Artificial Intelligence - Quiz

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Q1.

Ans- Initial Configuration

2	—
1	3

Final Configuration

1	2
3	—

Using A* algorithm with the Manhattan distance heuristic, we will compute f(n), g(n) and h(n), where
h(n) = heuristic cost = distance of current node n wrt goal node
g(n) = Generating cost = distance of current node n wrt starting node.
f(n) = cost function = g(n) + h(n).

open: ~~A~~ ~~B~~ ~~C~~ ~~D~~ ~~E~~ F G
closed: A B E F

2	—
1	3

A

g(n) = 0
h(n) = 1+1+1 = 3
f(n) = 0+3 = 3

g(n) = 1
h(n) = 1+1+2=4
f(n) = 1+4=5

2	3
1	—

C

—	2
1	3

B

g(n) = 1
h(n) = 1+0+1 = 2
f(n) = 1+2 = 3

g(n) = 2
h(n) = 0+0+1 = 1
f(n) = 2+1 = 3

1	2
—	3

E

2	—
1	3

D ~ A

g(n) = 2
h(n) = 1+1+1 = 3
f(n) = 2+3 = 5

g(n) = 3
h(n) = 0+0+0 = 0
f(n) = 3+0 = 3

1	2
3	—

F

GOAL STATE

—	2
1	3

G ~ B

g(n) = 3
h(n) = 1+0+1 = 2
f(n) = 3+2 = 5

The order of node traversal →

A ⟶ B ⟶ E ⟶ F

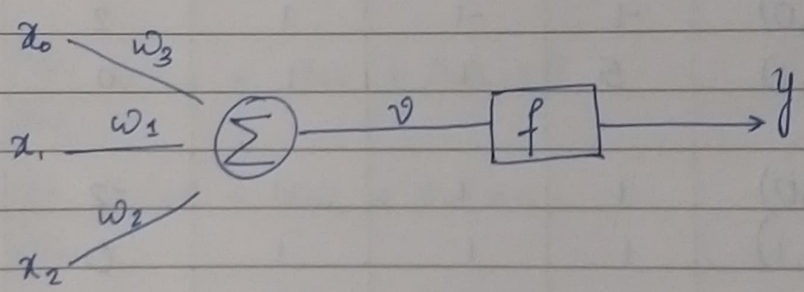
f = 3 f=3 f=3 f=3

Q2.

Ans - Given Table :

x_0	x_1	x_2	label	d.
1	0	0	1	-1
1	0	1	2	1
1	1	0	2	1
1	1	1	2	1

Representing single Perceptron model.



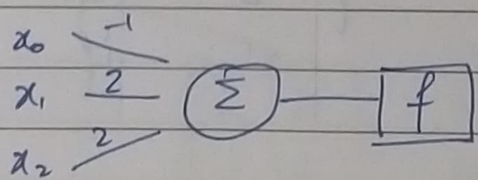
* All weights are initialised to 0 and thus :-

$$\phi(v) = \begin{cases} +1 & \text{if } v > 0 \\ 0 & \text{if } v = 0 \\ -1 & \text{if } v < 0 \end{cases}$$

SLP training via stochastic gradient descent

(w_0, w_1, w_2)	(x_0, x_1, x_2)	v	$y=\phi(v)$	d	$e=d-y$	$\Delta w = (\Delta w_0, \Delta w_1, \Delta w_2)$
(0,0,0)	(1,0,0)	0	0	-1	-1	(-1,0,0)
(-1,0,0)	(1,0,1)	-1	-1	1	2	(2,0,2)
(1,0,2)	(1,1,0)	1	1	1	0	(0,0,0)
(1,0,2)	(1,1,1)	3	1	1	0	(0,0,0)
(1,0,2)	(1,0,0)	1	1	-1	-2	(-2,0,0)
(-1,0,2)	(1,0,1)	1	1	1	0	(0,0,0)
(-1,0,2)	(1,1,0)	-1	-1	1	2	(2,2,0)
(1,2,2)	(1,1,1)	5	1	1	0	(0,0,0)
(1,2,2)	(1,0,0)	1	1	-1	-2	(-2,0,0)
(-1,2,2)	(1,0,1)	1	1	1	0	(0,0,0)
(-1,2,2)	(1,1,0)	1	1	1	0	(0,0,0)
(-1,2,2)	(1,1,1)	3	1	1	0	(0,0,0).
(-1,2,2)	(1,0,0)	-1	-1	-1	0	(0,0,0).

Hence, general weights are $w_0 = -1$, $w_1 = 2$, $w_2 = 2$.
Trained SLP will be →



Equation of hyperplane $y = w_0 + w_1 x_1 + w_2 x_2$

$$\boxed{y = -1 + 2x_1 + 2x_2}$$

Q3.

Ans -

Cost function (F):

$$F(\omega_1, \omega_2) = \omega_1 - \omega_2 + 2\omega_1^2 + \omega_2^2 + 2\omega_1\omega_2 \quad \& \quad W(1) = (0,0).$$

To find the optimum weight vector W^*:

$\frac{dF}{dW^*} = 0$, since the cost function F will reach the global minimum,

we will take the partial derivatives of F wrt ω_1 and ω_2 ~~to zero~~ and equate them to zero.

$\Rightarrow$

$$\frac{\partial F}{\partial \omega_1} = 1 + 4\omega_1 + 2\omega_2 = 0 \quad -(i)$$

$$\frac{\partial F}{\partial \omega_2} = -1 + 2\omega_2 + 2\omega_1 = 0 \quad -(ii)$$

Solving (i) & (ii), we have,

$\omega_1 = -1$ and $\omega_2 = \frac{3}{2}$.

Hence,

$\boxed{\text{The suitable optimum weight vector is } W = \left[-1, \frac{3}{2}\right].}$