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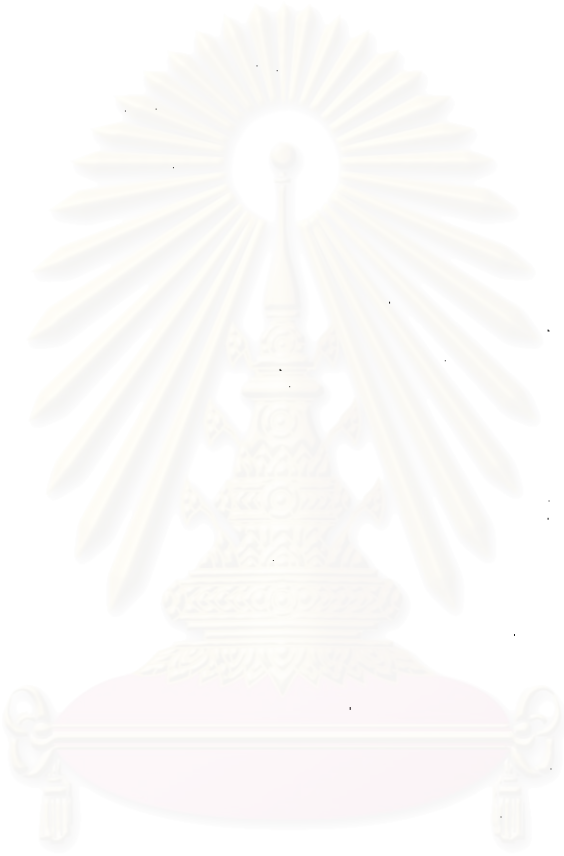

APPENDIX A

TRAINING RESULTS OF BACKPROPAGATION USING VALUES OF ADMITTED BANKNOTES AS INPUT DATA (7.3.4)

1. Training data for forecasting issued banknotes in 1996.

Objective: To investigate the result from using different data of the same input.

Data: Input set# 4, as mentioned in 7.2.1 and 7.2.2 (Normalization type B)

1.1 Training data: 1992-1995, Testing data: 1993-1996

1.2 Training data: 1991-1995, Testing data: 1992-1996

1.3 Training data: 1990-1995, Testing data: 1991-1996

1.4 Training data: 1989-1995, Testing data: 1990-1996

Parameter: number of neurons

Initial Conditions: Weight and bias are initialized by random, epoch = 2000, learning rate = 0.009, rate of increase in learning rate = 1.05, and rate of decrease in learning rate = 0.7.

Result: See Table A.1-A.4

1.1 Training data: 1992-1995, Testing data: 1993-1996

Table A.1 - Forecasting Issued Banknotes focused on 1996

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.679516	1.3646
2	0.299069	0.4183
3	0.299740	0.4197
4	0.633090	1.0861
5	0.633250	1.0689
6	0.350747	0.5685
7	0.305400	0.4404
8	0.633093	1.0836
9	0.308034	0.4499
10	0.297730	0.4161
11	0.303773	0.4370
12	0.303536	0.4394
13	0.298292	0.4146

Table A.1 - Forecasting Issued Banknotes focused on 1996 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
14	0.305451	0.4472
15	0.309712	0.4567
16	0.302561	0.4351
17	0.633371	1.1001
18	0.304416	0.4311
19	0.302635	0.4322
20	0.300570	0.4289
21	0.298921	0.4179
22	0.298811	0.4191
23	0.376984	0.6163
24	0.309919	0.4510
25	0.297713	0.4183
26	0.308848	0.4436
27	0.298394	0.4196
28	0.300168	0.4262
29	0.302493	0.4344
30	0.309404	0.4621
31	0.316353	0.4317
32	0.302878	0.4330
33	0.298556	0.4178
34	0.297712	0.4209
35	0.325300	0.4764
36	0.296396	0.4173
37	0.300564	0.4283
38	0.311266	0.4628
39	0.358514	0.5736
40	0.303920	0.4349
41	0.307596	0.4584
42	0.298103	0.4181
43	0.306246	0.4132
44	0.298391	0.4169
45	0.300173	0.4144
46	0.308706	0.4429
47	0.305552	**0.4100**
48	0.640944	0.9895

1.2 Training data: 1991-1995, Testing data: 1992-1996

Table A.2 - Forecasting Issued Banknotes focused on 1996

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.864218	1.4610
2	0.338007	0.4709
3	0.340423	0.4645
4	0.864607	1.4413
5	0.864319	1.4512
6	0.378953	0.5889
7	0.346032	0.4956
8	0.522197	0.9029
9	0.347941	0.4960
10	0.336096	**0.4581**
11	0.344703	0.4891
12	0.340051	0.4735
13	0.337826	0.4683
14	0.351670	0.5188
15	0.341054	0.4775
16	0.351487	0.5082
17	0.864337	1.4621
18	0.351847	0.4757
19	0.344065	0.4856
20	0.338570	0.4710
21	0.337807	0.4723
22	0.340921	0.4624
23	0.348771	0.5051
24	0.339441	0.4741
25	0.336194	0.4689
26	0.348134	0.4973
27	0.338779	0.4752
28	0.339218	0.4768
29	0.354452	0.5137
30	0.348719	0.5056
31	0.347144	0.4974
32	0.349213	0.4750
33	0.337156	0.4729
34	0.333505	0.4656

Table A.2 - Forecasting Issued Banknotes focused on 1996

No. of Neuron	SSE of Training Data	SSE of Testing Data
35	0.348827	0.4812
36	0.331965	0.4612
37	0.332553	0.4639
38	0.349656	0.5073
39	0.389136	0.6118
40	0.346725	0.4855
41	0.347085	0.4980
42	0.338004	0.4620
43	0.337093	0.4693
44	0.337707	0.4695
45	0.339372	0.4714
46	0.350824	0.4897
47	0.348222	0.5002
48	0.353424	0.5222
49	0.341802	0.4799
50	0.338102	0.4714
51	0.331519	0.4696
52	0.330691	0.4615
53	0.341112	0.4752
54	0.337351	0.4735
55	0.356938	0.4764
56	0.332888	0.4593
57	0.337628	0.4705
58	0.335626	0.4665
59	0.339265	0.4752
60	0.327153	0.4597

1.3 Training data: 1990-1995, Testing data: 1991-1996

Table A.3 - Forecasting Issued Banknotes focused on 1996

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	1.123230	1.8559
2	0.357329	0.5033

Table A.3 - Forecasting Issued Banknotes focused on 1996 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
3	0.368802	0.5035
4	1.123220	1.8492
5	1.12323	1.8494
6	0.392012	0.5731
7	0.40072	0.6107
8	0.366495	0.5414
9	0.366171	0.5368
10	0.358354	0.4977
11	0.364108	0.5344
12	0.36004	0.5174
13	0.357522	0.5083
14	0.368091	0.5466
15	0.360278	0.5161
16	0.360334	0.5157
17	0.822795	1.4676
18	0.364537	0.5248
19	0.362603	0.5240
20	0.383452	0.5127
21	0.358233	0.5106
22	0.357339	0.5068
23	0.397757	0.6284
24	0.357132	0.5080
25	0.356559	0.5062
26	0.365776	0.5357
27	0.357276	0.5068
28	0.358846	0.5146
29	0.357685	0.5067
30	0.367842	0.5485
31	0.364657	0.5321
32	0.362855	0.5264
33	0.374230	0.5473
34	0.358848	0.5022
35	0.365379	0.5409
36	0.377388	0.5501
37	0.357499	0.4981
38	0.366428	0.5406

Table A.3 - Forecasting Issued Banknotes focused on 1996 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
39	0.360628	0.5153
40	0.360690	0.5173
41	0.365609	0.5360
42	0.375764	0.5043
43	0.356348	0.5064
44	0.360182	0.5223
45	0.358671	0.5113
46	0.366303	0.5413
47	0.366845	0.5026
48	0.391555	0.5812
49	0.370970	0.5135
50	0.357599	0.5102
51	0.355543	0.5019
52	0.359945	0.5176
53	0.360523	0.5231
54	0.361011	0.5118
55	0.366231	0.5253
56	0.355650	0.5017
57	0.357268	0.5105
58	0.356492	0.5086
59	0.365882	0.5047
60	0.357268	0.5105
61	0.356578	0.5072
62	0.364098	0.5310
63	0.358761	0.5151
64	0.368293	0.5457
65	0.359740	0.5086
66	0.361839	0.5178
67	0.355493	0.5029
68	0.355443	0.5045
69	0.355730	0.5030
70	0.355399	0.5018
71	0.356557	0.5062
72	0.370961	0.5572

1.4 Training data: 1989-1995, Testing data: 1990-1996

Table A.4 - Forecasting Issued Banknotes focused on 1996

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.391841	0.5537
2	0.371704	0.5234
3	0.377668	0.5212
4	0.414239	0.6602
5	0.384065	0.5739
6	0.375675	0.5386
7	0.376499	0.5248
8	0.377684	0.5442
9	0.382061	0.5554
10	0.382573	**0.5180**
11	0.375099	0.5331
12	0.374262	0.5300
13	0.378936	0.5449
14	0.385047	0.5670
15	0.373999	0.5355
16	0.379745	0.5483
17	0.375874	0.5410
18	0.380157	0.5504
19	0.378533	0.5459
20	0.371898	0.5278
21	0.373920	0.5399
22	0.371368	0.5249
23	0.388232	0.5758
24	0.371403	0.5236
25	0.370705	0.5224
26	0.379599	0.5578
27	0.372244	0.5244
28	0.372309	0.5343
29	0.372071	0.5242
30	0.379357	0.5527
31	0.381189	0.5423
32	0.377399	0.5459
33	0.370427	0.5225
34	0.370500	0.5244

Table A.4 - Forecasting Issued Banknotes focused on 1996 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
35	0.382739	0.5667
36	0.370546	0.5235
37	0.375689	0.5182
38	0.382033	0.5512
39	0.375649	0.5368
40	0.375809	0.5336
41	0.380861	0.5570
42	0.370417	0.5248
43	0.371300	0.5277
44	0.374196	0.5329
45	0.373528	0.5287
46	0.379965	0.5567
47	0.370742	0.5249
48	0.378021	0.5499
49	0.377136	0.5336
50	0.372025	0.5274
51	0.369939	0.5233
52	0.370038	0.5254
53	0.371927	0.5337
54	0.384686	0.5317
55	0.383666	0.5665
56	0.370163	0.5239
57	0.370966	0.5250
58	0.370257	0.5251
59	0.382744	0.5248
60	0.373281	0.5375
61	0.370164	0.5254
62	0.379904	0.5537
63	0.369795	0.5267
64	0.385965	0.5532
65	0.373279	0.5310
66	0.375532	0.5332
67	0.370477	0.5223
68	0.371419	0.5212
69	0.371401	0.5285
70	0.370243	0.5248

Table A.4 - Forecasting Issued Banknotes focused on 1996 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
71	0.369669	0.5263
72	0.702340	0.5284
73	0.370197	0.5249
74	0.371706	0.5212
75	0.370653	0.5273
76	0.370253	0.5260
77	0.370631	0.5330
78	0.372568	0.5213
79	0.370132	0.5258
80	0.370077	0.5239
81	0.370613	0.5236
82	0.377084	0.5222
83	0.371248	0.5213
84	0.370872	0.5226

2. Training Data for forecasting issued banknotes in 1995.

Objective: To investigate the result from using different data of the same input.

Data: Input set# 4, as mentioned in 7.2.1 and 7.2.2 (Normalization type B)

2.1 Training data: 1991-1994, Testing data: 1992-1995

2.2 Training data: 1990-1994, Testing data: 1991-1995

2.3 Training data: 1989-1994, Testing data: 1990-1995

Parameter: number of neurons

Initial Conditions: Weight and bias are initialized by random, epoch = 2000, learning rate = 0.009, rate of increased learning rate = 1.05, and rate of decrease learning rate = 0.7.

Result: see Table A.5-A.7

2.1 Training data: 1991-1994, Testing data: 1992-1995

Table A.5 - Forecasting Issued Banknotes focused on 1995

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.407943	0.8500
2	0.226733	0.3244
3	0.224380	0.3156
4	0.407973	0.8454
5	0.408064	0.8410
6	0.245939	0.4251
7	0.227912	0.3367
8	0.410695	0.8048
9	0.229240	0.3458
10	0.218325	0.3076
11	0.227290	0.3311
12	0.225299	0.3137
13	0.222778	0.3031
14	0.229717	0.3480
15	0.234341	0.3514
16	0.226417	0.3178
17	0.407985	0.8457
18	0.227545	0.3321
19	0.226727	0.3260
20	0.223580	0.3059
21	0.220821	0.3124
22	0.223876	0.3074
23	0.274458	0.4704
24	0.229864	0.3504
25	0.218972	0.3013
26	0.229141	0.3455
27	0.223218	0.3035

Table A.5 - Forecasting Issued Banknotes focused on 1995 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
28	0.222916	0.3239
29	0.219518	0.3093
30	0.245361	0.4039
31	0.234028	0.3680
32	0.263828	0.4144
33	0.223446	0.3151
34	0.220237	0.3024
35	0.227618	0.3385
36	0.217803	0.3030
37	0.218253	0.3055
38	0.232814	0.3443
39	0.265163	0.4589
40	0.227930	0.3261
41	0.228403	0.3411
42	0.220080	0.3167
43	0.217462	**0.3005**
44	0.226404	0.3301
45	0.224844	0.3146
46	0.223312	0.3152
47	0.229466	0.3314
48	0.256383	0.4659

2.2 Training data: 1990-1994, Testing data: 1991-1995

Table A.6 - Forecasting Issued Banknotes focused on 1995

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.557256	1.0914
2	0.243108	0.3482
3	0.243666	0.3494
4	0.557273	1.0948
5	0.557354	1.1846
6	0.259703	0.4257
7	0.247526	0.3761
8	0.254293	0.3894

Table A.6 - Forecasting Issued Banknotes focused on 1995 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
9	0.248083	0.3776
10	0.241722	0.3472
11	0.255867	0.3577
12	0.244409	0.3517
13	0.243274	0.3468
14	0.248794	0.3794
15	0.246041	0.3517
16	0.245451	0.3550
17	0.557241	1.0869
18	0.246980	0.3697
19	0.253785	0.3560
20	0.251630	**0.3418**
21	0.243149	0.3488
22	0.243268	0.3497
23	0.281448	0.4898
24	0.260278	0.4095
25	0.241372	0.3488
26	0.247448	0.3746
27	0.243262	0.3471
28	0.255914	0.3890
29	0.243502	0.3484
30	0.249390	0.3829
31	0.247385	0.3754
32	0.246059	0.3671
33	0.242656	0.3488
34	0.242621	0.3439
35	0.247370	0.3771
36	0.243793	0.3537
37	0.241319	0.3487
38	0.249445	0.3915
39	0.247351	0.3549
40	0.248087	0.3678
41	0.247643	0.3754
42	0.262633	0.3936
43	0.241598	0.3469
44	0.253828	0.3793

Table A.6 - Forecasting Issued Banknotes focused on 1995 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
45	0.244269	0.3500
46	0.243774	0.3519
47	0.243328	0.3504
48	0.247969	0.3688
49	0.245539	0.3592
50	0.245645	0.3495
51	0.241660	0.3515
52	0.241319	0.3512
53	0.245019	0.3452
54	0.245604	0.3603
55	0.247558	0.3731
56	0.241270	0.3502
57	0.243065	0.3462
58	0.242652	0.3474
59	0.243665	0.3500
60	0.242864	0.3466

2.3 Training data: 1989-1994, Testing data: 1990-1995

Table A.7 - Forecasting Issued Banknotes focused on 1995

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.258639	0.3656
2	0.258777	0.3711
3	0.266359	0.3690
4	0.257630	0.3605
5	0.257828	0.3641
6	0.259988	0.3702
7	0.267672	0.3779
8	0.257756	0.3632
9	0.262624	0.3879
10	0.259714	0.3803
11	0.268409	0.3647
12	0.258638	0.3659

Table A.7 - Forecasting Issued Banknotes focused on 1995 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
13	0.258245	0.3686
14	0.262790	0.3860
15	0.257564	0.3715
16	0.258023	0.3627
17	0.261606	0.3835
18	0.259339	0.3723
19	0.257038	0.3667
20	0.257241	0.3704
21	0.261209	0.3794
22	0.263909	0.3843
23	0.259174	0.3717
24	0.259042	0.3838
25	0.259879	0.3761
26	0.273241	0.3822
27	0.259457	0.3712
28	0.261236	0.3891
29	0.256993	0.3690
30	0.262095	0.3972
31	0.260099	0.3769
32	0.268988	0.3979
33	0.258617	0.3742
34	0.259196	0.3762
35	0.259702	0.3751
36	0.261146	0.3910
37	0.257350	0.3693
38	0.261089	0.3835
39	0.262661	0.3676
40	0.255948	0.3717
41	0.257970	0.3690
42	0.263602	**0.3580**
43	0.257972	0.3770
44	0.261024	0.3825
45	0.260471	0.3721
46	0.256659	0.3699
47	0.260603	0.3857
48	0.259201	0.3783

Table A.7 - Forecasting Issued Banknotes focused on 1995 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
49	0.260066	0.3683
50	0.257120	0.3695
51	0.259254	0.3825
52	0.260300	0.3805
53	0.264090	0.3959
54	0.263403	0.3678
55	0.257175	0.3882
56	0.259718	0.3758
57	0.260036	0.3759
58	0.256975	0.3675
59	0.258372	0.3892
60	0.262133	0.3869
61	0.259743	0.3794
62	0.259491	0.3673
63	0.259857	0.3868
64	0.256781	0.3687
65	0.257986	0.3695
66	0.255975	0.3817
67	0.256637	0.3812
68	0.256744	0.3693
69	0.256761	0.3763
70	0.257502	0.3664
71	0.261642	0.3634
72	0.257083	0.3838

3. Training Data for forecasting issued banknotes in 1994.

Objective: To investigate the result from using different data of the same input.

