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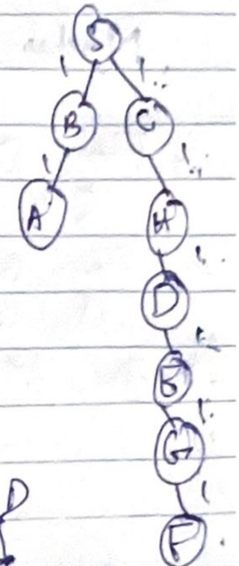
21L-5648- Assignment 4

AI:—

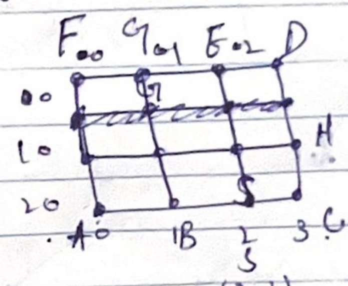
State of the vehicle can be represent with coordinates x, y.

will add $\boxed{f = g + h}$ < heuristic, path cost



(b)

We can use Manhattan distance as well as eucledian distance to calculate our heuristic cost.



(c)

We will use manhattan distance

Open list: [ ]

close list: [ ]

we will expand the node with lowest cost

$f = g + h$.

Manhattan dist from G to all other nodes.

$dist(A, G) = 3 \quad \because |2-0| + |(0-1)| = 2+1=3. \quad A(2,0) \quad G = (0,1)$

$dist(B, G) = 2$

$dist(S, G) = 3$

$dist(C, G) = 4$

$dist(H, G) = 3$

$dist(D, G) = 2$

$dist(E, G) = 1$

$dist(F, G) = 1$

$\therefore$ Expand [S B A C H D E G].

Path Cost: 5, Total 7 moves

Visited ((2,1), (2,0), (2,3), (1,3), (0,3), (0,2), (0,1))

(d)

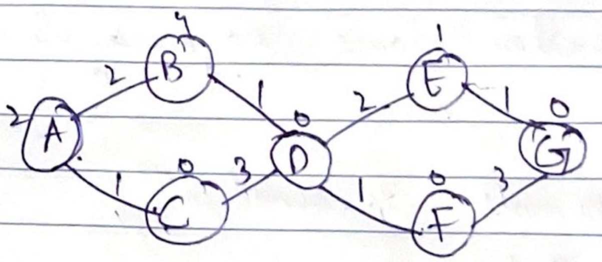
Nodes Expanded by A* BFS DFS:

→ For DFS we will expand 13 nodes if we consider S & G too.

→ For BFS since it is level by level it will traverse all nodes $7 \times 7 = 49$.

→ For A* it will expand nodes with lower cost.
= path nodes + additional explore nodes.
≈ 13-20.

Q2:

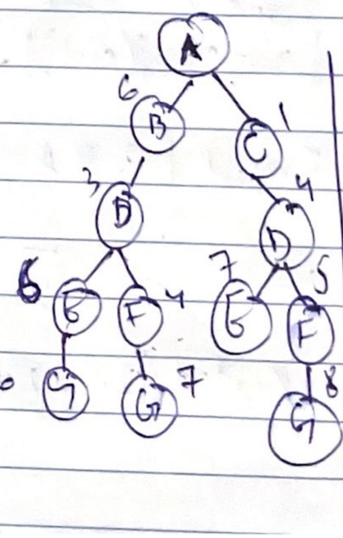


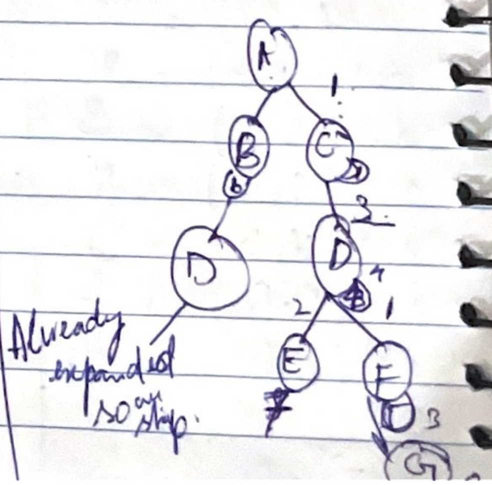
A	2
B	4
C	0
D	0
E	0
F	0
G	G

Total Cost = 6.

