











Table 5. Input Data File (bp-infile.txt): application mode

```
bp-infile.txt
4      : PImax, Number of PIs
3      : IImax, Nuber of elemnets in IL
3      : HLmax, Nuber of elemnets in HL
3      : OLmax, Nuber of elemnets in OL
0.6    : alpha, Training coefficient
G      : iltf & hltf: S/T/G: sine/tan/sigmoid
G      : oltf, TF for OL
5.0    : Gain for the TF: I' = I * Gain
0.25   : Tssth, Threshold error: 0.3 => 30%
4      : Pmax & the Pattern associations: Yi, Xi
1 0 0 1
0 1 0
0 1 1 0
1 0 1
1 1 1 0
1 0 0
0 1 1 1
0 0 1
```

Table 6. BP-Simulator Output simulation trace - in application mode (bp-outfile-training-mode.txt)

```
*****
** Back-Propagation Neural Network Simulator **
** Traning mode: Output Simulation trcae **
*****
Reading input data from: bp-infile.txt
BP NETWORK - TRAINING MODE:
# of PES in PI/IN/HL/OL:      4 3 3 3
LR for IN, HL, and OL:      Delta Rule
Training Coefficient (alpha): 0.60
TF Input/Hidden Layers (hltf): Sigmoid
TF of Output Layer (oltf):   Sigmoid
Gain factor for the TFs:     5.00
Error Threshold (TssTh):     0.25
# of pattern associations (pmax): 4
                                0      1      2      3      4
X[ 0] 1.00      1.00      0.00      0.00      1.00
D[ 0]          0.00      1.00      0.00
X[ 1] 1.00      0.00      1.00      1.00      0.00
D[ 1]          1.00      0.00      1.00
X[ 2] 1.00      1.00      1.00      1.00      0.00
D[ 2]          1.00      0.00      0.00
X[ 3] 1.00      0.00      1.00      1.00      1.00
D[ 3]          0.00      0.00      1.00

Network training starts here:
Weight Matrices of the Network:
      PI: 0      PI: 1      PI: 2      PI: 3      PI: 4
IL: 1 -0.018000  0.034000 -0.032000 -0.100000  0.038000
IL: 2 -0.052000  0.056000  0.016000  0.024000  0.028000
IL: 3 -0.090000 -0.010000  0.062000 -0.046000  0.022000
      IL: 0      IL: 1      IL: 2      IL: 3
HL: 1 0.082000  0.090000 -0.016000 -0.046000
HL: 2 -0.028000  0.082000 -0.092000 -0.096000
HL: 3 0.006000  0.084000  0.064000 -0.058000
      HL: 0      HL: 1      HL: 2      HL: 3
OL: 1 -0.068000 -0.064000  0.090000 -0.006000
OL: 2 -0.048000  0.042000 -0.024000  0.038000
OL: 3 -0.076000  0.034000  0.098000 -0.030000
CYCLE: 1
YOL[ 0]-: 0.41 0.49 0.46
YOL[ 0]+: 0.28 0.66 0.31
DOL[ 0] : 0.00 1.00 0.00
YOL[ 1]-: 0.28 0.66 0.31
YOL[ 1]+: 0.47 0.46 0.50
DOL[ 1] : 1.00 0.00 1.00
YOL[ 2]-: 0.47 0.46 0.50
YOL[ 2]+: 0.64 0.31 0.34
DOL[ 2] : 1.00 0.00 0.00
YOL[ 3]-: 0.64 0.31 0.34
YOL[ 3]+: 0.45 0.24 0.53
DOL[ 3] : 0.00 0.00 1.00
Tssp: rms errors: p0...pmax: 0.46 0.69 0.50 0.56
TssC[cycle]: Cumulative-Tssp rms error(before)-: 0.55
```

```
CYCLE:574
YOL[ 0]-: 0.10 0.87 0.00
YOL[ 1]-: 0.81 0.00 1.00
YOL[ 2]-: 0.79 0.07 0.05
YOL[ 3]-: 0.23 0.01 0.84
Tssp: rms errors: p0...pmax: 0.09 0.11 0.13 0.16
TssC[cycle]: Cumulative-Tssp rms error(before)-: 0.12

Network Training Complete: Cycles: 574

Writing Network into the File bp-ckt.txt...

Writing TssC into the File bp-outfile-TssC.txt...

END BACK-PROPAGATION SIMULATION: TRAINING SESSION
```

Table 7. BP-Simulator Output simulation trace - in Recall mode (bp-outfile-recall-mode.txt)

```
BACK-PROPAGATION NETWORK - RECALL MODE:
Reading Network Weights from: bp-outfile-ckt.txt
Trained BP Network:
Number of Elements: PI/IL/HL/OL: 4 3 3 3
Transfer Function for the IN, HL: G
Transfer Function for the OL: G
Gain factor for Sine/siGmiod/Tanh TFs: 5.0

Weight Matrix WIL:
      0      1      2      3      4
1 -0.117929  0.373708 -0.169350 -0.237350 -0.004736
2 -0.290731  1.331819 -0.518565 -0.510565  0.278290
3 -0.305431  0.594064 -0.425380 -0.533380  1.221188

Weight Matrix WHL:
      0      1      2      3
1 0.095929 -0.120610 -0.397326 -0.594480
2 0.319776 -0.298146 -0.848796 -0.394399
3 -0.021513  0.066980  0.139034 -0.572369

Weight Matrix WOL:
      0      1      2      3
1 -0.588324  0.765280 -0.185429  1.184759
2 0.436281 -1.127587 -1.576824 -0.380790
3 -1.586459  1.415305  2.336450  0.023212

BACK-PROPAGATION NETWORK: Recall Mode:
Back-Propagation Network: Results of Testing:
Enter 9 9 9 9 to Terminate Testing:
Enter a Test Input: x1..x4
      0      1      2      3      4
PI: 1.000 1.000 0.000 0.000 1.000
IIL: 0.251 1.319 1.510
YIL: 1.000 0.778 0.999 0.999
IHL: -0.989 -1.154 -0.403
YHL: 1.000 0.007 0.003 0.118
IOL: -0.444 0.379 -1.566
YOL: 0.098 0.869 0.000

Enter a Test Input: x1..x4
      0      1      2      3      4
PI: 1.000 0.000 1.000 1.000 0.000
IIL: -0.525 -1.320 -1.264
YIL: 1.000 0.068 0.001 0.002
IHL: 0.086 0.298 -0.018
YHL: 1.000 0.606 0.816 0.478
IOL: 0.290 -1.716 1.189
YOL: 0.810 0.000 0.997

...
Enter a Test Input: x1..x4
END BACK-PROPAGATION SIMULATION: RECALL SESSION
```