Data: Input set# 4, as mentioned in 7.2.1 and 7.2.2 (Normalization type B)

3.1 Training data: 1990-1993, Testing data: 1991-1994

3.2 Training data: 1989-1993, Testing data: 1990-1994

Parameter: number of neurons

Initial Conditions: Weight and bias are initialized by random, epoch = 2000, learning rate = 0.001, rate of increased learning rate = 1.05, and rate of decrease learning rate = 0.7.

Result: see Table A.8 - A.9

3.1 Training data: 1990-1993, Testing data: 1991-1994

Table A.8 - Forecasting Issued Banknotes focused on 1994

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.27520	0.5440
2	0.165651	0.2301
3	0.166043	0.2310
4	0.275208	0.5433
5	0.275217	0.5433
6	0.177674	0.2985
7	0.168184	0.2403
8	0.170331	0.2397
9	0.168336	0.2468
10	0.165221	0.2268
11	0.167575	0.2423
12	0.166456	0.2351
13	0.165230	0.2264
14	0.169007	0.2534
15	0.166971	0.2311
16	0.166585	0.2318
17	0.168872	0.2309
18	0.167880	0.2408
19	0.167078	0.2375
20	0.165652	0.2312
21	0.165650	0.2303
22	0.165809	0.2320
23	0.196208	0.3708
24	0.172911	0.2701

Table A.8 - Forecasting Issued Banknotes focused on 1994 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
25	0.165018	0.2244
26	0.168024	0.2463
27	0.165970	0.2307
28	0.168932	0.2297
29	0.168572	0.2250
30	0.170990	0.2528
31	0.168408	0.2478
32	0.167117	0.2346
33	0.169894	0.2451
34	0.170786	0.2629
35	0.167829	0.2452
36	0.165203	0.2251
37	0.165228	0.2276
38	0.169847	0.2600
39	0.167465	0.2318
40	0.168085	0.2417
41	0.168056	0.2448
42	0.165698	0.2310
43	0.174182	0.2447
44	0.165414	0.2288
45	0.166135	0.2310
46	0.167627	0.2411
47	0.170898	0.2250
48	0.168651	0.2489

3.2 Training data: 1989-1993, Testing data: 1990-1994

Table A.9 - Forecasting Issued Banknotes focused on 1994

No. of Neuron	SSE of Training Data	SSE of Testing Data
1	0.381196	0.6883
2	0.182198	0.2461
3	0.181771	0.2529
4	0.381152	0.6896

Table A.9 - Forecasting Issued Banknotes focused on 1994 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
5	0.201443	0.3406
6	0.181833	0.2538
7	0.184351	0.2620
8	0.18585	0.2713
9	0..182041	0.2508
10	0.182457	0.2531
11	0.191392	0.2892
12	0.183536	0.2640
13	0.182106	0.2482
14	0.182226	**0.2444**
15	0.198545	0.3021
16	0.186637	0.2808
17	0.179857	0.2496
18	0.194076	0.2631
19	0.183251	0.2519
20	0.190228	0.2477
21	0.180980	0.2610
22	0.181553	0.2500
23	0.183477	0.2580
24	0.181757	0.2578
25	0.184344	0.2679
26	0.186881	0.2694
27	0.181651	0.2487
28	0.181923	0.2485
29	0.188715	0.2464
30	0.184781	0.2714
31	0.182640	0.2483
32	0.191018	0.2553
33	0.180634	0.2454
34	0.191484	0.2573
35	0.184035	0.2553
36	0.181321	0.2450
37	0.180168	0.2469
38	0.182075	0.2576
39	0.180264	0.2523
40	0.191420	0.3012

Table A.9 - Forecasting Issued Banknotes focused on 1994 (cont.)

No. of Neuron	SSE of Training Data	SSE of Testing Data
41	0.190800	0.2784
42	0.184595	0.2648
43	0.180647	0.2455
44	0.191003	0.2945
45	0.180814	0.2482
46	0.181161	0.2512
47	0.183439	0.2521
48	0.180804	0.2445
49	0.180582	0.2516
50	0.181792	0.2584
51	0.183531	0.2636
52	0.179918	0.2512
53	0.184103	0.2604
54	0.180770	0.2607
55	0.180325	0.2483
56	0.180444	0.2563
57	0.182694	0.2538
58	0.181063	0.2499
59	0.180073	0.2490
60	0.181811	0.2449

APPENDIX B

COMPARISON BETWEEN ACTUAL AND FORECASTING ISSUED BANKNOTES USING VALUES OF ADMITTED BANKNOTES AS INPUT DATA (7.3.4)

Table B.1 Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1992) and Testing Data (1993-1996)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1993	43,600	42,601.74	998.26
Feb 1993	27,070	32,526.75	-5,456.75
Mar 1993	33,260	33,772.21	-512.21
April 1993	36,470	30,227.84	6,242.16
May 1993	30,300	34,020.48	-3,720.48
June 1993	32,660	35,448.23	-2,788.23
July 1993	35,680	35,230.12	449.88
Aug 1993	33,300	35,619.49	-2,319.49
Sep 1993	34,800	35,098.08	-298.08
Oct 1993	36,060	33,567.71	2,492.29
Nov 1993	37,680	35,338.22	2,341.78
Dec 1993	55,200	32,815.94	21,384.06
Total for 1993	**436,080**	**416,266.81**	**19,813.19**
Error = 4.5 %			
Jan 1994	38,840	43,714.34	-4,874.34
Feb 1994	48,900	41,335.02	7,564.98
Mar 1994	40,230	41,369.49	-1,139.49
April 1994	40,100	35,827.08	4,272.92
May 1994	35,850	38,943.94	-3,093.94
June 1994	41,870	41,628.94	241.06
July 1994	38,580	39,559.52	-979.52
Aug 1994	41,700	44,381.75	-2,681.75
Sep 1994	44,200	40,975.38	3,224.62
Oct 1994	41,050	38,859.50	2,190.50
Nov 1994	44,720	43,110.85	1,609.15
Dec 1994	66,990	40,515.24	26,474.76
Total for 1994	**523,030**	**490,221.05**	**32,808.95**
Error = 6.27%			

Table B.1 Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1992) and Testing Data (1993-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1995	66,890	53,466.94	13,423.06
Feb 1995	36,350	48,497.85	-12,147.85
Mar 1995	54,340	48,652.68	5,687.32
April 1995	47,390	41,666.06	5,723.94
May 1995	49,520	51,781.76	-2,261.76
June 1995	60,170	49,906.28	10,263.72
July 1995	43,740	49,194.59	-5,454.59
Aug 1995	50,760	50,352.43	407.57
Sep 1995	48,970	46,234.98	2,735.02
Oct 1995	51,040	47,095.12	3,944.88
Nov 1995	55,640	50,308.90	5,331.10
Dec 1995	72,970	45,240.78	27,729.22
Total for 1995	**637,780**	**582,398.37**	**55,381.63**
Error = 8.68%			
Jan 1996	52,250	60,083.85	-7,833.85
Feb 1996	81,850	53,645.71	28,204.29
Mar 1996	55,350	57,960.74	-2,610.74
April 1996	63,580	54,145.70	9,434.30
May 1996	59,180	55,474.38	3,705.62
June 1996	55,450	53,219.05	2,230.95
July 1996	57,430	55,175.82	2,254.18
Aug 1996	56,520	54,386.87	2,133.13
Sep 1996	54,440	51,822.95	2,617.05
Oct 1996	63,870	51,371.22	12,498.78
Nov 1996	61,800	52,407.03	9,392.97
Dec 1996	80,140	48,998.35	31,141.65
Total for 1996	**741,860**	**648,691.67**	**93,168.33**
Error = 12.56%			
Total	**2,338,750**	**2,137,577.80**	**201,172.2**
Error = 8.6%			

Table B.2 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1992-1995) and Testing Data (1993-1996)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1993	43,600	46,733.64	-3,133.64
Feb 1993	27,070	35,870.26	-8,800.26
Mar 1993	33,260	37,211.83	-3,951.83
April 1993	36,470	33,398.10	3,071.90
May 1993	30,300	37,479.46	-7,179.46
June 1993	32,660	39,019.67	-6,359.67
July 1993	35,680	38,784.27	-3,104.27
Aug 1993	33,300	39,204.54	-5,904.54
Sep 1993	34,800	38,641.79	-3,841.79
Oct 1993	36,060	36,991.44	-931.44
Nov 1993	37,680	38,900.94	-1,220.94
Dec 1993	55,200	36,181.62	19,018.38
Total for 1993	**436,080**	**458,417.56**	**-22,337.56**
Error = -5.12%			
Jan 1994	38,840	47,925.11	-9,085.11
Feb 1994	48,900	45,372.51	3,527.49
Mar 1994	40,230	45,409.60	-5,179.60
April 1994	40,100	39,428.64	671.36
May 1994	35,850	42,794.66	-6,944.66
June 1994	41,870	45,688.70	-3,818.70
July 1994	38,580	43,459.04	-4,879.04
Aug 1994	41,700	48,637.58	-6,937.58
Sep 1994	44,200	44,985.36	-758.39
Oct 1994	41,050	42,703.49	-1,653.49
Nov 1994	44,720	47,279.36	-2,559.36
Dec 1994	66,990	44,489.68	22,500.32
Total for 1994	**523,030**	**538,173.73**	**-15,143.73**
Error = -2.90%			

Table B.2 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1992-1995) and Testing Data (1993-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1995	66,890	58,033.04	8,856.96
Feb 1995	36,350	52,978.74	-16,628.74
Mar 1995	54,340	53,139.79	1,200.21
April 1995	47,390	45,728.62	1,661.38
May 1995	49,520	56,348.25	-6,828.25
June 1995	60,170	54,436.33	5,733.67
July 1995	43,740	53,701.93	-9,961.93
Aug 1995	50,760	54,894.34	-4,134.34
Sep 1995	48,970	50,604.88	-1,634.88
Oct 1995	51,040	51,511.34	-471.34
Nov 1995	55,640	54,849.74	790.26
Dec 1995	72,970	49,551.69	23,418.31
Total for 1995	**637,780**	**635,778.69**	**2,001.31**
Error = 0.31%			
Jan 1996	52,250	64,249.64	-11,999.64
Feb 1996	81,850	58,209.73	23,640.27
Mar 1996	55,350	62,334.64	6,984.64
April 1996	63,580	58,701.67	4,878.33
May 1996	59,180	59,992.19	812.19
June 1996	55,450	57,787.38	2,337.38
July 1996	57,430	59,704.40	2,274.40
Aug 1996	56,520	58,937.75	2,417.75
Sep 1996	54,440	56,389.83	1,949.83
Oct 1996	63,870	55,932.84	7,937.16
Nov 1996	61,800	56,977.30	4,822.70
Dec 1996	80,140	53,498.65	26,641.35
Total for 1996	**741,860**	**702,716.02**	**39,143.98**
Error = 5.27%			
Total	**2,338,750**	**2,335,085.90**	**3,664.10**
Error = 0.16%			

Table B.3 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1991-1995) and Testing Data (1992-1996)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1992	41,971	36,979.66	4,991.34
Feb 1992	22,420	32,434.00	-10,014.00
Mar 1992	27,448	28,718.85	-1,270.85
April 1992	30,036	27,675.13	2,360.87
May 1992	25,661	27,237.55	-1,576.55
June 1992	25,558	33,144.72	-7,586.72
July 1992	27,224	30,730.84	-3,506.84
Aug 1992	30,710	32,919.06	-2,209.06
Sep 1992	28,582	31,148.66	-2,566.66
Oct 1992	30,128	29,730.25	397.75
Nov 1992	29,135	30,715.79	-1,580.79
Dec 1992	44,840	28,106.75	16,733.25
Total for 1992	**363,712**	**369,541.26**	**-5,829.26**
Error = -1.45%			
Jan 1993	43,600	46,053.88	-2,453.88
Feb 1993	27,070	34,498.68	-7,428.68
Mar 1993	33,260	35,874.49	-2,614.49
April 1993	36,470	32,050.10	4,419.90
May 1993	30,300	36,152.01	-5,852.01
June 1993	32,660	37,765.21	-5,105.21
July 1993	35,680	37,517.05	-1,837.05
Aug 1993	33,300	37,960.44	-4,660.44
Sep 1993	34,800	37,367.11	-2,567.11
Oct 1993	36,060	35,646.66	420.02
Nov 1993	37,680	37,639.98	40.02
Dec 1993	55,200	34,815.52	20,384.52
Total for 1993	**436,080**	**443,341.13**	**-7,261.13**
Error = -1.67%			

Table B.3 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1991-1995) and Testing Data (1992-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1994	38,840	47,340.47	-8,500.47
Feb 1994	48,900	44,582.17	4,317.83
Mar 1994	40,230	44,622.29	-4,329.29
April 1994	40,100	38,197.52	1,902.48
May 1994	35,850	41,797.85	-5,947.85
June 1994	41,870	44,924.12	-3,054.12
July 1994	38,580	42,514.32	-3934.32
Aug 1994	41,700	48,108.39	6,408.39
Sep 1994	44,200	44,163.51	36.49
Oct 1994	41,050	41,699.64	-649.64
Nov 1994	44,720	46,643.48	-1,923.48
Dec 1994	66,990	43,627.59	23,362.41
Total for 1994	**523,030**	**526,221.35**	**-3,191.35**
Error = -0.61%			
Jan 1995	66,890	57,995.49	8,894.51
Feb 1995	36,350	52,745.92	-16,395.92
Mar 1995	54,340	52,916.12	1,423.88
April 1995	47,390	44,967.29	2,422.71
May 1995	49,520	56,268.85	-6,748.85
June 1995	60,170	54,280.07	5,889.93
July 1995	43,740	53,508.87	-9,768.87
Aug 1995	50,760	54,759.09	-3,999.09
Sep 1995	48,970	50,220.47	-1,250.47
Oct 1995	51,040	51,188.28	-148.28
Nov 1995	55,640	54,712.51	927.49
Dec 1995	72,970	49,091.50	23,878.50
Total for 1995	**637,780**	**632,654.46**	**5,125.54**
Error = 0.80%			

Table B.3 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1991-1995) and Testing Data (1992-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1996	52,250	64,091.46	-11,841.46
Feb 1996	81,850	58,174.99	23,675.01
Mar 1996	55,350	62,267.14	-6,917.14
April 1996	63,580	58,673.14	4,906.86
May 1996	59,180	59,967.70	-787.70
June 1996	55,450	57,745.38	-2,295.38
July 1996	57,430	59,680.61	-2,250.61
Aug 1996	56,520	58,911.31	-2,391.31
Sep 1996	54,440	56,311.78	-1,817.78
Oct 1996	63,870	55,839.25	8,030.75
Nov 1996	61,800	56,916.58	4,883.42
Dec 1996	80,140	53,294.76	26,845.24
Total for 1996	**741,860**	**701,874.10**	**39,985.90**
Error = 5.39%			
Total	**2,702,462**	**2,673,632.30**	**28,829.70**
Error = 1.07%			