Path:
A → B → D → E → G.

State: —
A C D F B D F E G.





(c) E will be in the frontier queue

(d) The path will be. $A \to C \to D \to F \to G$.
but it is not optimal path.

(e) In this algo we will expand $A \to C \to D \to F \to G$
G is in successor list of F and we will not move from F to other lower cost which is B.
It will end there.
It will not be optimal because cost is 8
but it is complete.

Q3:

Knapsack

n = 100 array.

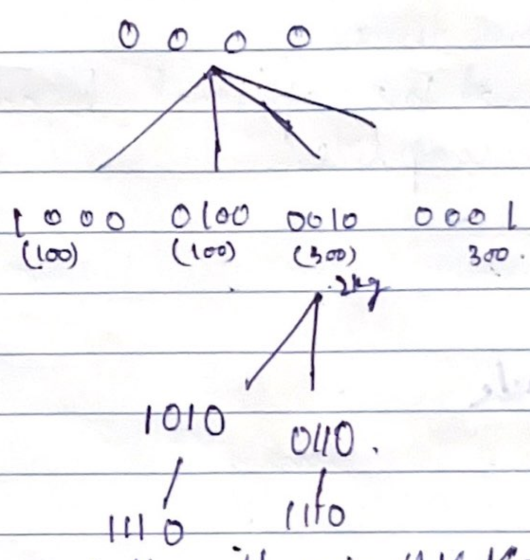
(i)

0 if not included
1 if included.
Total search space = 2^{100}.
Reason: Each of the item can be either in the Knapsack or not.

(ii) The state has 100 bits. so it can 100 have possible successor at each level. because each bit can be use to generate a new successor.

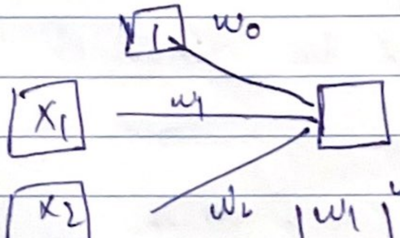
(c):- The suitable function will be to maximize the ~~weight~~ cost and minimize the weight where we will get as many value within the provided threshold.

(d):



Both will give 4K Kg & 500.

(Q4)



$y = \begin{cases} 1 & \text{if } f(x) \geq 0. \\ 0 & \text{otherwise} \end{cases}$ 1 if $x_2 >= x_1$

w_1	w_2	X_1	X_2	Y
-2	0	0	1	1
-2	0	-1	1	1
-2	0	1	0	-1
-2	0	1	-1	-1

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For all of these weights our output will be 2 pos & 2 neg according to the X value

x_1	x_2	y
0	1	1
-1	1	1
1	0	-1
1	-1	-1

Initial weigh = [0 0 0].

For 1 epoch:-

X1:

[1 0 1] x [0 0 0]

= 0 f(0) = 1 (No weights

For x = 2:

[1 -1 1] [0 0 0]

= 0 => f(0) = 1

For x = 3.

[1 1 0] [0 0 0] = 1 ≠ -1

update weights.

$$\begin{array}{r} [0\ 0\ 0] \\ 1\ 1\ 0 \\ \hline -1\ -1\ 0 \\ \hline \end{array}$$

For x = 4

[1 1 -1] [-1 -1 0]

= [-1 -1] = -2 = -1.

