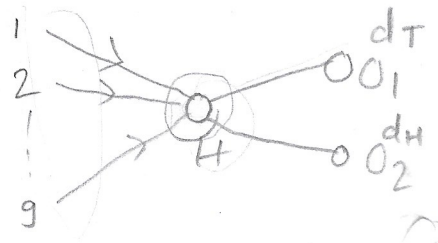
Q-1 (a)

T = 111010010 , D_T = 466 , $d_T = \frac{466}{512} = 0.910$

H = 101111101 , D_H = 381 , $d_H = \frac{381}{512} = 0.744$ — (1)



— (3)

$net_{Hidden} = 5 \times 0.5 = 2.5$

$O_H = f(net_H) = \frac{1-e^{-2x}}{1+e^{-2x}}$

$= \frac{2}{1+e^{-2x}} - 1$

$= \frac{2}{1+e^{-2\times 2.5}} - 1 = 0.9866$ — (1.5)

Input to both o/p nodes = $0.5 \times 0.9866 = 0.4933 = net_o$

$O_1 = O_2 = f(net_o) = net_o = 0.4933$ — (2)

error vector at o/p $\delta_{O_1} = (d_T - O_1)1' = (0.910 - 0.4933) = 0.4167$ — (2)

($1'$ → derivative)

$\delta_{O_2} = (d_H - O_2)1 = (0.744 - 0.4933) = 0.2507$

derivative of tanigmoid $\left(y = \frac{1-e^{-mx}}{1+e^{-mx}}\right)$, equals to $\frac{m}{2}(1-y^2)$, here $m = 2$

Error vector at hidden layer, $\delta_H = (1-y^2)\,[(\delta_1 + \delta_2) \times 0.5]$ — (3)

(y^2 → derivative)

$\Rightarrow \delta_H = [1-(0.9866)^2][(0.4167 + 0.2507) \times 0.5]$

$= 0.0089$

Weight change hidden to O/p $O_1 = \eta \delta_{O_1} O_H = 0.6 \times 0.4167 \times 0.9866 = 0.2467$

" " O/p $O_2 = \eta \delta_{O_2} O_H = 0.6 \times 0.2507 \times 0.9866 = 0.1484$

weight change input to hidden = $\eta \delta_H \cdot X$

if $X = 0$, $\Delta W_{ih} = 0$

if $X = 1$, $\Delta W_{ih} = 0.6 \times 0.0089 \times 1 = 0.0053$

$W_{H-O_1} = 0.5 + 0.1233 = 0.7467$ — (1)

$W_{H-O_2} = 0.5 + 0.0742 = 0.6484$ — (1)

$W_{1H} = W_{2H} = W_{3H} = W_{5H} = W_{8H} = 0.5 + 0.0053 = 0.5053$

$W_{4H} = W_{6H} = W_{7H} = W_{9H} = 0.5 + 0 = 0.5$

4.5

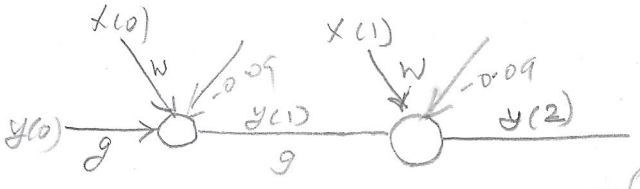
Que (1)(b)

```
p= [ 111 0 1 0 0 11 ; 1 0 11 11 1 0 1 ; 0 1 0 0 1 0 0 1 0 ; 1 1 1 1 1 1 1 1 1 ]'   (1 1/2)

t= [ .91  .74  .28  .99 ;
     .74  .28  .99   0  ]                                   (2)

pl= [0 1 0 1 1 1 1 1 0 1]'

net = newff( minmax(p) ; [12,6,2], {'logsig','logsig','purelin'});
      (1/2)              (1/2)     (1/2)

net = train(net, P, t)                                      (1/2)

sim(net pl)                                                 (1/2)
```

$x(0) = -0.1 \quad x(1) = 0.2 \quad y(0) = 0$ **Que (2)**

$y_d(1) = 0.4 \quad y_d(2) = 0.6$, $w = g = 0.5$, $b = -0.09$

Activation function is Relu



(2)

$$y(1) = f[x(0).w + y(0).g + 0.09]$$
$$= f[-0.1 \times 0.5 + 0 - 0.09]$$
$$= f[-.05 - .09]$$
$$= f[-.14] = 0 \text{ as Relu}$$

(1)

$$y(2) = f[w.x(1) + g.y(1) - 0.09]$$
$$= f[0.5 \times 0.2 + 0.5 \times 0 - 0.09] = f[.1 - .09] = f[0.01] = 0.01$$

(1)

$$e(2) = y_d(2) - y(2) = 0.6 - .01 = 0.59$$
$$e(1) = y_d(1) - y(1) = 0.4 - 0 = 0.4$$

(2)

(2) $\delta_2 = e(2) \times 1 = 0.59$

$\delta_1 = [e_1 + \delta_2 g] \times 0 = [0.4 + 0.59 \times 0.5] \times 0 = 0$

(1.5)