Table B.4 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1995) and Testing Data (1991-1996)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1991	22,924	30,558.58	-7,634.58
Feb 1991	32,413	26,161.45	6,251.55
Mar 1991	22,273	27,619.46	-5,346.46
April 1991	24,362	24,699.31	-337.31
May 1991	22,835	26,526.37	-3,691.37
June 1991	22,442	26,230.72	-3,788.72
July 1991	23,429	26,236.85	-2,807.85
Aug 1991	24,986	27,899.24	-2,913.24
Sep 1991	25,687	28,485.83	-2,798.83
Oct 1991	28,092	29,082.64	-990.64
Nov 1991	26,705	27,741.87	-1,036.87
Dec 1991	38,326	24,042.30	14,283.70
Total for 1991	**314,474**	**325,284.62**	**-10,810.62**
Error = 3.44%			
Jan 1992	41,971	37,012.79	4,958.21
Feb 1992	22,420	32,191.98	-9,771.98
Mar 1992	27,448	27,961.94	-513.94
April 1992	30,036	26,664.10	3,371.90
May 1992	25,661	26,092.40	-431.4
June 1992	25,558	32,962.79	-7,404.79
July 1992	27,224	30,304.40	-3,080.40
Aug 1992	30,710	32,718.95	-2,008.95
Sep 1992	28,582	30,773.70	-2,191.70
Oct 1992	30,128	29,159.29	968.71
Nov 1992	29,135	30,287.41	-1,152.41
Dec 1992	44,840	27,210.41	17,629.59
Total for 1992	**363,712**	**363,340.16**	**371.84**
Error = 0.10%			

Table B.4 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1995) and Testing Data (1991-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1993	43,600	46,228.14	-2,628.14
Feb 1993	27,070	34,410.82	-7,340.82
Mar 1993	33,260	35,860.58	-2,600.58
April 1993	36,470	31,771.95	4,698.05
May 1993	30,300	36,150.85	-5,850.85
June 1993	32,660	37,826.23	-5,166.23
July 1993	35,680	37,569.72	-1,889.72
Aug 1993	33,300	38,027.76	-4,727.76
Sep 1993	34,800	37,414.53	-2,614.53
Oct 1993	36,060	35,621.78	438.22
Nov 1993	37,680	37,696.84	-16.84
Dec 1993	55,200	34,746.41	20,453.59
Total for 1993	**436,080**	**443,325.61**	**-7,245.61**
Error = -1.66%			
Jan 1994	38,840	47,511.71	-8,671.71
Feb 1994	48,900	44,754.34	4,145.66
Mar 1994	40,230	44,794.60	-4,564.60
April 1994	40,100	38,272.15	1,827.85
May 1994	35,850	41,947.66	-6,097.66
June 1994	41,870	45,097.33	-3,227.33
July 1994	38,580	42,672.42	-4,092.42
Aug 1994	41,700	48,275.80	-6,575.80
Sep 1994	44,200	44,333.93	-133.93
Oct 1994	41,050	41,848.17	-798.17
Nov 1994	44,720	46,816.89	-2,096.89
Dec 1994	66,990	43,794.99	23,195.01
Total for 1994	**523,030**	**530,119.99**	**-7,089.99**
Error = -1.36%			

Table B.4 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1995) and Testing Data (1991-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1995	66,890	57,989.37	8,900.63
Feb 1995	36,350	52,860.27	-16,510.27
Mar 1995	54,340	53,027.57	1,312.43
April 1995	47,390	45,140.61	2,249.39
May 1995	49,520	56,309.60	-678.96
June 1995	60,170	54,365.93	5,804.07
July 1995	43,740	53,609.73	-9,869.73
Aug 1995	50,760	54,834.93	-4,074.93
Sep 1995	48,970	50,369.95	-1,399.95
Oct 1995	51,040	51,326.03	-286.03
Nov 1995	55,640	54,789.34	850.66
Dec 1995	72,970	49,251.90	23,718.10
Total for 1995	**637,780**	**633,875.23**	**3,904.77**
Error = 0.61%			
Jan 1996	52,250	63,855.70	-11,605.70
Feb 1996	81,850	58,163.57	23,686.43
Mar 1996	55,350	62,111.57	-6,761.57
April 1996	63,580	58,646.59	4,933.41
May 1996	59,180	59,898.79	-718.79
June 1996	55,450	57,746.51	-2,296.51
July 1996	57,430	59,621.48	-2,191.48
Aug 1996	56,520	58,877.30	-2,357.30
Sep 1996	54,440	56,351.45	-1,911.45
Oct 1996	63,870	55,890.53	7,979.47
Nov 1996	61,800	56,940.60	4,859.40
Dec 1996	80,140	53,399.53	26,780.47
Total for 1996	**741,860**	**701,503.62**	**40,356.38**
Error = 5.44%			
Total	**3,016,939**	**2,997,449.20**	**19,486.80**
Error = 0.65%			

Table B.5 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1995) and Testing Data (1990-1996)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1990	28,304	25,418.75	2,885.25
Feb 1990	15,105	21,284.18	-6,179.18
Mar 1990	20,599	21,823.65	-1,224.65
April 1990	21,308	20,431.21	876.79
May 1990	19,089	25,534.90	-6,445.90
June 1990	20,751	23,853.16	-3,102.16
July 1990	21,656	24,879.83	-3,223.83
Aug 1990	24,744	24,642.07	101.93
Sep 1990	21,263	23,539.18	-2,276.18
Oct 1990	21,969	24,777.21	-2,808.21
Nov 1990	24,069	25,229.09	-1,160.09
Dec 1990	29,221	21,196.33	8,024.67
Total for 1990	**268,076**	**282,609.56**	**-14,533.56**
Error = -5.4%			
Jan 1991	22,924	31,036.64	-8,112.64
Feb 1991	32,413	26,190.40	6,222.60
Mar 1991	22,273	27,821.92	-5,548.92
April 1991	24,362	24,514.19	-152.19
May 1991	22,835	26,601.82	-3,766.82
June 1991	22,442	26,268.68	-3,826.68
July 1991	23,429	26,275.59	-2,846.59
Aug 1991	24,986	28,131.67	-3,145.67
Sep 1991	25,687	28,778.20	-3,091.20
Oct 1991	28,092	29,432.36	-1,340.36
Nov 1991	26,705	27,957.55	-1,252.55
Dec 1991	38,326	23,741.26	14,584.74
Total for 1991	**314,474**	**326,750.28**	**-12,276.28**
Error = -3.9%			

Table B.5 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1995) and Testing Data (1990-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1992	41,971	37,884.29	4,086.71
Feb 1992	22,420	32,793.18	-10,373.18
Mar 1992	27,448	28,200.96	-752.96
April 1992	30,036	26,756.52	3,279.48
May 1992	25,661	26,112.28	-451.28
June 1992	25,558	33,616.10	-8,058.10
July 1992	27,224	30,761.60	-3,537.60
Aug 1992	30,710	33,356.17	-2,646.17
Sep 1992	28,582	31,269.04	-2,687.04
Oct 1992	30,128	29,516.13	611.87
Nov 1992	29,135	30,743.20	-1,608.00
Dec 1992	44,840	27,367.30	17,472.70
Total for 1992	**363,712**	**368,376.77**	**-4,664.77**
Error = -1.28%			
Jan 1993	43,600	47,261.92	-3,661.92
Feb 1993	27,070	35,152.55	-8,082.55
Mar 1993	33,260	36,679.12	-3,419.12
April 1993	36,470	32,343.19	4,126.81
May 1993	30,300	36,983.39	-6,683.39
June 1993	32,660	38,730.86	-6,070.86
July 1993	35,680	38,464.28	-2,604.28
Aug 1993	33,300	38,940.06	-5,640.06
Sep 1993	34,800	38,302.83	-3,502.83
Oct 1993	36,060	36,428.46	-368.46
Nov 1993	37,680	38,596.43	-916.43
Dec 1993	55,200	35,506.94	19,693.06
Total for 1993	**436,080**	**453,030.03**	**-16,950.03**
Error = -3.89%			

Table B.5 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1995) and Testing Data (1990-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1994	38,840	48,528.54	-9,688.54
Feb 1994	48,900	45,794.94	3,105.06
Mar 1994	40,230	45,835.19	-5,605.19
April 1994	40,100	39,193.46	906.54
May 1994	35,850	42,965.53	-7,115.53
June 1994	41,870	46,137.52	-4,267.52
July 1994	38,580	43,700.51	-5,120.51
Aug 1994	41,700	49,277.51	-7,577.51
Sep 1994	44,200	45,374.06	-1,174.06
Oct 1994	41,050	42,864.39	-1,814.39
Nov 1994	44,720	47,844.20	-3,124.20
Dec 1994	66,990	44,832.98	22,157.02
Total for 1994	**523,030**	**542,348.83**	**-19,318.83**
Error = -3.69%			
Jan 1995	66,890	58,430.66	8,459.34
Feb 1995	36,350	53,687.24	-17,337.24
Mar 1995	54,340	53,845.29	494.71
April 1995	47,390	46,180.70	1,209.30
May 1995	49,520	56,901.33	-7,381.33
June 1995	60,170	55,101.89	5,068.11
July 1995	43,740	54,393.59	-10,653.59
Aug 1995	50,760	55,538.91	-4,778.91
Sep 1995	48,970	51,310.19	-2,340.19
Oct 1995	51,040	52,228.11	-1,188.11
Nov 1995	55,640	55,496.51	143.49
Dec 1995	72,970	50,228.66	22,741.34
Total for 1995	**637,780**	**643,343.08**	**-5,563.08**
Error = -0.87%			

Table B.5 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1995) and Testing Data (1990-1996) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1996	52,250	63,557.41	-11,307.41
Feb 1996	81,850	58,587.84	23,262.16
Mar 1996	55,350	62,071.31	-6,721.31
April 1996	63,580	59,022.17	4,557.83
May 1996	59,180	60,137.94	-957.94
June 1996	55,450	58,211.09	-2,761.09
July 1996	57,430	59,892.14	-2,462.14
Aug 1996	56,520	59,228.86	-2,708.86
Sep 1996	54,440	56,939.72	-2,499.72
Oct 1996	63,870	56,515.99	7,354.01
Nov 1996	61,800	57,478.71	4,321.29
Dec 1996	80,140	54,195.92	25,944.08
Total for 1996	**741,860**	**705,839.10**	**36,020.90**
Error = 4.86%			
Total	**3,285,012**	**3,322,297.70**	**-37,285.70**
Error = -1.14%			

Table B.6 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1991-1994) and Testing Data (1992-1995)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1992	41,971	35,944.91	6,026.09
Feb 1992	22,420	31,632.35	-9,212.35
Mar 1992	27,448	28,386.28	-938.28
April 1992	30,036	27,596.53	2,439.47
May 1992	25,661	27,296.70	-1,635.70
June 1992	25,558	32,293.26	-6,735.26
July 1992	27,224	30,088.44	-2,864.44
Aug 1992	30,710	32,082.60	-1372.6
Sep 1992	28,582	30,460.75	-1,878.75
Oct 1992	30,128	29,219.87	908.13
Nov 1992	29,135	30,075.12	-940.12
Dec 1992	44,840	27,912.21	16,927.79
Total for 1992	**363,712**	**362,989.02**	**722.98**
Error = 0.20%			
Jan 1993	43,600	44,623.65	-1,023.65
Feb 1993	27,070	33,570.09	-6,500.09
Mar 1993	33,260	34,883.34	-1,623.34
April 1993	36,470	31,278.84	5,191.16
May 1993	30,300	35,149.50	-4,849.50
June 1993	32,660	36,701.36	-4,041.36
July 1993	35,680	36,462.29	-782.29
Aug 1993	33,300	36,889.49	-3,589.49
Sep 1993	34,800	36,317.88	-1,517.88
Oct 1993	36,060	34,665.10	-1,394.90
Nov 1993	37,680	36,580.71	1,099.29
Dec 1993	55,200	33,871.40	20,328.60
Total for 1993	**436,080**	**430,993.65**	**5,096.36**
Error = 1.17%			

Table B.6 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1991-1994) and Testing Data (1992-1995) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1994	38,840	45,829.23	-6,989.23
Feb 1994	48,900	43,234.69	5,665.31
Mar 1994	40,230	43,272.68	-3,042.68
April 1994	40,100	37,117.96	2,982.04
May 1994	35,850	40,581.41	-4,731.41
June 1994	41,870	43,558.32	-1,688.32
July 1994	38,580	41,266.97	-2,686.97
Aug 1994	41,700	46,544.76	-4,844.76
Sep 1994	44,200	42,837.74	1,362.26
Oct 1994	41,050	40,487.30	562.70
Nov 1994	44,720	45,177.16	-457.16
Dec 1994	66,990	42,328.52	24,661.48
Total for 1994	**523,030**	**512,236.74**	**10,793.26**
Error = 2.06%			
Jan 1995	66,890	55,491.46	11,398.54
Feb 1995	36,350	50,800.20	-14,450.20
Mar 1995	54,340	50,954.25	3,385.75
April 1995	47,390	43,599.14	3,790.86
May 1995	49,520	53,961.16	-4,441.16
June 1995	60,170	52,183.75	7,986.25
July 1995	43,740	51,489.68	-7,749.68
Aug 1995	50,760	52,613.45	-1,853.45
Sep 1995	48,970	48,496.80	473.20
Oct 1995	51,040	49,383.42	1,656.58
Nov 1995	55,640	52,571.71	3,068.29
Dec 1995	72,970	47,456.31	25,513.69
Total for 1995	**637,780**	**609,001.33**	**28,778.67**
Error = 4.51%			
Total	**1,960,602**	**1,915,220.70**	**45,381.26**
Error = 2.31%			

Table B.7 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1994) and Testing Data (1991-1995)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1991	22,924	31,362.92	-8,438.92
Feb 1991	32,413	26,928.93	5,484.07
Mar 1991	22,273	28,446.84	-6,173.84
April 1991	24,362	25,322.76	-960.76
May 1991	22,835	27,315.12	-4,480.12
June 1991	22,442	27,002.61	-4,560.61
July 1991	23,429	27,009.11	-3,580.11
Aug 1991	24,986	28,731.41	-3,745.41
Sep 1991	25,687	29,322.46	-3,635.46
Oct 1991	28,092	29,916.93	-1,824.93
Nov 1991	26,705	28,571.57	-1,866.57
Dec 1991	38,326	24,558.35	13,767.65
Total for 1991	**314,474**	**334,489.01**	**-20,015.01**
Error = -6.36%			
Jan 1992	41,971	37,447.48	4,523.52
Feb 1992	22,420	32,932.38	-10,512.38
Mar 1992	27,448	28,794.94	-1,346.94
April 1992	30,036	27,459.68	2,576.32
May 1992	25,661	26,855.29	-1,194.29
June 1992	25,558	33,664.35	-8,106.35
July 1992	27,224	31,116.03	-3,892.03
Aug 1992	30,710	33,433.32	-2,723.32
Sep 1992	28,582	31,571.26	-2,989.26
Oct 1992	30,128	29,992.82	135.18
Nov 1992	29,135	31,099.50	-1,964.50
Dec 1992	44,840	28,027.29	16,812.71
Total for 1992	**363,712**	**372,394.34**	**-8,682.34**
Error = -2.39%			

Table B.7 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1994) and Testing Data (1991-1995) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1993	43,600	45,866.05	-2,266.05
Feb 1993	27,070	35,027.59	-7,957.59
Mar 1993	33,260	36,379.89	-3,119.89
April 1993	36,470	32,531.35	3,938.65
May 1993	30,300	36,649.38	-6,349.38
June 1993	32,660	38,198.01	-5,538.01
July 1993	35,680	37,961.59	-2,281.59
Aug 1993	33,300	38,383.60	-5,083.60
Sep 1993	34,800	37,818.45	-3,018.45
Oct 1993	36,060	36,157.89	-97.89
Nov 1993	37,680	38,078.78	-398.78
Dec 1993	55,200	35,341.63	19,858.37
Total for 1993	**436,080**	**448,394.21**	**-12,314.21**
Error = -2.82%			
Jan 1994	38,840	47,033.04	-8,193.04
Feb 1994	48,900	44,526.44	4,373.56
Mar 1994	40,230	44,563.04	-4,333.04
April 1994	40,100	38,608.49	1,491.51
May 1994	35,850	41,972.16	-6,122.16
June 1994	41,870	44,838.22	-2,968.22
July 1994	38,580	42,632.48	-4,052.48
Aug 1994	41,700	47,728.22	-6,028.22
Sep 1994	44,200	44,144.22	55.78
Oct 1994	41,050	41,881.46	-831.46
Nov 1994	44,720	46,401.24	-1,681.24
Dec 1994	66,990	43,654.10	23,335.90
Total for 1994	**523,030**	**527,983.11**	**-4,953.11**
Error = -0.95%			