For E = 2:

[1 0 1] [-1 -1 0] = -1 ≠ 1

update weights.

$$\begin{array}{r} -1\ -1\ 0 \\ 1\ \ 0\ 1 \\ \hline 0\ -1\ 1 \\ \hline \end{array}$$ new weight.

For x = 2.

[1 -1 1] [0 -1 1]

= 2 f(2) = 1 ✓

For x = 3:

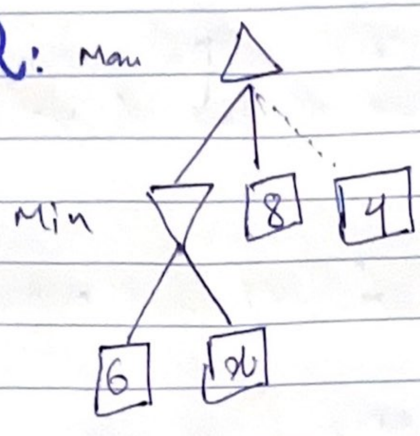
[1 1 0] [0 -1 1].

(-1) = -1 ✓

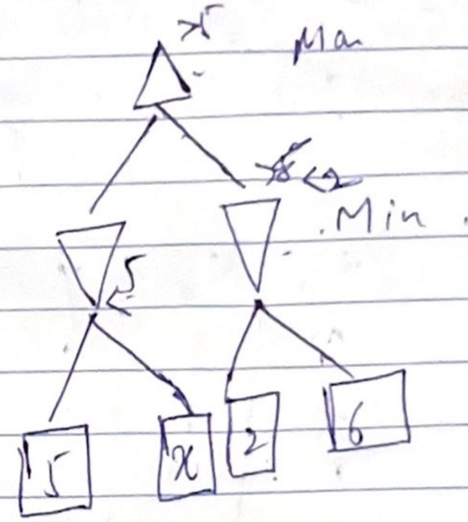
x = 4

[1 1 -1] [0 -1 1] = [-1 -1] = -2

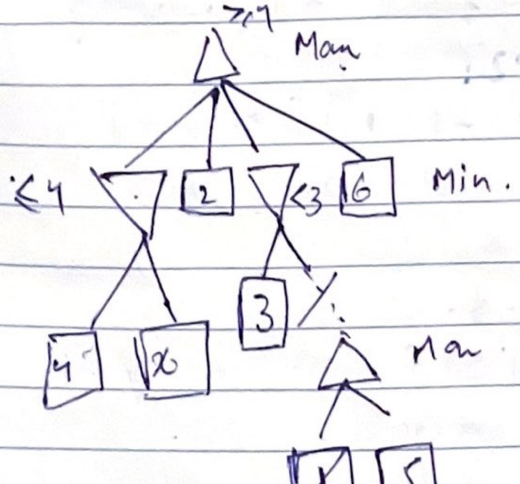
Q:



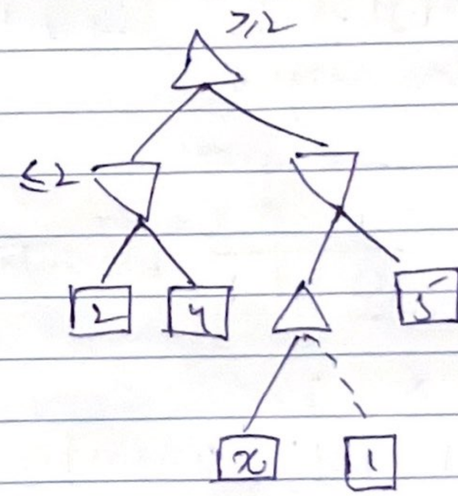
X None



X = 4, 5, 6 (val > 2)
(All) if ignore α.



X = 5, 6, 7 (x > 4)
It will prune.
(All) if ignore x.