$\Delta b_2 = \eta \delta_2 = 0.1 \times 0.59 = 0.059$

$\Delta w_2 = \eta \delta_2 x(1) = 0.1 \times 0.59 \times 0.2 = 0.0118$

$\Delta g_2 = \eta \delta_2 y(1) = 0.1 \times 0.59 \times 0 = 0$

(1.5)

$\Delta w_1 = \eta \delta_1 x(0) = 0$

$\Delta g_1 = \eta \delta_1 y(0) = 0$

$\Delta b_1 = \eta \delta_1 (1) = 0$

(3)

$w_{new} = 0.5 + \Delta w_1 + \Delta w_2 = 0.5118$

$g_{new} = 0.5 + \Delta g_1 + \Delta g_2 = 0.5$

$b_{new} = -0.09 + \Delta b_1 + \Delta b_2 = -0.031$

Que (3)

n = 6
EC = 1
CC = round(pc × (n − EC)) = 4
MC = n − EC − CC = 1 } — (1)

pc = 0.8
pm = 0.05

4

Table-A

String no	x1 (binary)	x2 (binary)	x1 (decoded)	x2 (decoded)	x1 (linear)	x2 (linear)	f(x)=F(x)	P	CP	Rand. No.	Pool mem
1	0110101001	0100011100	425	284	2.077	1.388	37.035	0.0616	0.0616	0.2091	2
2	0010101010	0000011010	170	26	0.831	0.127	141.543	0.2353	0.2969	0.8582	6
3	0000101010	0100011011	42	283	0.205	1.383	115.504	0.1920	0.4889	0.5339	4
4	1100011111	0101010100	799	340	3.905	1.662	35.065	0.0583	0.5472	0.7847	6
5	0100011100	1011100010	284	738	1.388	3.607	84.622	0.1407	0.6879	0.2333	2
6	1110010101	1001100101	917	613	4.482	2.996	187.727	0.3121	1.0000	0.4476	3
							601.496				

CrossOver I	Site	CP-x1	CP-x2	CC-x1	CC-x2	Mutaion N	Mutation	MP-x1	MP-x2	MC-x1
1	15	0010101010	0000011010	0010101010	0000000101	1	9	0010101010	0000011010	0010101000
		1110010101	1001100101	1110010101	1001111010					
2	5	1100011111	0101010100	1100010101	1001100101					
		1110010101	1001100101	1110011111	0101010100					

MC-x2
0000011010

Table-B →

NG-x1	NG-x2	type	NG-x1-dec	NG-x2-dec	NG-x1-act	NG-x2-act	f(x)=F(x)	EliteNG-x1	EliteNG-x2
1110010101	1001100101	Elite	917	613	4.482	2.996	187.727		
0010101010	0000000101	CC	170	5	0.831	0.024	143.836		
1110010101	1001111010	CC	917	634	4.482	3.099	198.690	1110010101	1001111010
1100010101	1001100101	CC	789	613	3.856	2.996	81.180		
1110011111	0101010100	CC	927	340	4.531	1.662	125.298		
0010101000	0000011010	MC	168	26	0.821	0.127	141.993		

Next generation elite
= (4.482, 3.099) — (1)

Que (4)

(a) Global best (position with minimum f value)
= (1, 2) ——— (1)

S.N.	X1	X2	V1	V2	fX	GB-x1	GB-x2	LB-x1	LB-x2	W	C1	C2	R1	R2	V1	V2	X1	X2
1	1	2	0.5	1	9	1	2	1	2	1	1.05	1.05	0.0497	0.5126	0.5000	1.0000	1.5000	3.0000
2	2	1	1	0.5	14	1	2	2	1	1	1.05	1.05	0.5138	0.0621	0.9348	0.5652	2.9348	1.5652
3	3	3	1.5	1.5	45	1	2	3	3	1	1.05	1.05	0.7578	0.7768	-0.1312	0.6844	2.8688	3.6844
4	4	5	2	2.5	96	1	2	4	5	1	1.05	1.05	0.9917	0.6320	0.0092	0.5092	4.0092	5.5092
5	5	4	2.5	2	107	1	2	5	4	1	1.05	1.05	0.2520	0.4537	0.5943	1.0472	5.5943	5.0472

S.N.	X1	X2	V1	V2	fX	GB-x1	GB-x2	LB-x1	LB-x2
1	1.5000	3.0000	0.5000	1.0000	21.00	1	2	1	2
2	2.9348	1.5652	0.9348	0.5652	30.23	1	2	2	1
3	2.8688	3.6844	-0.1312	0.6844	50.36	1	2	3	3
4	4.0092	5.5092	0.0092	0.5092	105.17	1	2	4	5
5	5.5943	5.0472	0.5943	1.0472	145.08	1	2	5	4

S.N.	X1	X2	V1	V2	R1	R2
1	1	2	0.5	1	0.0497	0.5126
2	2	1	1	0.5	0.5138	0.0621
3	3	3	1.5	1.5	0.7578	0.7768
4	4	5	2	2.5	0.9917	0.6320
5	5	4	2.5	2	0.2520	0.4537