Table B.7 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1994) and Testing Data (1991-1995) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1995	66,890	56,681.80	10,208.20
Feb 1995	36,350	51,917.35	-15,567.35
Mar 1995	54,340	52,071.13	2,268.87
April 1995	47,390	44,877.56	2,512.44
May 1995	49,520	55,108.16	-5,588.16
June 1995	60,170	53,304.54	6,865.46
July 1995	43,740	52,606.90	-8,866.90
Aug 1995	50,760	53,738.29	-2,978.29
Sep 1995	48,970	49,636.88	-666.88
Oct 1995	51,040	50,510.70	529.30
Nov 1995	55,640	53,696.10	1,943.90
Dec 1995	72,970	48,617.11	24,352.89
Total for 1995	**637,780**	**622,766.52**	**15,013.48**
Error = 2.35%			
Total	**2,275,076**	**2,306,027.20**	**-30,951.19**
Error = -1.36%			

Table B.8 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1994) and Testing Data (1990-1995)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1990	28,304	25,516.37	2,787.63
Feb 1990	15,105	21,201.45	-6,096.45
Mar 1990	20,599	21,894.47	-1,295.47
April 1990	21,308	19,878.85	1,429.15
May 1990	19,089	25,620.70	-6,531.70
June 1990	20,751	24,061.27	-3,310.27
July 1990	21,656	25,026.90	-3,370.90
Aug 1990	24,744	24,807.68	-63.68
Sep 1990	21,263	23,753.91	-2,490.91
Oct 1990	21,969	24,932.55	-2,963.55
Nov 1990	24,069	25,345.17	-1,276.17
Dec 1990	29,221	21,080.41	17,140.59
Total for 1990	**268,076**	**283,119.73**	**-15,043.73**
Error = -5.6%			
Jan 1991	22,924	30,394.07	-7,470.07
Feb 1991	32,413	26,203.47	6,209.53
Mar 1991	22,273	27,624.93	-5,351.93
April 1991	24,362	24,688.80	-326.80
May 1991	22,835	26,564.99	-3,729.99
June 1991	22,442	26,272.47	-3,830.47
July 1991	23,429	26,278.56	-2,849.56
Aug 1991	24,986	27,892.18	-2,906.18
Sep 1991	25,687	28,448.86	-2,761.86
Oct 1991	28,092	29,011.47	-919.47
Nov 1991	26,705	27,742.01	-1,037.01
Dec 1991	38,326	23,952.52	14,373.48
Total for 1991	**314,474**	**325,074.33**	**-10,600.33**
Error = -3.37%			

Table B.8 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1994) and Testing Data (1990-1995) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1992	41,971	36,486.75	5,484.25
Feb 1992	22,420	31,921.23	-9,501.23
Mar 1992	27,448	27,951.91	-503.91
April 1992	30,036	26,700.27	3,335.73
May 1992	25,661	26,134.49	-473.49
June 1992	25,558	32,643.76	-7,085.76
July 1992	27,224	30,156.45	-2,932.45
Aug 1992	30,710	32,414.98	-1,704.98
Sep 1992	28,582	30,595.13	-2,013.13
Oct 1992	30,128	29,083.52	1,044.48
Nov 1992	29,135	30,140.56	-1,005.56
Dec 1992	44,840	27,231.60	17,608.40
Total for 1992	**363,712**	**361,460.65**	**2,251.35**
Error = 0.62%			
Jan 1993	43,600	45,676.38	-2,076.38
Feb 1993	27,070	34,007.47	-6,937.47
Mar 1993	33,260	35,383.73	-2,123.73
April 1993	36,470	31,528.20	4,941.80
May 1993	30,300	35,660.79	-5,360.79
June 1993	32,660	37,270.86	-4,610.86
July 1993	35,680	37,023.10	-1,343.10
Aug 1993	33,300	37,465.85	-4,165.85
Sep 1993	34,800	36,873.43	-2,073.43
Oct 1993	36,060	35,156.19	903.81
Nov 1993	37,680	37,145.83	534.17
Dec 1993	55,200	34,324.98	20,875.02
Total for 1993	**436,080**	**437,516.81**	**-1,436.81**
Error = -0.33%			

Table B.8 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1994) and Testing Data (1990-1995) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1994	38,840	47,016.09	-8,176.09
Feb 1994	48,900	44,157.71	4,742.29
Mar 1994	40,230	44,198.92	-3,968.92
April 1994	40,100	37,702.70	2,397.30
May 1994	35,850	41,319.96	-5,469.96
June 1994	41,870	44,509.32	-2,639.00
July 1994	38,580	42,046.17	-3,466.17
Aug 1994	41,700	47,821.46	-1,621.46
Sep 1994	44,200	43,728.20	471.80
Oct 1994	41,050	41,220.61	-170.61
Nov 1994	44,720	46,288.86	-1,568.86
Dec 1994	66,990	43,179.92	23,810.08
Total for 1994	**523,030**	**523,189.92**	**-159.92**
Error = -0.03%			
Jan 1995	66,890	58,666.23	8,223.77
Feb 1995	36,350	52,787.97	-16,437.97
Mar 1995	54,340	52,973.93	1,366.07
April 1995	47,390	44,553.76	2,836.24
May 1995	49,520	56,698.26	-7,178.26
June 1995	60,170	54,474.64	5,715.36
July 1995	43,740	53,623.80	-9,883.80
Aug 1995	50,760	55,006.25	-4,246.25
Sep 1995	48,970	50,060.40	-1,090.40
Oct 1995	51,040	51,098.84	-58.84
Nov 1995	55,640	54,954.44	685.56
Dec 1995	72,970	48,859.14	24,110.86
Total for 1995	**637,780**	**633,757.66**	**4,022.34**
Error = 0.63%			
Total	**2,543,152**	**2,564,118.70**	**-20,966.70**
Error = -0.82%			

Table B.9 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1993) and Testing Data (1991-1994)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1991	22,924	29,538.16	-6,614.16
Feb 1991	32,413	25,676.07	6,736.93
Mar 1991	22,273	26,913.03	-4,640.03
April 1991	24,362	24,499.21	-137.21
May 1991	22,835	25,980.33	-3,145.33
June 1991	22,442	25,733.53	-3,291.53
July 1991	23,429	25,738.61	-2,309.61
Aug 1991	24,986	27,156.33	-2,170.33
Sep 1991	25,687	27,671.73	-1,984.73
Oct 1991	28,092	28,202.65	-110.65
Nov 1991	26,705	27,019.26	-314.26
Dec 1991	38,326	23,995.27	14,330.73
Total for 1991	**314,474**	**318,124.18**	**-3,650.18**
Error = -1.16%			
Jan 1992	41,971	35,498.07	6,472.93
Feb 1992	22,420	31,041.22	-8,621.22
Mar 1992	27,448	27,211.09	236.91
April 1992	30,036	26,096.15	3,939.85
May 1992	25,661	25,618.93	42.07
June 1992	25,558	31,755.41	-6,197.41
July 1992	27,224	29,306.27	-2,082.27
Aug 1992	30,710	31,529.29	819.29
Sep 1992	28,582	29,734.93	1,152.93
Oct 1992	30,128	28,271.26	1,856.74
Nov 1992	29,135	29,290.79	-155.79
Dec 1992	44,840	26,560.50	1,8279.5
Total for 1992	**363,712**	**351,913.91**	**11,798.09**
Error = 3.24%			

Table B.9 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1990-1993) and Testing Data (1991-1994) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1993	43,600	43,397.61	202.39
Feb 1993	27,070	33,099.13	-6,029.13
Mar 1993	33,260	34,440.17	-1,180.17
April 1993	36,470	30,653.02	5,816.98
May 1993	30,300	34,707.49	-4,407.49
June 1993	32,660	36,238.82	-3,578.82
July 1993	35,680	36,005.85	-325.85
Aug 1993	33,300	36,421.42	-3,121.42
Sep 1993	34,800	35,864.62	-1,064.62
Oct 1993	36,060	34,219.89	1,840.11
Nov 1993	37,680	36,121.38	1,558.62
Dec 1993	55,200	33,410.22	21,789.78
Total for 1993	**436,080**	**424,579.62**	**11,500.38**
Error = 2.64%			
Jan 1994	38,840	44,390.46	-5,550.46
Feb 1994	48,900	42,221.21	6,678.79
Mar 1994	40,230	42,253.84	-2,023.84
April 1994	40,100	36,642.34	3,457.66
May 1994	35,850	39,880.04	-4,030.04
June 1994	41,870	42,498.37	-628.37
July 1994	38,580	40,496.59	-1,916.59
Aug 1994	41,700	44,967.05	-3,267.05
Sep 1994	44,200	41,878.72	2,321.28
Oct 1994	41,050	39,794.78	1,255.22
Nov 1994	44,720	43,856.75	863.25
Dec 1994	66,990	41,435.33	25,554.67
Total for 1994	**523,030**	**500,315.48**	**22,714.52**
Error = 4.3%			
Total	**1,637,296**	**1,594,933.10**	**42,362.90**
Error = 2.59%			

Table B.10 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1993) and Testing Data (1990-1994)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1990	28,304	25,127.95	3,176.05
Feb 1990	15,105	21,017.97	-5,912.97
Mar 1990	20,599	21,551.99	-952.99
April 1990	21,308	20,186.23	1,121.77
May 1990	19,089	25,242.12	-6,153.12
June 1990	20,751	23,576.72	-2,825.72
July 1990	21,656	24,596.36	-2,940.36
Aug 1990	24,744	24,360.96	383.04
Sep 1990	21,263	23,263.58	-2,000.58
Oct 1990	21,969	24,494.82	-2,525.82
Nov 1990	24,069	24,941.21	-872.21
Dec 1990	29,221	20,931.45	8,289.55
Total for 1990	**268,076**	**279,291.36**	**-11,215.36**
Error = -4.18%			
Jan 1991	22,924	30,438.58	-7514.58
Feb 1991	32,413	25,883.54	6529.46
Mar 1991	22,273	27,455.68	-5182.68
April 1991	24,362	24,234.14	127.86
May 1991	22,835	26,283.39	-3448.39
June 1991	22,442	25,959.78	-3517.78
July 1991	23,429	25,966.51	-2537.51
Aug 1991	24,986	27,749.88	-2763.88
Sep 1991	25,687	28,359.36	-2672.36
Oct 1991	28,092	28,969.59	-877.59
Nov 1991	26,705	27,584.67	-879.67
Dec 1991	38,326	23,465.17	14860.83
Total for 1991	**314,474**	**322,350.00**	**-7,876.29**
Error = -2.5%			

Table B.10 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1993) and Testing Data (1990-1994) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1992	41,971	36,317.40	5,653.60
Feb 1992	22,420	32,003.24	-9,583.24
Mar 1992	27,448	27,815.50	-367.50
April 1992	30,036	26,433.17	3,602.83
May 1992	25,661	25,807.37	-146.37
June 1992	25,558	32,721.41	-7,163.41
July 1992	27,224	30,189.50	-2,965.50
Aug 1992	30,710	32,495.54	-1,785.54
Sep 1992	28,582	30,648.17	-2,066.17
Oct 1992	30,128	29,047.26	1,080.74
Nov 1992	29,135	30,172.80	-1,037.80
Dec 1992	44,840	27,021.33	17,818.67
Total for 1992	**363,712**	**360,672.69**	**3,039.31**
Error = 0.84%			
Jan 1993	43,600	43,853.35	-253.35
Feb 1993	27,070	34,039.03	-6,969.03
Mar 1993	33,260	35,321.31	-2,061.31
April 1993	36,470	31,606.61	4,863.39
May 1993	30,300	35,574.05	-5,274.05
June 1993	32,660	37,009.86	-4,349.86
July 1993	35,680	36,792.39	-1,112.39
Aug 1993	33,300	37,180.15	-3,880.15
Sep 1993	34,800	36,660.44	-1,860.44
Oct 1993	36,060	35,112.43	947.57
Nov 1993	37,680	36,900.26	779.74
Dec 1993	55,200	34,338.95	20,861.05
Total for 1993	**436,080**	**434,388.83**	**1,691.17**
Error = 0.39%			

Table B.10 - Comparison between Actual and Forecasting Issued Banknotes using Training Data (1989-1993) and Testing Data (1990-1994) (cont.)

Month/Year	Actual (millions of baht)	Forecast (millions of baht)	Error (millions of baht)
Jan 1994	38,840	44,883.82	-6,043.82
Feb 1994	48,900	42,672.80	6,227.20
Mar 1994	40,230	42,705.05	-2,475.05
April 1994	40,100	37,386.03	2,713.97
May 1994	35,850	40,414.24	-4,564.24
June 1994	41,870	42,947.55	-1,077.55
July 1994	38,580	41,000.18	-2,420.18
Aug 1994	41,700	45,499.83	-3,799.83
Sep 1994	44,200	42,335.86	1,864.14
Oct 1994	41,050	40,333.59	716.41
Nov 1994	44,720	44,325.51	394.49
Dec 1994	66,990	41,903.48	25,087.00
Total for 1994	**523,030**	**506,407.94**	**16,622.88**
Error = 3.18%			
Total	**1,905,372**	**1,903,110.80**	**-2,261.18**
Error = 0.12%			

APPENDIX C

TRAINING RESULTS OF BACKPROPAGATION USING THE SAME INPUT DATA AS IN REGRESSION METHOD (7.3.5)

Table C.1 Result of using Training Data (1980-1994:1995)

and Testing Data (1981-1995:1996)

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
1	1	10^{-1}	4.43×10^{-2}	6.70×10^{-2}	112,690
		10^{-2}	9.78×10^{-3}	2.17×10^{-2}	224,230
		10^{-3}	6.33×10^{-5}	1.60×10^{-3}	331,110
		10^{-4}	6.33×10^{-5}	1.60×10^{-3}	331,110
		0	3.08×10^{-33}	2.3×10^{-3}	323,150
	10^{-1}	10^{-1}	4.43×10^{-2}	6.70×10^{-2}	112,690
		10^{-2}	7.31×10^{-3}	1.80×10^{-2}	237,600
		10^{-3}	4.89×10^{-5}	3.10×10^{-3}	316,150
		10^{-4}	4.89×10^{-5}	3.10×10^{-3}	316,150
		0	4.93×10^{-10}	2.30×10^{-3}	323,150
	10^{-2}	10^{-1}	4.43×10^{-2}	6.70×10^{-2}	112,690
		10^{-2}	9.77×10^{-3}	2.17×10^{-2}	224,310
		10^{-3}	7.74×10^{-4}	5.80×10^{-3}	295,330
		10^{-4}	5.97×10^{-5}	3.2×10^{-3}	315,420
		0	4.93×10^{-32}	2.30×10^{-3}	323,150
	10^{-3}	10^{-1}	4.4×10^{-2}	6.70×10^{-2}	112,690
		10^{-2}	9.54×10^{-2}	2.14×10^{-2}	225,440
		10^{-3}	9.64×10^{-4}	6.30×10^{-3}	292,100
		10^{-4}	5.79×10^{-5}	3.10×10^{-3}	315,540
		0	3.08×10^{-33}	2.30×10^{-3}	323,150
	10^{-4}	10^{-1}	4.43×10^{-2}	6.7×10^{-2}	112,690
		10^{-2}	9.71×10^{-3}	2.16×10^{-2}	224,590
		10^{-3}	7.41×10^{-4}	5.70×10^{-2}	295,930
		10^{-4}	7.34×10^{-5}	3.30×10^{-2}	314,590
		0	0	2.30×10^{-2}	323,150

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
2	1	10^{-1}	2.29×10^{-2}	1.06×10^{-2}	47,455
		10^{-2}	1.48×10^{-4}	3.70×10^{-3}	310,970
		10^{-3}	1.48×10^{-4}	3.70×10^{-3}	310,970
		10^{-4}	6.29×10^{-6}	2.60×10^{-3}	320,640
		0	0	2.30×10^{-3}	323,150
	10^{-1}	10^{-1}	5.08×10^{-2}	7.51×10^{-2}	97,658
		10^{-2}	1.40×10^{-3}	7.40×10^{-3}	285,760
		10^{-3}	8.01×10^{-3}	5.90×10^{-3}	294,850
		10^{-4}	3.95×10^{-6}	2.50×10^{-3}	321,160
		0	0	2.30×10^{-3}	323,150
	10^{-2}	10^{-1}	9.77×10^{-2}	1.30×10^{-1}	10,683
		10^{-2}	8.45×10^{-3}	1.97×10^{-3}	231,210
		10^{-3}	6.16×10^{-4}	5.40×10^{-3}	298,330
		10^{-4}	6.00×10^{-5}	3.20×10^{-3}	315,400
		0	0	2.30×10^{-3}	323,150
	10^{-3}	10^{-1}	9.94×10^{-2}	1.32×10^{-1}	7,911
		10^{-2}	9.58×10^{-3}	2.14×10^{-2}	225,280
		10^{-3}	9.15×10^{-4}	6.20×10^{-3}	292,900
		10^{-4}	8.80×10^{-5}	3.30×10^{-3}	313,770
		0	3.08×10^{-33}	2.30×10^{-3}	323,150
	10^{-4}	10^{-1}	1.00×10^{-2}	1.33×10^{-1}	6,926
		10^{-2}	9.93×10^{-3}	2.19×10^{-2}	223,500
		10^{-3}	6.17×10^{-4}	5.40×10^{-3}	298,310
		10^{-4}	1.99×10^{-5}	2.80×10^{-3}	318,690
		0	4.93×10^{-32}	2.30×10^{-3}	323,150
3	1	10^{-1}	3.78×10^{-4}	8.40×10^{-4}	342,640
		10^{-2}	3.78×10^{-4}	8.40×10^{-4}	342,640
		10^{-3}	3.78×10^{-4}	8.40×10^{-4}	342,640
		10^{-4}	1.86×10^{-5}	1.90×10^{-3}	327,510
		0	0	2.30×10^{-3}	323,190