$\boxed{X = \text{none}}$

	$C_1=(2,10)$	$C_2=(5,8)$	$C_3=(1,2)$	Clusters.
A1 (2,10)	0	–	–	C_1
A2 (2,5)	5	4.24.	3.16.	C_3.
A3 (8,4)	8.4	5	7.28.	C_2
A4 (5,8)	–	0	–	C_2
A6 (6,4)	7.2.	4.12	5.38	C_2
A7 (1,2)	8.06	7.21	0	C_3.
A8 (4,9)	2.23	1.41	7.61	C_2
A5 (7,5)	7.07	3.6	6.7.	C_2

P in 1st C

(2,10)

P in 2nd C

(8,4), (5,8), (6,4)
(4,9) (7,5)

P in 3rd C

(2,5)
(1,2)

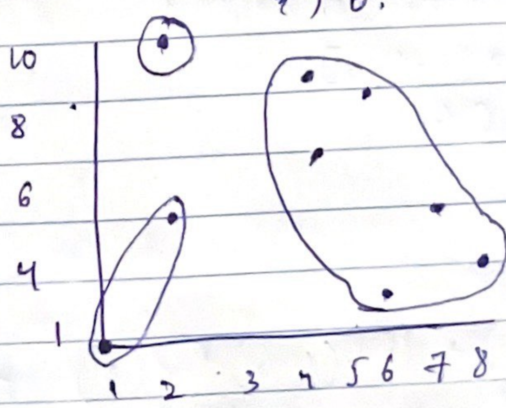
③ :-

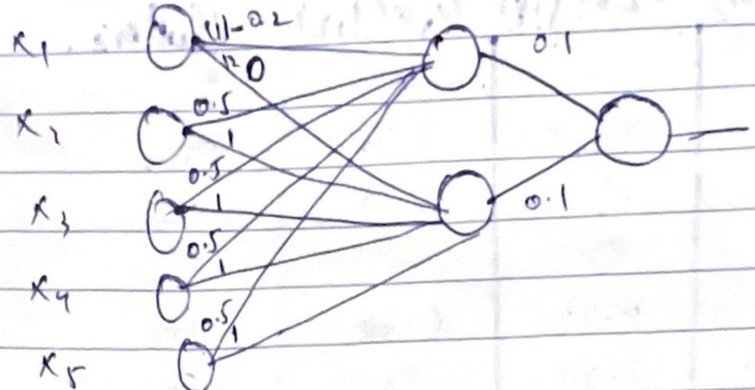
C_1 (2,10)

C_2 $\frac{8+5+6+4+7}{5}$, $\frac{4+8+4+9+5}{5}$

6, 6.

, C_3 (1.5, 3.5).





ⓐ

To train the data we will label it as.
# of Projects Avg Success Ratio Avg Comp Time Skill Exp Grade.

ⓑ.

For Empl:

$h_1 = [5\ \ -0.4\ \ 0.8\ \ 0.1\ \ 0.3]\ [-0.2\ \ 0.5\ \ 0.5\ \ 0.5\ \ 0.5] + 0$

$= [-1\ \ -0.2\ \ 0.4\ \ 0.05\ \ 0.15] = (-0.6)$

$= -0.\cancel{7}$

$h_2 = [5\ \ -0.4\ \ 0.8\ \ -0.1\ \ 0.3]\ [0\ 1\ 1\ 1\ 1]$

$= [0 - 0.4 + 0.8 + 0.1 + 0.3]$.

$= \cancel{1.7} = 0.6$.

Output layer.

$y = (0.1)(-0.7) + (0.1)(0.6) + 2(0) = -0.01$

$= \cancel{1.99} \Rightarrow \cancel{0.87} = 0.49$.

