance to go from two points. We use it as estemed distance. And this is an underesteemed of the true cost. So it is admissible and it is also consistent

(b) for h1,

for admisible,

$S \rightarrow 6 \leq 6, 7$; true

$A \rightarrow 4 \leq 4$; true

$B \rightarrow 4 \leq 3$; false

$C \rightarrow 6 \leq 5$; false

$D \rightarrow 2 \leq 3$; true

$G \rightarrow 0 \leq 0$; true

This is admissible.

$h(C) - h(D) \leq 2$

$\Rightarrow 6 - 2 \leq 2$; false

not consistent.

for h2,

$S \rightarrow 6 \leq 6, 7$; true

$A \rightarrow 4 \leq 4$; true

$B \rightarrow 1 \leq 3$; true

$C \rightarrow 3 \leq 5$; true

$D \rightarrow 1 \leq 3$; true

$G \rightarrow 0 \leq 3$; true.

this is admissible.

$$h(A) - h(B) \leq c(A,B)$$

$$\Rightarrow 4 - 1 \leq 1 \text{ ; false}$$

$\therefore$ not consistent.

for $h3$,

$S \rightarrow 6 \leq 6$; true

$A \rightarrow 3 \leq 4$; true

$B \rightarrow 2 \leq 3$; true

$C \rightarrow 4 \leq 5$; true

$D \rightarrow 2 \leq 3$; true

$G \rightarrow 0 \leq 0$; true

this is admissible.

$$h(S) - h(A) \leq c(S,A)$$

$$\rightarrow 6 - 3 \leq 2$$

$$\Rightarrow 3 \leq 2 \text{ ; false}$$

$\therefore$ not consistent.

Summer - 2020

1)

i) state : { (x, y), colorless cell booleans }

ii) state space size :

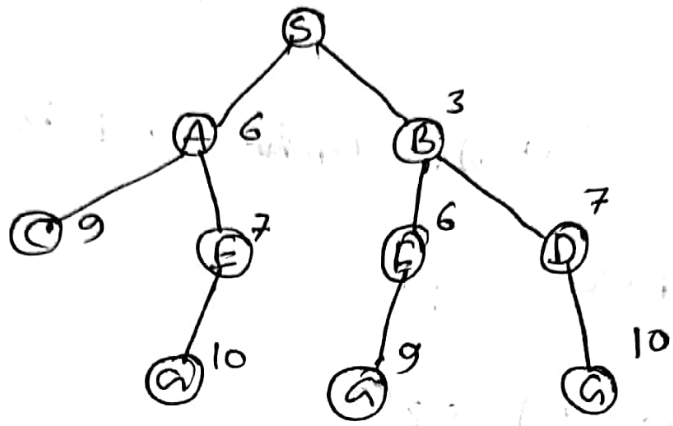
$$(36 - 7) \times 2^{29}$$

$$= 29 \times 2^{29}$$

(iii) Goal state :

All colorless cell false.