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
3	10^{-1}	10^{-1}	2.66×10^{-2}	4.48×10^{-2}	159,930
		10^{-2}	8.16×10^{-3}	1.80×10^{-3}	413,540
		10^{-3}	3.91×10^{-5}	1.80×10^{-3}	329,430
		10^{-4}	3.91×10^{-5}	1.80×10^{-3}	329,430
		0	0	2.30×10^{-3}	323,170
	10^{-2}	10^{-1}	9.89×10^{-2}	1.32×10^{-1}	8,672
		10^{-2}	6.50×10^{-3}	1.67×10^{-2}	242,570
		10^{-3}	8.41×10^{-4}	6.00×10^{-3}	294,180
		10^{-4}	2.25×10^{-5}	2.80×10^{-3}	318,430
		0	0	2.30×10^{-3}	323,170
	10^{-3}	10^{-1}	9.68×10^{-2}	1.29×10^{-1}	12,016
		10^{-2}	8.63×10^{-3}	2.00×10^{-2}	230,290
		10^{-3}	5.75×10^{-4}	5.20×10^{-3}	299,200
		10^{-4}	6.55×10^{-5}	3.20×10^{-3}	315,080
		0	0	2.30×10^{-3}	323,170
	10^{-4}	10^{-1}	9.96×10^{-2}	1.32×10^{-1}	7,497
		10^{-2}	9.61×10^{-3}	2.15×10^{-2}	225,110
		10^{-3}	8.20×10^{-4}	5.90×10^{-3}	294,530
		10^{-4}	7.88×10^{-6}	2.10×10^{-3}	325,980
		0	0	2.30×10^{-3}	323,170
4	1	10^{-1}	5.41×10^{-2}	7.90×10^{-2}	90,586
		10^{-2}	2.92×10^{-4}	4.30×10^{-3}	306,050
		10^{-3}	2.92×10^{-4}	4.30×10^{-3}	306,050
		10^{-4}	2.98×10^{-5}	2.90×10^{-3}	317,690
		0	0	2.30×10^{-3}	323,150
	10^{-1}	10^{-1}	2.20×10^{-4}	4.00×10^{-3}	308,320
		10^{-2}	2.20×10^{-4}	4.00×10^{-3}	308,320
		10^{-3}	2.20×10^{-4}	4.00×10^{-3}	308,320
		10^{-4}	8.29×10^{-5}	3.30×10^{-3}	314,040
		0	0	2.30×10^{-3}	323,150

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
4	10^{-2}	10^{-1}	7.66×10^{-2}	1.06×10^{-1}	46,369
		10^{-2}	4.44×10^{-3}	1.32×10^{-2}	256,520
		10^{-3}	3.51×10^{-4}	4.50×10^{-3}	304,410
		10^{-4}	9.42×10^{-5}	3.40×10^{-3}	313,440
		0	0	2.30×10^{-3}	323,150
	10^{-3}	10^{-1}	9.28×10^{-2}	1.25×10^{-1}	18,525
		10^{-2}	5.50×10^{-3}	1.50×10^{-2}	248,960
		10^{-3}	4.87×10^{-4}	5.00×10^{-3}	301,080
		10^{-4}	5.89×10^{-6}	2.10×10^{-3}	325,570
		0	0	2.30×10^{-3}	323,150
	10^{-4}	10^{-1}	9.88×10^{-2}	1.32×10^{-1}	8,758
		10^{-2}	6.95×10^{-3}	1.74×10^{-2}	239,780
		10^{-3}	9.37×10^{-4}	6.30×10^{-3}	292,540
		10^{-4}	3.26×10^{-5}	2.90×10^{-3}	317,440
		0	0	2.30×10^{-3}	323,150
5	1	10^{-1}	3.71×10^{-2}	5.86×10^{-2}	129,620
		10^{-2}	1.29×10^{-4}	1.50×10^{-3}	333,260
		10^{-3}	1.29×10^{-4}	1.50×10^{-3}	333,260
		10^{-4}	6.32×10^{-6}	2.20×10^{-3}	324,450
		0	0	2.50×10^{-3}	321,940
	10^{-1}	10^{-1}	3.17×10^{-2}	1.66×10^{-2}	500,320
		10^{-2}	6.21×10^{-3}	1.65×10^{-2}	243,360
		10^{-3}	4.41×10^{-5}	3.20×10^{-3}	315,440
		10^{-4}	4.41×10^{-5}	3.20×10^{-3}	315,440
		0	0	2.50×10^{-3}	322,070
	10^{-2}	10^{-1}	9.65×10^{-2}	6.83×10^{-2}	633,010
		10^{-2}	7.38×10^{-3}	1.30×10^{-3}	408,140
		10^{-3}	4.12×10^{-4}	8.47×10^{-4}	342,510
		10^{-4}	1.52×10^{-8}	2.40×10^{-3}	322,350
		0	0	2.40×10^{-3}	322,230

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
5	10^{-3}	10^{-1}	9.90×10^{-2}	7.05×10^{-2}	637,060
		10^{-2}	8.06×10^{-3}	1.60×10^{-3}	412,110
		10^{-3}	8.23×10^{-4}	4.24×10^{-4}	351,020
		10^{-4}	1.50×10^{-6}	2.30×10^{-3}	323,560
		0	0	2.40×10^{-3}	322,340
	10^{-4}	10^{-1}	9.80×10^{-2}	6.96×10^{-2}	635,460
		10^{-2}	8.82×10^{-3}	2.00×10^{-3}	416,210
		10^{-3}	5.26×10^{-4}	6.94×10^{-4}	345,280
		10^{-4}	2.19×10^{-5}	2.00×10^{-3}	327,020
		0	0	2.40×10^{-3}	322,340
6	1	10^{-1}	1.24×10^{-2}	2.56×10^{-2}	211,770
		10^{-2}	1.05×10^{-4}	3.40×10^{-3}	312,930
		10^{-3}	1.05×10^{-4}	3.40×10^{-3}	312,930
		10^{-4}	1.16×10^{-5}	2.70×10^{-3}	319,770
		0	0	2.30×10^{-3}	323,180
	10^{-1}	10^{-1}	4.35×10^{-2}	6.61×10^{-2}	114,510
		10^{-2}	1.17×10^{-5}	2.00×10^{-3}	326,600
		10^{-3}	1.17×10^{-5}	2.00×10^{-3}	326,600
		10^{-4}	1.17×10^{-5}	2.00×10^{-3}	326,600
		0	0	2.30×10^{-3}	323,180
	10^{-2}	10^{-1}	9.73×10^{-2}	1.30×10^{-1}	11,194
		10^{-2}	8.58×10^{-2}	1.99×10^{-2}	230,570
		10^{-3}	1.97×10^{-4}	3.90×10^{-3}	309,160
		10^{-4}	9.51×10^{-5}	3.40×10^{-3}	313,430
		0	3.08×10^{-33}	2.30×10^{-3}	323,180
	10^{-3}	10^{-1}	9.69×10^{-2}	1.29×10^{-1}	11,862
		10^{-2}	7.68×10^{-3}	1.85×10^{-2}	235,560
		10^{-3}	6.81×10^{-4}	5.60×10^{-3}	297,090
		10^{-4}	3.22×10^{-6}	2.20×10^{-3}	324,970
		0	3.08×10^{-33}	2.30×10^{-3}	323,180

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
6	10^{-4}	10^{-1}	1.00×10^{-1}	1.33×10^{-1}	696,970
		10^{-2}	9.05×10^{-3}	2.06×10^{-2}	228,030
		10^{-3}	3.42×10^{-4}	4.50×10^{-3}	304,670
		10^{-4}	2.09×10^{-5}	2.80×10^{-3}	318,610
		0	3.09×10^{-33}	2.30×10^{-3}	323,180
7	1	10^{-1}	3.25×10^{-3}	4.40×10^{-3}	305,120
		10^{-2}	3.25×10^{-4}	4.40×10^{-3}	305,120
		10^{-3}	3.25×10^{-4}	4.40×10^{-3}	305,120
		10^{-4}	1.83×10^{-5}	2.80×10^{-3}	318,870
		0	3.08×10^{-33}	2.30×10^{-3}	323,150
	10^{-1}	10^{-1}	7.39×10^{-2}	1.03×10^{-1}	512,360
		10^{-2}	1.87×10^{-3}	2.74×10^{-5}	366,690
		10^{-3}	5.58×10^{-4}	6.18×10^{-4}	346,760
		10^{-4}	1.96×10^{-5}	1.90×10^{-3}	327,550
		0	0	2.40×10^{-3}	323,130
	10^{-2}	10^{-1}	3.82×10^{-2}	4.60×10^{-3}	439,680
		10^{-2}	5.98×10^{-3}	1.09×10^{-4}	382,050
		10^{-3}	5.76×10^{-5}	2.00×10^{-3}	326,900
		10^{-4}	5.76×10^{-5}	2.00×10^{-3}	326,900
		0	3.08×10^{-33}	2.70×10^{-3}	319,490
	10^{-3}	10^{-1}	7.74×10^{-2}	2.45×10^{-2}	528,270
		10^{-2}	9.53×10^{-3}	2.40×10^{-3}	420,690
		10^{-3}	9.83×10^{-4}	2.93×10^{-4}	354,500
		10^{-4}	3.18×10^{-5}	1.80×10^{-3}	328,790
		0	0	2.30×10^{-3}	323,150
	10^{-4}	10^{-1}	9.30×10^{-2}	3.59×10^{-2}	560,990
		10^{-2}	8.87×10^{-3}	2.10×10^{-3}	417,360
		10^{-3}	9.70×10^{-4}	2.99×10^{-4}	354,340
		10^{-4}	6.64×10^{-5}	1.60×10^{-3}	331,350
		0	3.08×10^{-33}	2.30×10^{-3}	323,200

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
8	1	10^{-1}	3.26×10^{-3}	**3.35×10^{-7}**	**371,040**
		10^{-2}	3.26×10^{-3}	**3.35×10^{-7}**	**371,040**
		10^{-3}	1.09×10^{-4}	2.20×10^{-3}	324,560
		10^{-4}	1.74×10^{-5}	2.80×10^{-3}	318,310
		0	0	3.30×10^{-3}	314,160
	10^{-1}	10^{-1}	4.52×10^{-2}	1.07×10^{0}	101,580
		10^{-2}	5.18×10^{-3}	1.69×10^{-2}	241,700
		10^{-3}	9.86×10^{-4}	7.25×10^{-4}	344,690
		10^{-4}	3.03×10^{-6}	3.50×10^{-3}	312,860
		0	0	3.40×10^{-3}	313,410
	10^{-2}	10^{-1}	3.28×10^{-2}	1.30×10^{-3}	408,220
		10^{-2}	6.46×10^{-3}	1.96×10^{-5}	367,200
		10^{-3}	4.71×10^{-4}	1.90×10^{-3}	327,850
		10^{-4}	7.66×10^{-5}	4.80×10^{-3}	302,440
		0	0	3.70×10^{-3}	311,130
	10^{-3}	10^{-1}	8.49×10^{-2}	7.1×10^{-3}	455,850
		10^{-2}	9.54×10^{-3}	9.73×10^{-4}	402,810
		10^{-3}	7.75×10^{-4}	9.97×10^{-4}	340,000
		10^{-4}	4.94×10^{-5}	2.70×10^{-3}	319,470
		0	2.77×10^{-32}	3.50×10^{-3}	312,500
	10^{-4}	10^{-1}	8.89×10^{-2}	9.70×10^{-3}	470,130
		10^{-2}	9.38×10^{-3}	1.20×10^{-3}	406,570
		10^{-3}	8.21×10^{-4}	9.81×10^{-4}	340,300
		10^{-4}	5.55×10^{-5}	2.70×10^{-3}	319,280
		0	3.08×10^{-33}	3.60×10^{-3}	311,880
9	1	10^{-1}	6.56×10^{-2}	9.28×10^{-2}	670,470
		10^{-2}	5.56×10^{-4}	5.20×10^{-3}	299,580
		10^{-3}	5.56×10^{-4}	5.20×10^{-3}	299,580
		10^{-4}	6.15×10^{-5}	3.20×10^{-3}	315,310
		0	0	2.30×10^{-3}	323,150

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
9	10^{-1}	10^{-1}	7.65×10^{-16}	2.30×10^{-3}	323,150
		10^{-2}	7.65×10^{-16}	2.30×10^{-3}	323,150
		10^{-3}	7.65×10^{-16}	2.30×10^{-3}	323,150
		10^{-4}	7.65×10^{-16}	2.30×10^{-3}	323,150
		0	1.23×10^{-32}	2.30×10^{-3}	323,150
	10^{-2}	10^{-1}	4.88×10^{-2}	7.26×10^{-2}	102,260
		10^{-2}	7.30×10^{-3}	1.79×10^{-2}	237,710
		10^{-3}	7.97×10^{-4}	4.09×10^{-4}	351,390
		10^{-4}	6.95×10^{-5}	1.60×10^{-3}	331,480
		0	3.08×10^{-33}	2.30×10^{-3}	323,150
	10^{-3}	10^{-1}	8.60×10^{-2}	1.17×10^{-1}	298,280
		10^{-2}	5.50×10^{-3}	1.50×10^{-2}	249,010
		10^{-3}	7.35×10^{-5}	3.30×10^{-3}	314,570
		10^{-4}	7.35×10^{-5}	3.30×10^{-3}	314,570
		0	1.23×10^{-32}	2.30×10^{-3}	323,150
	10^{-4}	10^{-1}	7.94×10^{-2}	1.09×10^{-1}	414,450
		10^{-2}	9.89×10^{-3}	2.19×10^{-2}	223,710
		10^{-3}	6.07×10^{-7}	2.40×10^{-3}	322,370
		10^{-4}	6.07×10^{-7}	2.40×10^{-3}	322,370
		0	7.70×10^{-32}	2.30×10^{-3}	323,150

Table C.1 Result of using Training Data (1980-1994:1995) and Testing Data (1981-1995:1996) (cont.)