For Emp2:

h_1

x [1 0.4 0.1 1 -0.5] [-0.2 0.5 0.5 0.5 0.5]

= -0.075 = -0.075.

h_2 = [1 0.4 0.1 1 -0.5] [0 1 1 1 1]

= [1] = 1

y = (2)(0) + (-0.075)(0.1) + (1)(0.1)

= 0.09 => $\frac{1}{1+e^{-0.09}}$

$\boxed{= 0.522}$

(Part C)

x [4 -0.5 0.3 -0.2 0.5]

h_1 = $x h_1$ = -0.75.

h_2 = $x h_2$. = 0.1 = 0.1

y = (2)(0) + (-0.75)(0.1) + (0.1)(0.1)

= -0.06 = 0.517.

error at y = 1 - 0.517 = 0.49.

= (0.517)(1 - 0.517)(0.49)

= 0.122.

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error at h1:-

$$(-0.75)(1+0.75)((0.1)(0.123))$$

$$= -0.016.$$

error at h2:-

$$\cancel{= (0.514)(1-0.514)((0.1)(0.123))}$$
$$\cancel{= 0.0002}$$
$$= (0.1)(1-0.1)(0.1)(0.123)$$
$$= 0.0011$$

Computing new weights.

at Y:

$$LR = 1$$

$$Y_{11} = (1)(-0.75)(0.123)$$
$$= -0.09 + 0.1$$
$$= 0.01$$

$$Y_{12} = (1)(0.123)(0.1) = 0.0123 + 0.1$$
$$= 0.11$$

New Weights at X_1

$$X_{11} = \cancel{(1)(0.2)}\ (1)(4)(-0.016) = \boxed{-0.26.}$$
$$X_{21} = (1)(-0.5)(-0.016) + 0.5 = 0.508.$$
$$= (1)(0.3)(-0.016) + 0.5 = 0.495.$$
$$(1)(-0.2)(-0.016) + 0.5 = 0.503$$
$$(1)(0.5)(-0.016) + 0.5. = 0.492$$

For h_2 :-

$X_{12} = (1)(0.001)(4) + 0 = \cancel{4.00}\ 0.004$.

$X_{22} = (1)(0.001)(-0.5) + 1 = 0.99$.

$X_{32} = (1)(0.001)(0.3) + 1 = 1.0003$

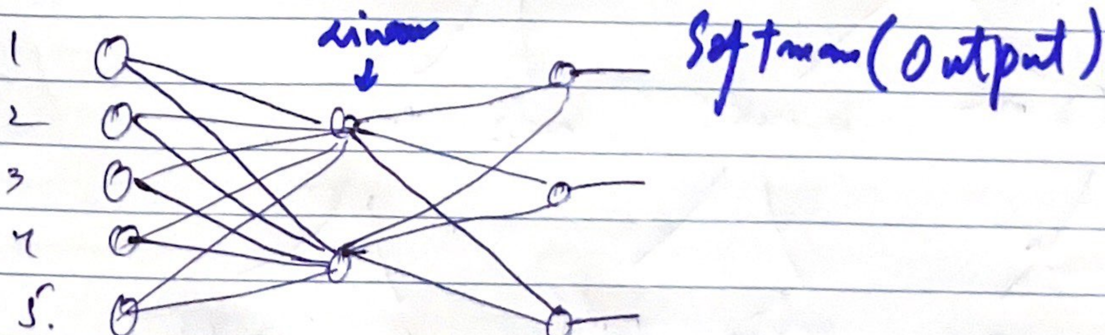
$X_{42} = (1)(0.001)(-0.2) + 1 = 0.99$

$X_{52} = (1)(0.001)(0.5) + 1 = 1.0005$.

(d):

We will use 3 neurons instead of 1 which will represent Good AVG Bad.

→ Also we will apply Softmax instead of Sigmoid. to convert data into probabilities.



(Q#6)

(a) 1st level $= 5 = 5$.

2nd level $= 5 \times 5 = 25$.

3rd level $= 5 \times 5 \times 5 = 125$.

Total is $7 \times 6 = 42$ level.

we geometric series formula $= \dfrac{b^{d+1} - 1}{b-1} = \dfrac{5^{43} - 1}{4}$

$= 9.86 \times 10^{23}$