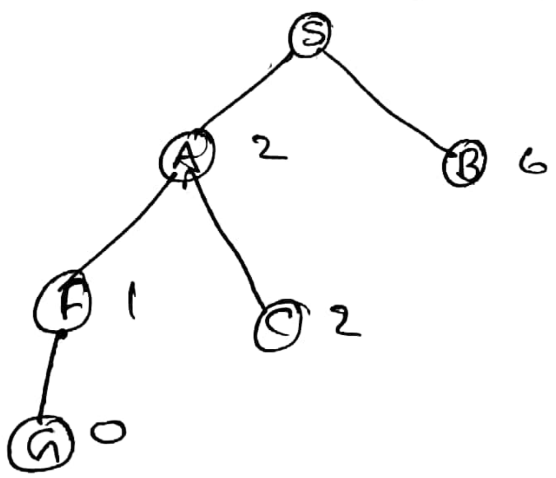
2/ (i) UCS



Path : S → B → E → G

Cost : 0 + 3 + 3 + 3 = 9

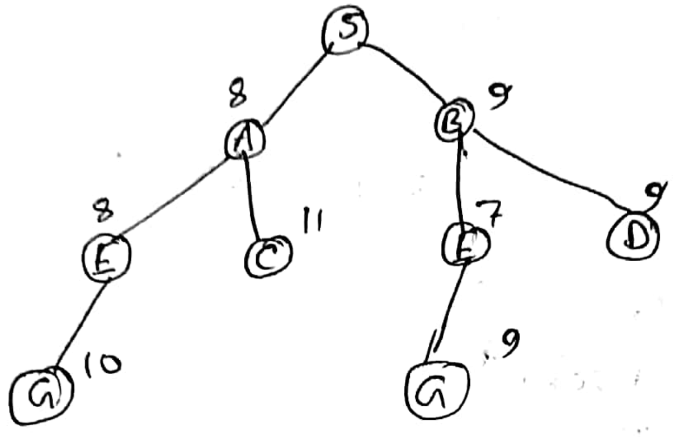
(ii) Greedy BFS



Path : S → A → B → G

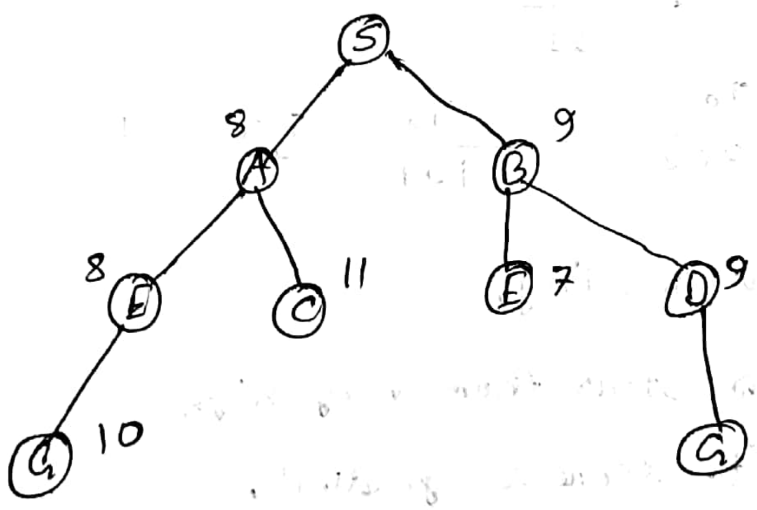
Cost : 6 + 1 + 3 = 10

(iii) A* search:



Path : S → B → E → G

(iv) A* graph search:



path : S → B → D → G

Cost : 10.

Q] (ii) $T_k = \dfrac{T_0}{1+\alpha k}$

1st iteration, $T_1 = \dfrac{T_0}{1+5\times 1}$ [$\alpha = 5$]

$= \dfrac{T_0}{6}$

$T_1 = \dfrac{T_0}{1+50\times 1}$

$= \dfrac{T_0}{51}$ [$\alpha = 50$]

2nd iteration, $T_2 = \dfrac{T_0}{1+5\times 2}$ [$\alpha = 5$]

$= \dfrac{T_0}{11}$

$T_2 = \dfrac{T_0}{1+50\times 2} = \dfrac{T_0}{101}$ [$\alpha = 50$]

for simulated annealing,

1. T has to start from very high
2. T has to decrease gradually

when we put, $\alpha = 5$, this equation follows this two rules better than when we put $\alpha = 50$.

$\alpha = 5$ will be choosen for better performance.

Fall - 2020

1| (i) PEAs for Delivery Robot for Hospital

Performance measuring : Accurately reach the destination, picking right object

Environment : Room, Wall, Table, chair, Bed, People

Actuator : Wheel, Arm, Carrying box.

Sensor : Camera, Sonar sensor.

(ii) This robot do those actions what it can precives. It don't aware of whole environment. So this robot's environment is partially observable.

The Robot aware of its path ~~as~~. and move when ~~ob~~ obstackle comes, so its stochastic.

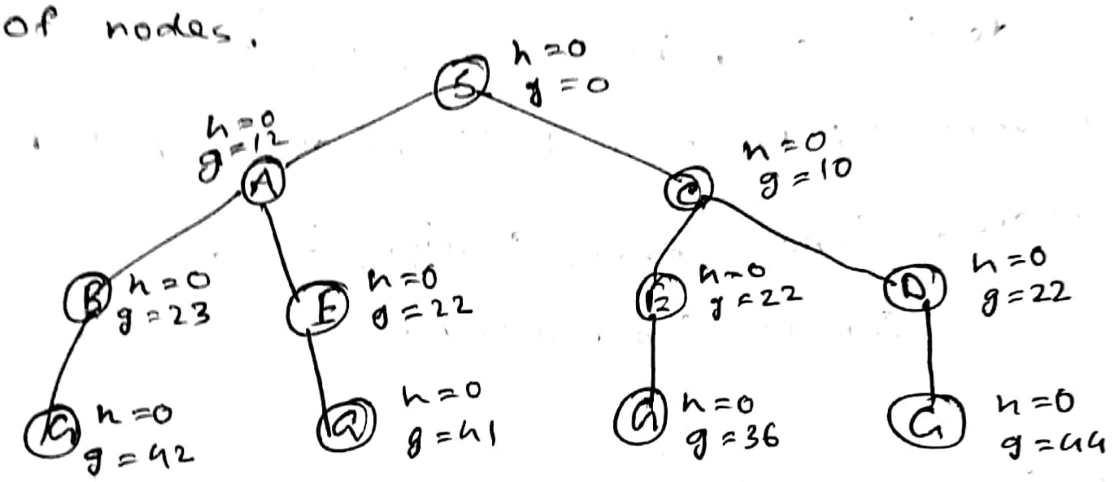
The robot needs to do its work one by one. so the environment is sequential.

The robot needs to go through some finite no of path, so the environment is discrete.

3)

~~h1 h when every~~ h1

When every henustic value in h1 is 0 than the heunistic h1 will produce maximum number of nodes.



On the other hand h2 heunistic only genarates S, C, D and G in a minimum number of nodes.

4]

(i) In greedy hill climbing search algorithm, first child nodes are compared to each other and find best child among them. If the best child greater than parent node then it'll be the next node and this node will be extended and others will be discarded. So this way it has to store very minimum tree.

(ii) When T approaches zero, simulate annealing starts behaving like first choice hill climbing search as it will increase the branching factor. So it will be generate one by one and behaving like first choice hill climbing search.

(iii) The mutation step in generic algorithm increases diversification as it makes variations in the state. After the cross over we can change 1 bit randomly which can introduce many variations in the state and as a result it increases diversification.