Table C.2 Result of using Training Data (1980-1993:1994) and Testing Data (1981-1994:1995)

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
1	1	10^{-1}	2.22×10^{-2}	1.11×10^{-2}	428,390
		10^{-2}	1.87×10^{-5}	2.30×10^{-3}	274,910
		10^{-3}	1.87×10^{-5}	2.30×10^{-3}	274,910
		10^{-4}	1.87×10^{-5}	2.30×10^{-3}	274,910
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
	10^{-1}	10^{-1}	8.90×10^{-2}	6.47×10^{-2}	577,530
		10^{-2}	6.51×10^{-3}	1.40×10^{-3}	359,940
		10^{-3}	1.54×10^{-4}	9.93×10^{-4}	291,630
		10^{-4}	6.37×10^{-5}	1.30×10^{-3}	287,220
		0	0	1.90×10^{-3}	279,240
	10^{-2}	10^{-1}	9.76×10^{-2}	7.21×10^{-2}	591,590
		10^{-2}	9.49×10^{-3}	2.90×10^{-3}	376,680
		10^{-3}	9.61×10^{-4}	1.67×10^{-4}	310,230
		10^{-4}	3.03×10^{-5}	1.50×10^{-3}	284,740
		0	0	1.90×10^{-3}	279,240
	10^{-3}	10^{-1}	9.83×10^{-2}	7.27×10^{-2}	592,830
		10^{-2}	9.77×10^{-3}	3.00×10^{-3}	378,100
		10^{-3}	8.72×10^{-4}	2.07×10^{-4}	308,770
		10^{-4}	3.44×10^{-5}	1.40×10^{-3}	285,110
		0	0	1.90×10^{-3}	279,240
	10^{-4}	10^{-1}	9.98×10^{-2}	7.40×10^{-2}	595,140
		10^{-2}	8.46×10^{-3}	2.30×10^{-3}	371,200
		10^{-3}	9.80×10^{-4}	1.59×10^{-4}	310,550
		10^{-4}	5.60×10^{-5}	1.30×10^{-3}	286,730
		0	0	1.90×10^{-3}	279,240

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
2	1	10^{-1}	3.96×10^{-2}	5.90×10^{-2}	80,307
		10^{-2}	2.56×10^{-4}	7.79×10^{-4}	295,240
		10^{-3}	2.56×10^{-4}	7.79×10^{-4}	295,240
		10^{-4}	1.09×10^{-5}	1.60×10^{-3}	282,530
		0	0	1.90×10^{-3}	279,240
	10^{-1}	10^{-1}	8.78×10^{-2}	6.37×10^{-2}	575,520
		10^{-2}	2.41×10^{-3}	$\mathbf{2.73\times10^{-5}}$	**328,370**
		10^{-3}	6.43×10^{-4}	3.44×10^{-4}	304,600
		10^{-4}	6.81×10^{-6}	1.70×10^{-3}	281,850
		0	0	1.90×10^{-3}	279,240
	10^{-2}	10^{-1}	9.47×10^{-2}	6.96×10^{-2}	587,040
		10^{-2}	8.94×10^{-3}	2.60×10^{-3}	373,790
		10^{-3}	4.49×10^{-4}	5.17×10^{-4}	300,420
		10^{-4}	1.21×10^{-7}	2.00×10^{-3}	278,890
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
	10^{-3}	10^{-1}	9.94×10^{-2}	7.37×10^{-2}	594,590
		10^{-2}	9.78×10^{-3}	3.00×10^{-3}	378,120
		10^{-3}	9.21×10^{-4}	1.84×10^{-4}	309,580
		10^{-4}	1.45×10^{-5}	1.60×10^{-3}	283,040
		0	0	1.90×10^{-3}	279,240
	10^{-4}	10^{-1}	9.94×10^{-2}	7.37×10^{-2}	594,580
		10^{-2}	8.34×10^{-3}	2.20×10^{-3}	370,570
		10^{-3}	5.48×10^{-4}	4.20×10^{-4}	302,650
		10^{-4}	3.44×10^{-5}	1.40×10^{-3}	285,100
		0	0	1.90×10^{-3}	279,240
3	1	10^{-1}	7.77×10^{-2}	1.04×10^{-1}	526
		10^{-2}	2.69×10^{-4}	7.57×10^{-4}	295,640
		10^{-3}	2.69×10^{-4}	7.57×10^{-4}	295,640
		10^{-4}	1.32×10^{-5}	1.60×10^{-3}	282,880
		0	0	1.90×10^{-3}	279,240

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
3	10^{-1}	10^{-1}	$1.87x10^{-2}$	$3.26x10^{-2}$	142,580
		10^{-2}	$5.74x10^{-3}$	$1.10x10^{-3}$	355,010
		10^{-3}	$2.73x10^{-5}$	$1.50x10^{-3}$	284,470
		10^{-4}	$2.73x10^{-5}$	$1.50x10^{-3}$	284,470
		0	0	$1.90x10^{-3}$	279,240
	10^{-2}	10^{-1}	$9.96x10^{-2}$	$1.29x10^{-1}$	-36,296
		10^{-2}	$8.13x10^{-3}$	$1.80x10^{-2}$	189,050
		10^{-3}	$5.86x10^{-4}$	$4.60x10^{-3}$	255,030
		10^{-4}	$1.52x10^{-5}$	$2.30x10^{-3}$	275,340
		0	$3.08x10^{-33}$	$1.90x10^{-3}$	279,240
	10^{-3}	10^{-1}	$9.98x10^{-2}$	$1.30x10^{-1}$	-36,662
		10^{-2}	$8.64x10^{-3}$	$1.87x10^{-2}$	186,290
		10^{-3}	$4.01x10^{-4}$	$4.10x10^{-3}$	259,210
		10^{-4}	$4.54x10^{-5}$	$2.60x10^{-3}$	272,500
		0	0	$1.90x10^{-3}$	279,240
	10^{-4}	10^{-1}	$9.35x10^{-2}$	$1.22x10^{-1}$	-26,612
		10^{-2}	$9.48x10^{-3}$	$2.00x10^{-2}$	181,900
		10^{-3}	$5.73x10^{-4}$	$4.60x10^{-3}$	255,290
		10^{-4}	$5.73x10^{-6}$	$1.70x10^{-3}$	281,630
		0	$2.77x10^{-32}$	$1.90x10^{-3}$	279,240
4	1	10^{-1}	$3.44.x10^{-2}$	$2.00x10^{-2}$	464,670
		10^{-2}	$1.19x10^{-3}$	$8.77x10^{-5}$	313,780
		10^{-3}	$6.45x10^{-6}$	$1.70x10^{-3}$	281,780
		10^{-4}	$6.45x10^{-6}$	$1.70x10^{-3}$	281,780
		0	$3.08x10^{-33}$	$1.90x10^{-3}$	279,240
	10^{-1}	10^{-1}	$3.44x10^{-2}$	$2.00x10^{-2}$	464,670
		10^{-2}	$8.60x10^{-3}$	$2.40x10^{-3}$	371,960
		10^{-3}	$4.85x10^{-6}$	$1.70x10^{-3}$	281,440
		10^{-4}	$4.85x10^{-6}$	$1.70x10^{-3}$	281,440
		0	$3.08x10^{-33}$	$1.90x10^{-3}$	279,240

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
4	10^{-2}	10^{-1}	3.44×10^{-2}	2.00×10^{-2}	464,670
		10^{-2}	8.71×10^{-2}	2.40×10^{-3}	372,570
		10^{-3}	6.25×10^{-4}	3.57×10^{-4}	304,250
		10^{-4}	9.79×10^{-5}	1.20×10^{-3}	289,140
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
	10^{-3}	10^{-1}	3.44×10^{-2}	2.00×10^{-2}	464,670
		10^{-2}	9.53×10^{-3}	2.90×10^{-3}	376,860
		10^{-3}	7.71×10^{-4}	2.60×10^{-4}	307,020
		10^{-4}	5.01×10^{-5}	1.40×10^{-3}	286,320
		0	0	1.90×10^{-3}	279,240
	10^{-4}	10^{-1}	3.44×10^{-2}	2.00×10^{-2}	464,700
		10^{-2}	9.69×10^{-3}	3.00×10^{-3}	377,660
		10^{-3}	8.55×10^{-4}	2.15×10^{-4}	308,480
		10^{-4}	7.05×10^{-5}	1.30×10^{-3}	287,640
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
5	1	10^{-1}	5.75×10^{-2}	3.83×10^{-2}	518,960
		10^{-2}	1.99×10^{-4}	3.40×10^{-3}	265,130
		10^{-3}	1.99×10^{-4}	3.40×10^{-3}	265,130
		10^{-4}	9.78×10^{-6}	2.20×10^{-3}	276,110
		0	0	1.90×10^{-3}	279,240
	10^{-1}	10^{-1}	4.74×10^{-2}	6.84×10^{-2}	616,100
		10^{-2}	9.87×10^{-3}	3.10×10^{-3}	378,590
		10^{-3}	6.96×10^{-5}	1.30×10^{-3}	287,590
		10^{-4}	6.96×10^{-5}	1.30×10^{-3}	287,590
		0	0	1.90×10^{-3}	279,240
	10^{-2}	10^{-1}	8.14×10^{-2}	1.08×10^{-1}	-6127
		10^{-2}	5.82×10^{-3}	1.45×10^{-2}	202,920
		10^{-3}	5.49×10^{-3}	4.50×10^{-3}	255,810
		10^{-4}	1.87×10^{-6}	1.80×10^{-3}	280,610
		0	0	1.90×10^{-3}	279,240

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
5	10^{-3}	10^{-1}	9.56×10^{-2}	1.25×10^{-1}	-29,969
		10^{-2}	9.38×10^{-3}	1.98×10^{-2}	182,410
		10^{-3}	5.31×10^{-4}	4.50×10^{-3}	256,190
		10^{-4}	1.07×10^{-6}	2.00×10^{-3}	278,200
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
	10^{-4}	10^{-1}	9.67×10^{-2}	1.26×10^{-1}	-31,660
		10^{-2}	7.94×10^{-3}	1.77×10^{-2}	190,110
		10^{-3}	7.66×10^{-4}	5.10×10^{-3}	251,570
		10^{-4}	2.80×10^{-5}	2.40×10^{-3}	273,950
		0	4.93×10^{-32}	1.90×10^{-3}	279,240
6	1	10^{-1}	7.21×10^{-2}	5.05×10^{-2}	547,840
		10^{-2}	3.99×10^{-3}	1.15×10^{-2}	216,040
		10^{-3}	3.38×10^{-5}	2.50×10^{-3}	273,420
		10^{-4}	3.38×10^{-5}	2.50×10^{-3}	273,420
		0	0	1.90×10^{-3}	279,240
	10^{-1}	10^{-1}	1.40×10^{-2}	2.63×10^{-2}	160,860
		10^{-2}	3.30×10^{-3}	1.03×10^{-2}	221,770
		10^{-3}	3.76×10^{-6}	1.80×10^{-3}	281,180
		10^{-4}	3.76×10^{-6}	1.80×10^{-3}	281,180
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
	10^{-2}	10^{-1}	9.73×10^{-2}	1.26×10^{-1}	-32,619
		10^{-2}	5.80×10^{-3}	1.44×10^{-2}	203,110
		10^{-3}	8.87×10^{-4}	5.40×10^{-3}	249,460
		10^{-4}	6.33×10^{-5}	2.70×10^{-3}	271,290
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
	10^{-3}	10^{-1}	9.92×10^{-2}	1.29×10^{-1}	-35,794
		10^{-2}	9.24×10^{-3}	1.96×10^{-2}	183,100
		10^{-3}	5.38×10^{-4}	4.50×10^{-3}	256,060
		10^{-4}	4.51×10^{-5}	2.60×10^{-3}	272,520
		0	3.08×10^{-33}	1.90×10^{-3}	279,240

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
6	10^{-4}	10^{-1}	9.79×10^{-2}	1.27×10^{-1}	-33,688
		10^{-2}	8.29×10^{-3}	1.82×10^{-2}	188,210
		10^{-3}	7.42×10^{-4}	5.10×10^{-3}	252,010
		10^{-4}	6.73×10^{-6}	2.20×10^{-3}	276,650
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
7	1	10^{-1}	2.36×10^{-4}	8.15×10^{-4}	294,590
		10^{-2}	2.36×10^{-4}	8.15×10^{-4}	294,590
		10^{-3}	2.36×10^{-4}	8.15×10^{-3}	294,590
		10^{-4}	1.33×10^{-5}	1.60×10^{-3}	282,880
		0	3.08×10^{-33}	1.90×10^{-3}	279,240
	10^{-1}	10^{-1}	3.71×10^{-2}	5.60×10^{-2}	86,567
		10^{-2}	6.30×10^{-3}	1.52×10^{-2}	199,860
		10^{-3}	9.42×10^{-4}	1.75×10^{-4}	309,940
		10^{-4}	9.82×10^{-6}	1.70×10^{-3}	282,370
		0	0	1.90×10^{-3}	279,240
	10^{-2}	10^{-1}	9.04×10^{-2}	1.19×10^{-1}	-21,454
		10^{-2}	6.78×10^{-3}	1.59×10^{-2}	196,910
		10^{-3}	2.24×10^{-4}	3.50×10^{-3}	264,280
		10^{-4}	7.55×10^{-5}	2.80×10^{-3}	270,550
		0	0	1.90×10^{-3}	279,240
	10^{-3}	10^{-1}	9.30×10^{-2}	1.22×10^{-1}	25,742
		10^{-2}	7.60×10^{-3}	1.72×10^{-2}	192,060
		10^{-3}	4.41×10^{-4}	4.20×10^{-3}	258,240
		10^{-4}	3.25×10^{-7}	2.00×10^{-3}	278,670
		0	1.23×10^{-32}	1.90×10^{-3}	279,240
	10^{-4}	10^{-1}	8.65×10^{-2}	1.29×10^{-1}	35,867
		10^{-2}	6.00×10^{-3}	1.93×10^{-2}	184,070
		10^{-3}	1.46×10^{-4}	5.30×10^{-3}	250,210
		10^{-4}	6.33×10^{-5}	2.80×10^{-3}	270,500
		0	1.23×10^{-32}	3.70×10^{-3}	262,510

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
8	1	10^{-1}	5.93×10^{-3}	1.46×10^{-2}	202,140
		10^{-2}	5.93×10^{-3}	1.46×10^{-2}	202,140
		10^{-3}	1.98×10^{-4}	3.40×10^{-3}	265,040
		10^{-4}	3.17×10^{-5}	2.50×10^{-3}	273,500
		0	0	1.90×10^{-3}	279,130
	10^{-1}	10^{-1}	6.95×10^{-2}	4.82×10^{-2}	542,710
		10^{-2}	7.96×10^{-3}	2.00×10^{-3}	368,380
		10^{-3}	4.54×10^{-7}	1.90×10^{-3}	279,800
		10^{-4}	4.54×10^{-7}	1.90×10^{-3}	279,800
		0	3.08×10^{-33}	1.90×10^{-3}	279,130
	10^{-2}	10^{-1}	9.34×10^{-2}	3.92×10^{-1}	-303,190
		10^{-2}	4.67×10^{-3}	1.26×10^{-2}	210,800
		10^{-3}	2.49×10^{-4}	3.60×10^{-3}	263,360
		10^{-4}	8.40×10^{-5}	2.80×10^{-3}	269,960
		0	1.23×10^{-32}	1.90×10^{-3}	279,130
	10^{-3}	10^{-1}	9.97×10^{-2}	4.52×10^{-1}	-348,950
		10^{-2}	9.70×10^{-3}	2.03×10^{-2}	180,580
		10^{-3}	8.84×10^{-4}	5.40×10^{-3}	249,370
		10^{-4}	2.58×10^{-5}	2.40×10^{-3}	274,030
		0	1.23×10^{-32}	1.90×10^{-3}	279,110
	10^{-4}	10^{-1}	9.85×10^{-2}	3.92×10^{-1}	-303,310
		10^{-2}	8.52×10^{-3}	4.12×10^{-2}	120,160
		10^{-3}	8.32×10^{-4}	1.78×10^{-2}	189,740
		10^{-4}	5.01×10^{-5}	1.21×10^{-2}	213,210
		0	3.08×10^{-33}	1.05×10^{-2}	220,800
9	1	10^{-1}	6.69×10^{-2}	9.15×10^{-2}	206,220
		10^{-2}	3.70×10^{-3}	2.86×10^{-4}	340,070
		10^{-3}	3.14×10^{-5}	1.50×10^{-3}	284,820
		10^{-4}	3.14×10^{-5}	1.50×10^{-3}	284,820
		0	3.08×10^{-33}	1.90×10^{-3}	279,220

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
9	10^{-1}	10^{-1}	3.61×10^{-14}	1.90×10^{-3}	279,220
		10^{-2}	3.61×10^{-14}	1.90×10^{-3}	279,220
		10^{-3}	3.61×10^{-14}	1.90×10^{-3}	279,220
		10^{-4}	3.61×10^{-14}	1.90×10^{-3}	279,220
		0	3.08×10^{-33}	1.90×10^{-3}	279,220
	10^{-2}	10^{-1}	9.24×10^{-2}	6.76×10^{-2}	583,240
		10^{-2}	7.38×10^{-3}	1.80×10^{-3}	365,150
		10^{-3}	4.12×10^{-4}	5.58×10^{-4}	299,520
		10^{-4}	8.45×10^{-5}	2.80×10^{-3}	270,030
		0	1.23×10^{-32}	1.90×10^{-3}	279,220
	10^{-3}	10^{-1}	9.87×10^{-2}	7.31×10^{-2}	593,440
		10^{-2}	9.40×10^{-3}	2.80×10^{-3}	376,150
		10^{-3}	6.68×10^{-4}	3.27×10^{-4}	305,060
		10^{-4}	9.34×10^{-5}	1.20×10^{-3}	288,880
		0	3.08×10^{-33}	1.90×10^{-3}	279,220
	10^{-4}	10^{-1}	9.83×10^{-2}	7.27×10^{-2}	592,800
		10^{-2}	8.80×10^{-3}	2.50×10^{-3}	373,010
		10^{-3}	5.58×10^{-4}	4.12×10^{-4}	302,850
		10^{-4}	5.91×10^{-5}	1.30×10^{-3}	286,910
		0	0	1.90×10^{-3}	279,220

Table C.2 Result of using Training Data (1980-1993:1994)

and Testing Data (1981-1994:1995) (cont.)

