

The output of the program is:

At first we get weight matrix

```
3 -1 -1 1 -1 3 -1 1 1 1 -1 3 3 -1 -1
-1 -1 3 1 -1 -1 -1 1 -3 1 -1 -1 -1 -1 3
-1 3 -1 1 -1 -1 3 -3 1 1 -1 -1 -1 3 -1
```

and the bias on right side are

```
1 1 1
```

and the bias on left side are

```
1 1 1 3 -3 1 1 -1 -1 3 -3 1 1 1 1
```

!!!!!!ORDINARY CASE

=====

When x = C, yin = -15 13 17

thus, y = -1 1 1

Sequentially, on opposite direction, xin = -5 3 3 1 -1

```
-5 3 -3 -3 1 -1 -5 -5 3 3
```

thus, x = -1 1 1 1 -1 -1 1 -1 -1 1 -1 -1 -1 1 1

If we print it out, it will be like:

```
. # #
# . .
# . .
# . .
. # #
```

=====

When x = D, yin = 15 -13 15

thus, y = 1 -1 1

Sequentially, on opposite direction, xin = 3 3 -5 1 -1

```
3 3 -3 5 1 -1 3 3 3 -5
```

thus, x = 1 1 -1 1 -1 1 1 -1 1 1 -1 1 1 1 -1

If we print it out, it will be like:

```
# # .
# . #
# . #
# . #
# # .
```

=====

When x = X, yin = 17 13 -15

```
thus, y = 1 1 -1
Sequentially, on opposite direction, xin = 3 -5 3 1 -1
3 -5 5 -3 1 -1 3 3 -5 3
thus, x = 1 -1 1 1 -1 1 -1 1 -1 1 -1 1 1 -1 1
If we print it out, it will be like:
# . #
# . #
. # .
# . #
# . #
```

!!!!NOISY CASE from right to left

=====

When activation of Y become similar but not exact X: 01-1 xin  
= 0 -4 4 0 0 0 -4 4 -4 0 0 0 0 -4 4

```
thus, x = 0 -1 1 0 0 0 -1 1 -1 0 0 0 0 -1 1
```

If we print it out, it will be like:

```
* . #
* * *
. # .
* * *
* . #
```

```
Sequentially, on opposite direction, yin = 1 13 -15
thus, y = 1 1 -1
```

!!!!MISTOOK CASE from right to left

=====

When activation of Y have characteristic of both X and C, xin  
= -3 -3 5 -1 1 -3 -3 3 -5 -1 1 -3 -3 -3 5

```
thus, x = -1 -1 1 -1 1 -1 -1 1 -1 -1 1 -1 -1 -1 1
```

If we print it out, it will be like:

```
. . #
. # .
. # .
. # .
. . #
```

```
Sequentially, on opposite direction, yin = -15 13 -15
thus, y = -1 1 -1
```

**!!!!MISTOOK CASE from right to left WITH bias**

**=====**

**When activation of Y have characteristic of both X and C, xin**

**= -2 -2 6 2 -2 -2 -2 2 -6 2 -2 -2 -2 -2 6**

**thus, x = -1 -1 1 1 -1 -1 -1 1 -1 1 -1 -1 -1 -1 1**

**If we print it out, it will be like:**

```
. . #  
# . .  
. # .  
# . .  
. . #
```

**Sequentially, on opposite direction, yin = -6 22 -6**

**thus, y = -1 1 -1**

**=====**

**When x = C', yin = -6 2 14**

**thus, y = -1 1 1**

**Sequentially, on opposite direction, xin = -5 3 3 1 -1**

**-5 3 -3 -3 1 -1 -5 -5 3 3**

**thus, x = -1 1 1 1 -1 -1 1 -1 -1 1 -1 -1 -1 1 1**

**If we print it out, it will be like:**

```
. # #  
# . .  
# . .  
# . .  
. # #
```

**=====**

**When x = D', yin = 9 -3 1**

**thus, y = 1 -1 1**

**Sequentially, on opposite direction, xin = 3 3 -5 1 -1**

**3 3 -3 5 1 -1 3 3 3 -5**

**thus, x = 1 1 -1 1 -1 1 1 -1 1 1 -1 1 1 1 -1**

**If we print it out, it will be like:**

```
# # .  
# . #  
# . #  
# . #  
# # .
```

=====

When  $x = X'$ ,  $y_{in} = 0 \ 4 \ -4$

thus,  $y = 0 \ 1 \ -1$

Sequentially, on opposite direction,  $x_{in} = 0 \ -4 \ 4 \ 0 \ 0 \ 0$   
 $-4 \ 4 \ -4 \ 0 \ 0 \ 0 \ -4 \ 4$

thus,  $x = 0 \ -1 \ 1 \ 0 \ 0 \ 0 \ -1 \ 1 \ -1 \ 0 \ 0 \ 0 \ 0 \ -1 \ 1$

If we print it out, it will be like:

```
* . #
* * *
. # .
* * *
* . #
```

And we input into round 2:

1 13 -15

thus,  $y = 1 \ 1 \ -1$

Sequentially, on opposite direction,  $x_{in} = 3 \ -5 \ 3 \ 1 \ -1$   
 $3 \ -5 \ 5 \ -3 \ 1 \ -1 \ 3 \ 3 \ -5 \ 3$

thus,  $x = 1 \ -1 \ 1 \ 1 \ -1 \ 1 \ -1 \ 1 \ -1 \ 1 \ 1 \ -1 \ 1$

If we print it out, it will be like:

```
# . #
# . #
. # .
# . #
# . #
```

=====

When  $x = D'$  but works WITH bias,  $y_{in} = 1 \ 5 \ -3$

thus,  $y = 1 \ 1 \ -1$

Sequentially, on opposite direction,  $x_{in} = 4 \ -4 \ 4 \ 4 \ -4$   
 $4 \ -4 \ 4 \ -4 \ 4 \ -4 \ 4 \ 4 \ -4 \ 4$

thus,  $x = 1 \ -1 \ 1 \ 1 \ -1 \ 1 \ -1 \ 1 \ -1 \ 1 \ 1 \ -1 \ 1$

If we print it out, it will be like:

```
# . #
# . #
. # .
# . #
# . #
```