Table C.3 Results of using Training Data (1980-1992:1993)

and Testing Data (1981-1993:1994)

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
1	1	10^{-1}	1.55×10^{-4}	9.96×10^{-4}	247,670
		10^{-2}	1.55×10^{-4}	9.96×10^{-4}	247,670
		10^{-3}	1.55×10^{-4}	9.96×10^{-4}	247,670
		10^{-4}	9.21×10^{-6}	1.70×10^{-3}	238,260
		0	0	1.90×10^{-3}	235,221
	10^{-1}	10^{-1}	5.40×10^{-2}	7.64×10^{-2}	2,289
		10^{-2}	1.27×10^{-3}	6.40×10^{-3}	199,540
		10^{-3}	8.59×10^{-4}	5.40×10^{-3}	205,920
		10^{-4}	2.23×10^{-5}	2.40×10^{-3}	230,500
		0	0	1.90×10^{-3}	235,221
	10^{-2}	10^{-1}	9.53×10^{-2}	1.25×10^{-1}	-73,558
		10^{-2}	7.96×10^{-3}	1.78×10^{-2}	145,990
		10^{-3}	2.51×10^{-4}	3.6×10^{-3}	219,380
		10^{-4}	4.45×10^{-5}	1.40×10^{-3}	241,890
		0	6.93×10^{-33}	1.90×10^{-3}	235,220
	10^{-3}	10^{-1}	9.59×10^{-2}	1.25×10^{-1}	-74,472
		10^{-2}	7.23×10^{-3}	1.66×10^{-2}	150,210
		10^{-3}	2.85×10^{-4}	3.70×10^{-3}	218,340
		10^{-4}	1.67×10^{-5}	1.60×10^{-3}	239,310
		0	0	1.90×10^{-3}	235,221
	10^{-4}	10^{-1}	9.92×10^{-1}	1.29×10^{-1}	-79,728
		10^{-2}	8.13×10^{-3}	1.80×10^{-2}	145,070
		10^{-3}	4.64×10^{-4}	4.30×10^{-3}	213,670
		10^{-4}	1.33×10^{-7}	2.00×10^{-3}	234,860
		0	6.93×10^{-33}	1.90×10^{-3}	235,220

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
2	1	10^{-1}	1.46×10^{-3}	6.80×10^{-3}	197,050
		10^{-2}	1.46×10^{-3}	6.80×10^{-3}	197,050
		10^{-3}	6.18×10^{-5}	2.70×10^{-3}	227,360
		10^{-4}	6.18×10^{-5}	2.70×10^{-3}	227,360
		0	7.70×10^{-34}	1.90×10^{-3}	235,221
	10^{-1}	10^{-1}	1.37×10^{-2}	2.60×10^{-2}	118,030
		10^{-2}	7.87×10^{-3}	1.76×10^{-2}	146,520
		10^{-3}	3.88×10^{-5}	2.50×10^{-3}	229,000
		10^{-4}	3.88×10^{-5}	2.50×10^{-3}	229,000
		0	3.08×10^{-33}	1.90×10^{-3}	235,220
	10^{-2}	10^{-1}	8.30×10^{-2}	1.10×10^{-1}	-529,450
		10^{-2}	6.05×10^{-3}	1.48×10^{-2}	157,440
		10^{-3}	5.89×10^{-4}	4.70×10^{-3}	210,950
		10^{-4}	6.87×10^{-7}	1.90×10^{-3}	236,050
		0	0	1.90×10^{-3}	235,221
	10^{-3}	10^{-1}	9.41×10^{-2}	1.23×10^{-1}	-71,518
		10^{-2}	8.99×10^{-3}	1.93×10^{-2}	140,420
		10^{-3}	8.64×10^{-4}	5.40×10^{-3}	205,820
		10^{-4}	8.23×10^{-5}	2.80×10^{-3}	226,150
		0	0	1.90×10^{-3}	235,221
	10^{-4}	10^{-1}	9.75×10^{-2}	1.27×10^{-1}	-77,098
		10^{-2}	6.06×10^{-3}	1.48×10^{-2}	157,380
		10^{-3}	1.95×10^{-4}	3.40×10^{-3}	221,240
		10^{-4}	3.19×10^{-5}	1.50×10^{-3}	240,870
		0	0	1.90×10^{-3}	235,221
3	1	10^{-1}	2.72×10^{-2}	1.46×10^{-2}	400,020
		10^{-2}	9.40×10^{-5}	2.90×10^{-3}	225,530
		10^{-3}	9.40×10^{-5}	2.90×10^{-3}	225,530
		10^{-4}	9.40×10^{-5}	2.90×10^{-3}	225,530
		0	0	1.90×10^{-3}	235,220

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
3	10^{-1}	10^{-1}	5.47×10^{-2}	3.60×10^{-2}	469,000
		10^{-2}	6.53×10^{-3}	1.40×10^{-3}	316,030
		10^{-3}	5.58×10^{-4}	4.60×10^{-3}	211,590
		10^{-4}	9.55×10^{-6}	2.20×10^{-3}	232,130
		0	3.08×10^{-33}	1.90×10^{-3}	235,220
	10^{-2}	10^{-1}	9.70×10^{-2}	7.16×10^{-2}	546,830
		10^{-2}	9.17×10^{-3}	2.70×10^{-3}	331,000
		10^{-3}	7.22×10^{-4}	2.94×10^{-4}	262,090
		10^{-4}	5.32×10^{-6}	1.70×10^{-3}	237,530
		0	3.08×10^{-33}	1.90×10^{-3}	235,220
	10^{-3}	10^{-1}	9.98×10^{-2}	7.39×10^{-2}	551,170
		10^{-2}	8.39×10^{-3}	2.30×10^{-3}	326,830
		10^{-3}	8.10×10^{-4}	2.42×10^{-4}	263,690
		10^{-4}	1.59×10^{-5}	1.60×10^{-3}	239,210
		0	3.08×10^{-33}	1.90×10^{-3}	235,220
	10^{-4}	10^{-1}	9.87×10^{-2}	7.30×10^{-2}	549,340
		10^{-2}	8.88×10^{-3}	2.50×10^{-3}	329,430
		10^{-3}	9.57×10^{-4}	1.71×10^{-4}	266,150
		10^{-4}	3.84×10^{-5}	1.40×10^{-3}	241,420
		0	0	1.90×10^{-3}	235,220
4	1	10^{-1}	1.02×10^{-2}	2.10×10^{-2}	134,420
		10^{-2}	5.49×10^{-5}	2.60×10^{-3}	227,820
		10^{-3}	5.49×10^{-5}	2.60×10^{-3}	227,820
		10^{-4}	5.49×10^{-5}	2.60×10^{-3}	227,820
		0	0	1.90×10^{-3}	235,230
	10^{-1}	10^{-1}	7.32×10^{-2}	9.90×10^{-2}	-35,357
		10^{-2}	4.13×10^{-5}	2.50×10^{-3}	228,800
		10^{-3}	4.13×10^{-5}	2.50×10^{-3}	228,800
		10^{-4}	4.13×10^{-5}	2.50×10^{-3}	228,800
		0	3.08×10^{-33}	1.90×10^{-3}	235,230

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
4	10^{-2}	10^{-1}	8.93×10^{-2}	1.18×10^{-1}	-63,607
		10^{-2}	9.25×10^{-3}	1.96×10^{-2}	139,070
		10^{-3}	8.34×10^{-4}	5.30×10^{-3}	206,350
		10^{-4}	6.60×10^{-5}	2.70×10^{-3}	227,100
		0	7.70×10^{-34}	1.90×10^{-3}	235,230
	10^{-3}	10^{-1}	9.89×10^{-2}	1.29×10^{-1}	-79,235
		10^{-2}	8.78×10^{-3}	1.90×10^{-2}	141,500
		10^{-3}	4.27×10^{-4}	4.20×10^{-3}	214,570
		10^{-4}	9.15×10^{-5}	2.90×10^{-3}	225,660
		0	0	1.90×10^{-3}	235,230
	10^{-4}	10^{-1}	9.99×10^{-2}	1.30×10^{-1}	-80,845
		10^{-2}	9.61×10^{-3}	2.02×10^{-2}	137,210
		10^{-3}	6.01×10^{-4}	4.70×10^{-3}	210,720
		10^{-4}	6.13×10^{-6}	2.20×10^{-3}	232,750
		0	0	1.90×10^{-3}	235,230
5	1	10^{-1}	1.81×10^{-3}	**2.23×10^{-6}**	**277,750**
		10^{-2}	1.81×10^{-3}	**2.23×10^{-6}**	**277,750**
		10^{-3}	6.05×10^{-5}	1.30×10^{-3}	243,000
		10^{-4}	6.05×10^{-5}	1.30×10^{-3}	243,000
		0	0	1.90×10^{-3}	235,221
	10^{-1}	10^{-1}	2.06×10^{-2}	1.16×10^{-2}	387,010
		10^{-2}	4.54×10^{-3}	1.80×10^{-3}	321,920
		10^{-3}	1.59×10^{-4}	4.35×10^{-4}	258,380
		10^{-4}	2.05×10^{-5}	2.86×10^{-4}	262,320
		0	0	2.19×10^{-4}	264,440
	10^{-2}	10^{-1}	9.08×10^{-2}	1.20×10^{-1}	-66,732
		10^{-2}	6.61×10^{-3}	1.53×10^{-2}	155,610
		10^{-3}	1.45×10^{-5}	2.00×10^{-3}	234,610
		10^{-4}	1.45×10^{-5}	2.00×10^{-3}	234,610
		0	3.08×10^{-33}	1.70×10^{-3}	238,390

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
5	10^{-3}	10^{-1}	9.67×10^{-2}	1.27×10^{-1}	-76,469
		10^{-2}	9.27×10^{-3}	1.93×10^{-2}	140,400
		10^{-3}	5.60×10^{-4}	4.20×10^{-3}	214,130
		10^{-4}	4.86×10^{-5}	2.30×10^{-3}	231,070
		0	0	1.70×10^{-3}	238,020
	10^{-4}	10^{-1}	8.93×10^{-2}	1.18×10^{-1}	-64,369
		10^{-2}	7.24×10^{-3}	1.62×10^{-2}	151,840
		10^{-3}	9.43×10^{-4}	5.20×10^{-3}	207,060
		10^{-4}	6.22×10^{-6}	1.50×10^{-3}	240,808
		0	0	1.70×10^{-3}	238,330
6	1	10^{-1}	3.48×10^{-2}	5.23×10^{-1}	1,002,400
		10^{-2}	5.10×10^{-3}	1.33×10^{-2}	163,830
		10^{-3}	6.77×10^{-4}	4.90×10^{-3}	209,210
		10^{-4}	8.37×10^{-5}	1.20×10^{-3}	244,370
		0	3.08×10^{-33}	1.90×10^{-3}	235,220
	10^{-1}	10^{-1}	1.57×10^{-2}	1.34×10^{-1}	644,590
		10^{-2}	9.85×10^{-3}	9.46×10^{-2}	586,840
		10^{-3}	2.91×10^{-4}	3.00×10^{-1}	826,730
		10^{-4}	7.68×10^{-6}	3.30×10^{-1}	853,790
		0	0	3.26×10^{-1}	850,100
	10^{-2}	10^{-1}	7.84×10^{-2}	7.70×10^{-3}	367,200
		10^{-2}	4.55×10^{-3}	2.61×10^{-1}	790,370
		10^{-3}	5.87×10^{-5}	3.29×10^{-1}	852,410
		10^{-4}	5.87×10^{-5}	3.29×10^{-1}	852,410
		0	3.08×10^{-33}	3.36×10^{-1}	858,950
	10^{-3}	10^{-1}	9.70×10^{-2}	9.60×10^{-3}	377,460
		10^{-2}	8.52×10^{-3}	2.52×10^{-1}	780,730
		10^{-3}	2.67×10^{-4}	2.80×10^{-1}	808,590
		10^{-4}	2.01×10^{-5}	2.83×10^{-1}	811,240
		0	4.93×10^{-32}	2.84×10^{-1}	812,170

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
6	10^{-4}	10^{-1}	9.99×10^{-2}	1.38×10^{-2}	396,710
		10^{-2}	4.22×10^{-3}	2.56×10^{-1}	785,130
		10^{-3}	6.52×10^{-4}	2.80×10^{-1}	808,030
		10^{-4}	3.62×10^{-5}	2.76×10^{-1}	804,850
		0	1.23×10^{-32}	2.75×10^{-1}	803,770
7	1	10^{-1}	3.20×10^{-4}	6.83×10^{-4}	253,110
		10^{-2}	3.20×10^{-4}	6.83×10^{-4}	253,110
		10^{-3}	3.20×10^{-4}	6.83×10^{-4}	253,110
		10^{-4}	1.80×10^{-5}	1.60×10^{-3}	239,460
		0	1.23×10^{-32}	1.90×10^{-3}	235,210
	10^{-1}	10^{-1}	6.29×10^{-2}	8.69×10^{-2}	15,497
		10^{-2}	1.60×10^{-3}	1.67×10^{-5}	275,150
		10^{-3}	4.76×10^{-4}	4.93×10^{-4}	257,030
		10^{-4}	1.66×10^{-5}	1.60×10^{-3}	239,290
		0	0	1.90×10^{-3}	235,210
	10^{-2}	10^{-1}	8.16×10^{-2}	1.09×10^{-1}	-50,492
		10^{-2}	1.07×10^{-3}	5.90×10^{-3}	202,450
		10^{-3}	8.59×10^{-4}	5.40×10^{-3}	205,910
		10^{-4}	8.46×10^{-5}	2.80×10^{-3}	226,010
		0	1.23×10^{-32}	1.90×10^{-3}	235,210
	10^{-3}	10^{-1}	9.69×10^{-2}	1.26×10^{-1}	-76,044
		10^{-2}	6.18×10^{-3}	1.50×10^{-3}	156,600
		10^{-3}	6.71×10^{-4}	4.90×10^{-3}	209,310
		10^{-4}	1.19×10^{-6}	2.00×10^{-3}	234,120
		0	9.32×10^{-32}	1.90×10^{-3}	235,210
	10^{-4}	10^{-1}	8.82×10^{-2}	1.16×10^{-1}	-61,739
		10^{-2}	8.79×10^{-3}	1.90×10^{-2}	141,480
		10^{-3}	2.17×10^{-4}	3.50×10^{-3}	220,490
		10^{-4}	9.08×10^{-5}	1.20×10^{-3}	244,740
		0	1.51×10^{-31}	1.90×10^{-3}	235,210

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
8	1	10^{-1}	5.05×10^{-2}	1.44×10^{-1}	658,670
		10^{-2}	3.38×10^{-3}	1.40×10^{-1}	651,990
		10^{-3}	5.33×10^{-4}	1.40×10^{-1}	653,160
		10^{-4}	1.12×10^{-6}	1.40×10^{-1}	652,810
		0	1.23×10^{-30}	1.40×10^{-1}	652,820
	10^{-1}	10^{-1}	8.98×10^{-2}	1.46×10^{-1}	661,040
		10^{-2}	4.07×10^{-4}	1.38×10^{-1}	650,000
		10^{-3}	4.07×10^{-4}	1.38×10^{-1}	650,000
		10^{-4}	1.46×10^{-5}	1.37×10^{-1}	649,760
		0	3.77×10^{-30}	1.37×10^{-1}	649,710
	10^{-2}	10^{-1}	5.64×10^{-2}	1.44×10^{-1}	659,020
		10^{-2}	2.78×10^{-3}	1.39×10^{-1}	651,710
		10^{-3}	5.51×10^{-4}	1.40×10^{-1}	652,800
		10^{-4}	3.37×10^{-6}	1.39×10^{-1}	652,440
		0	3.08×10^{-33}	1.39×10^{-1}	652,460
	10^{-3}	10^{-1}	4.53×10^{-2}	1.37×10^{-1}	649,930
		10^{-2}	8.14×10^{-3}	1.39×10^{-1}	652,230
		10^{-3}	3.18×10^{-4}	1.41×10^{-1}	654,240
		10^{-4}	1.18×10^{-5}	1.41×10^{-1}	654,030
		0	3.77×10^{-32}	1.40×10^{-1}	653,980
	10^{-4}	10^{-1}	9.80×10^{-2}	1.36×10^{-1}	647,820
		10^{-2}	9.79×10^{-3}	1.39×10^{-1}	651,880
		10^{-3}	7.61×10^{-4}	1.40×10^{-1}	653,010
		10^{-4}	2.48×10^{-6}	1.40×10^{-1}	653,420
		0	1.73×10^{-31}	1.40×10^{-1}	653,440
9	1	10^{-1}	7.89×10^{-2}	1.06×10^{-1}	-45,676
		10^{-2}	6.68×10^{-4}	4.90×10^{-3}	209,370
		10^{-3}	6.68×10^{-4}	4.90×10^{-3}	209,370
		10^{-4}	7.40×10^{-5}	2.80×10^{-3}	226,620
		0	7.70×10^{-34}	1.90×10^{-3}	235,220

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
9	10^{-1}	10^{-1}	1.53×10^{-2}	6.40×10^{-3}	359,110
		10^{-2}	3.24×10^{-3}	1.67×10^{-4}	292,180
		10^{-3}	6.78×10^{-5}	2.70×10^{-3}	226,990
		10^{-4}	6.78×10^{-5}	2.70×10^{-3}	226,990
		0	0	1.90×10^{-3}	235,220
	10^{-2}	10^{-1}	8.27×10^{-2}	1.10×10^{-1}	-52,375
		10^{-2}	9.23×10^{-3}	1.96×10^{-2}	139,140
		10^{-3}	3.94×10^{-5}	2.50×10^{-3}	228,950
		10^{-4}	3.94×10^{-5}	2.50×10^{-3}	228,950
		0	6.24×10^{-32}	1.90×10^{-3}	235,220
	10^{-3}	10^{-1}	9.92×10^{-2}	1.29×10^{-1}	-79,736
		10^{-2}	7.98×10^{-3}	1.78×10^{-2}	145,870
		10^{-3}	5.59×10^{-4}	4.60×10^{-3}	211,570
		10^{-4}	1.68×10^{-5}	2.30×10^{-3}	231,120
		0	3.08×10^{-33}	1.90×10^{-3}	235,220
	10^{-4}	10^{-1}	9.42×10^{-2}	1.23×10^{-1}	-71,589
		10^{-2}	9.63×10^{-3}	2.02×10^{-2}	137,100
		10^{-3}	4.87×10^{-4}	4.40×10^{-3}	213,180
		10^{-4}	3.12×10^{-7}	1.90×10^{-3}	235,810
		0	2.77×10^{-32}	1.90×10^{-3}	235,250

Table C.3 Results of using Training Data (1980-1992:1993) and Testing Data (1981-1993:1994) (cont.)

Table C.4 Results of using Training Data (1980-1991:1992)

and Testing Data (1981-1992:1993)

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
1	1	10^{-1}	3.06×10^{-2}	4.27×10^{-2}	28,698
		10^{-2}	4.90×10^{-3}	1.03×10^{-2}	133,700
		10^{-3}	4.12×10^{-6}	8.69×10^{-4}	205,740
		10^{-4}	4.12×10^{-6}	8.69×10^{-4}	205,740
		0	7.70×10^{-34}	9.93×10^{-4}	203,700
	10^{-1}	10^{-1}	3.06×10^{-2}	4.27×10^{-2}	28,698
		10^{-2}	5.06×10^{-3}	1.05×10^{-2}	132,570
		10^{-3}	3.38×10^{-5}	1.40×10^{-3}	197,890
		10^{-4}	3.38×10^{-5}	1.40×10^{-3}	197,890
		0	6.93×10^{-33}	9.93×10^{-4}	203,710
	10^{-2}	10^{-1}	3.06×10^{-2}	4.27×10^{-2}	28,698
		10^{-2}	9.91×10^{-3}	1.72×10^{-2}	104,170
		10^{-3}	7.59×10^{-4}	3.50×10^{-3}	176,160
		10^{-4}	4.13×10^{-5}	1.40×10^{-3}	197,280
		0	9.32×10^{-32}	9.93×10^{-4}	203,700
	10^{-3}	10^{-1}	3.06×10^{-2}	4.27×10^{-2}	28,698
		10^{-2}	9.59×10^{-3}	1.68×10^{-2}	105,770
		10^{-3}	8.95×10^{-4}	3.80×10^{-3}	173,790
		10^{-4}	4.00×10^{-5}	1.40×10^{-3}	197,380
		0	7.70×10^{-34}	9.93×10^{-4}	203,710
	10^{-4}	10^{-1}	3.06×10^{-2}	4.27×10^{-2}	28,698
		10^{-2}	9.70×10^{-3}	1.69×10^{-2}	105,200
		10^{-3}	9.48×10^{-4}	3.90×10^{-3}	172,910
		10^{-4}	5.07×10^{-5}	1.50×10^{-3}	196,590
		0	7.70×10^{-34}	9.93×10^{-4}	203,710

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
2	1	10^{-1}	1.36×10^{-3}	4.70×10^{-3}	166,850
		10^{-2}	1.36×10^{-3}	4.70×10^{-3}	166,850
		10^{-3}	5.76×10^{-5}	1.50×10^{-3}	196,120
		10^{-4}	5.76×10^{-5}	1.50×10^{-3}	196,120
		0	7.70×10^{-34}	9.93×10^{-4}	203,710
	10^{-1}	10^{-1}	1.28×10^{-2}	2.09×10^{-2}	90,579
		10^{-2}	7.33×10^{-3}	1.37×10^{-2}	118,080
		10^{-3}	3.61×10^{-5}	1.40×10^{-3}	197,700
		10^{-4}	3.61×10^{-5}	1.40×10^{-3}	197,700
		0	3.08×10^{-33}	9.93×10^{-4}	203,710
	10^{-2}	10^{-1}	9.54×10^{-2}	1.16×10^{-1}	-105,120
		10^{-2}	5.64×10^{-3}	1.14×10^{-2}	128,620
		10^{-3}	5.49×10^{-4}	3.00×10^{-3}	180,270
		10^{-4}	6.40×10^{-7}	9.43×10^{-4}	204,500
		0	0	9.93×10^{-4}	203,710
	10^{-3}	10^{-1}	8.77×10^{-2}	1.07×10^{-1}	-92,403
		10^{-2}	8.36×10^{-3}	1.51×10^{-2}	112,190
		10^{-3}	8.05×10^{-4}	3.60×10^{-3}	175,320
		10^{-4}	7.67×10^{-5}	1.60×10^{-3}	194,950
		0	0	9.93×10^{-4}	203,710
	10^{-4}	10^{-1}	9.09×10^{-2}	1.11×10^{-1}	-97,790
		10^{-2}	9.39×10^{-3}	1.65×10^{-2}	106,800
		10^{-3}	1.82×10^{-4}	2.00×10^{-3}	190,210
		10^{-4}	2.98×10^{-5}	6.79×10^{-4}	209,160
		0	0	9.93×10^{-4}	203,710
3	1	10^{-1}	6.83×10^{-2}	5.29×10^{-2}	465,120
		10^{-2}	2.37×10^{-4}	2.20×10^{-3}	188,320
		10^{-3}	2.37×10^{-4}	2.20×10^{-3}	188,320
		10^{-4}	1.16×10^{-5}	1.20×10^{-3}	200,290
		0	7.70×10^{-34}	9.93×10^{-4}	203,710

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
3	10^{-1}	10^{-1}	3.84×10^{-4}	2.60×10^{-3}	183,990
		10^{-2}	3.84×10^{-4}	2.60×10^{-3}	183,990
		10^{-3}	3.84×10^{-4}	2.60×10^{-3}	183,990
		10^{-4}	5.75×10^{-5}	1.50×10^{-3}	196,000
		0	7.70×10^{-34}	1.00×10^{-3}	203,590
	10^{-2}	10^{-1}	6.13×10^{-1}	3.39×10^{-2}	419,310
		10^{-2}	6.98×10^{-3}	2.70×10^{-3}	287,280
		10^{-3}	4.41×10^{-4}	1.10×10^{-4}	224,710
		10^{-4}	4.71×10^{-5}	7.89×10^{-4}	210,570
		0	0	9.93×10^{-4}	203,700
	10^{-3}	10^{-1}	8.63×10^{-3}	6.08×10^{-2}	481,730
		10^{-2}	9.55×10^{-3}	4.40×10^{-3}	301,420
		10^{-3}	9.30×10^{-4}	**1.03×10^{-6}**	**234,200**
		10^{-4}	9.89×10^{-5}	4.65×10^{-4}	213,650
		0	6.93×10^{-33}	9.93×10^{-4}	203,700
	10^{-4}	10^{-1}	9.44×10^{-2}	6.76×10^{-2}	495,310
		10^{-2}	9.50×10^{-3}	4.30×10^{-3}	301,160
		10^{-3}	8.34×10^{-4}	6.96×10^{-6}	232,580
		10^{-4}	6.35×10^{-5}	5.54×10^{-4}	211,680
		0	0	9.93×10^{-4}	203,700
4	1	10^{-1}	1.34×10^{-2}	2.18×10^{-2}	87,733
		10^{-2}	7.26×10^{-5}	1.60×10^{-3}	195,110
		10^{-3}	7.26×10^{-5}	1.60×10^{-3}	195,110
		10^{-4}	7.26×10^{-5}	1.60×10^{-3}	195,110
		0	0	9.98×10^{-4}	203,630
	10^{-1}	10^{-1}	9.68×10^{-2}	1.17×10^{-1}	-107,480
		10^{-2}	5.47×10^{-5}	1.50×10^{-3}	196,240
		10^{-3}	5.47×10^{-5}	1.50×10^{-3}	196,240
		10^{-4}	5.47×10^{-5}	1.50×10^{-3}	196,240
		0	5.47×10^{-5}	9.98×10^{-4}	203,630

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
4	10^{-2}	10^{-1}	9.81×10^{-2}	1.19×10^{-1}	-109,550
		10^{-2}	7.04×10^{-3}	1.33×10^{-2}	119,710
		10^{-3}	8.73×10^{-5}	1.70×10^{-3}	194,290
		10^{-4}	8.73×10^{-5}	1.70×10^{-3}	194,290
		0	1.23×10^{-32}	9.98×10^{-4}	203,630
	10^{-3}	10^{-1}	9.96×10^{-2}	1.21×10^{-1}	-111,960
		10^{-2}	8.69×10^{-3}	1.56×10^{-2}	110,430
		10^{-3}	5.64×10^{-4}	3.10×10^{-3}	179,880
		10^{-4}	1.46×10^{-6}	9.23×10^{-4}	204,840
		0	0	9.98×10^{-4}	203,630
	10^{-4}	10^{-1}	9.40×10^{-2}	1.14×10^{-1}	-102,880
		10^{-2}	9.63×10^{-3}	1.68×10^{-2}	105,520
		10^{-3}	7.94×10^{-4}	3.60×10^{-3}	175,450
		10^{-4}	8.12×10^{-6}	1.20×10^{-3}	200,780
		0	6.93×10^{-35}	9.98×10^{-4}	203,630
5	1	10^{-1}	7.14×10^{-2}	8.92×10^{-1}	-63,502
		10^{-2}	4.80×10^{-5}	1.50×10^{-3}	196,780
		10^{-3}	4.80×10^{-5}	1.50×10^{-3}	196,780
		10^{-4}	4.80×10^{-5}	1.50×10^{-3}	196,780
		0	7.70×10^{-34}	9.93×10^{-4}	203,710
	10^{-1}	10^{-1}	7.14×10^{-2}	8.92×10^{-1}	-63,502
		10^{-2}	2.38×10^{-3}	2.98×10^{-4}	252,500
		10^{-3}	6.86×10^{-4}	2.83×10^{-5}	229,900
		10^{-4}	1.68×10^{-5}	7.52×10^{-4}	207,800
		0	7.70×10^{-34}	9.93×10^{-4}	203,710
	10^{-2}	10^{-1}	7.14×10^{-2}	8.92×10^{-2}	-63,502
		10^{-2}	8.92×10^{-3}	1.59×10^{-2}	109,250
		10^{-3}	5.88×10^{-4}	3.10×10^{-3}	179,460
		10^{-4}	4.50×10^{-7}	9.51×10^{-4}	204,380
		0	3.08×10^{-33}	9.93×10^{-4}	203,710

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
5	10^{-3}	10^{-1}	7.14×10^{-2}	8.92×10^{-2}	-63,502
		10^{-2}	9.49×10^{-3}	1.66×10^{-2}	106,280
		10^{-3}	8.38×10^{-4}	3.70×10^{-3}	174,760
		10^{-4}	3.37×10^{-5}	1.40×10^{-3}	197,900
		0	6.93×10^{-33}	9.93×10^{-4}	203,710
	10^{-4}	10^{-1}	7.14×10^{-2}	8.92×10^{-2}	-63,502
		10^{-2}	9.91×10^{-3}	1.72×10^{-2}	104,160
		10^{-3}	9.85×10^{-4}	4.0×10^{-3}	172,320
		10^{-4}	6.38×10^{-5}	1.60×10^{-3}	195,720
		0	1.23×10^{-32}	9.93×10^{-4}	203,710
6	1	10^{-1}	2.09×10^{-2}	3.51×10^{-2}	47,816
		10^{-2}	1.77×10^{-4}	3.20×10^{-3}	178,490
		10^{-3}	1.77×10^{-4}	3.20×10^{-3}	178,490
		10^{-4}	1.96×10^{-5}	2.30×10^{-3}	187,330
		0	7.70×10^{-34}	1.90×10^{-3}	191,730
	10^{-1}	10^{-1}	7.32×10^{-2}	9.80×10^{-2}	-77,804
		10^{-2}	1.97×10^{-5}	1.50×10^{-3}	196,160
		10^{-3}	1.97×10^{-5}	1.50×10^{-3}	196,160
		10^{-4}	1.97×10^{-5}	1.50×10^{-3}	196,160
		0	7.70×10^{-34}	1.90×10^{-3}	191,740
	10^{-2}	10^{-1}	8.22×10^{-2}	1.08×10^{-1}	-93,870
		10^{-2}	4.63×10^{-3}	1.24×10^{-2}	123,930
		10^{-3}	3.31×10^{-4}	3.80×10^{-3}	173,620
		10^{-4}	8.16×10^{-5}	2.80×10^{-3}	182,740
		0	1.93×10^{-32}	1.90×10^{-3}	191,740
	10^{-3}	10^{-1}	9.25×10^{-2}	1.20×10^{-1}	-11,118
		10^{-2}	8.65×10^{-3}	1.85×10^{-2}	99,109
		10^{-3}	2.36×10^{-4}	3.50×10^{-3}	176,440
		10^{-4}	5.41×10^{-6}	1.70×10^{-3}	194,060
		0	0	1.90×10^{-3}	191,740

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
6	10^{-4}	10^{-1}	9.77×10^{-2}	1.26×10^{-1}	-119,690
		10^{-2}	6.76×10^{-3}	1.57×10^{-2}	109,830
		10^{-3}	5.76×10^{-4}	4.50×10^{-3}	167,830
		10^{-4}	3.52×10^{-5}	2.40×10^{-3}	185,830
		0	1.23×10^{-32}	1.90×10^{-3}	191,740
7	1	10^{-1}	1.94×10^{-4}	3.09×10^{-4}	217,650
		10^{-2}	1.94×10^{-4}	3.09×10^{-4}	217,650
		10^{-3}	1.94×10^{-4}	3.09×10^{-4}	217,650
		10^{-4}	1.09×10^{-5}	7.96×10^{-4}	207,010
		0	0	9.93×10^{-4}	203,710
	10^{-1}	10^{-1}	2.63×10^{-3}	6.90×10^{-3}	152,440
		10^{-2}	2.63×10^{-3}	6.90×10^{-3}	152,440
		10^{-3}	4.46×10^{-4}	2.80×10^{-3}	182,590
		10^{-4}	6.67×10^{-5}	5.45×10^{-4}	211,870
		0	7.70×10^{-34}	9.93×10^{-4}	203,710
	10^{-2}	10^{-1}	7.33×10^{-2}	9.13×10^{-2}	-67,013
		10^{-2}	8.91×10^{-3}	1.59×10^{-2}	109,310
		10^{-3}	1.53×10^{-4}	3.67×10^{-4}	216,080
		10^{-4}	9.77×10^{-5}	4.68×10^{-4}	213,590
		0	7.70×10^{-34}	9.94×10^{-4}	203,710
	10^{-3}	10^{-1}	9.78×10^{-2}	1.19×10^{-1}	-108,950
		10^{-2}	7.49×10^{-3}	1.39×10^{-2}	117,160
		10^{-3}	6.26×10^{-4}	3.20×10^{-3}	178,690
		10^{-4}	7.86×10^{-6}	8.24×10^{-4}	206,510
		0	7.70×10^{-34}	9.93×10^{-4}	203,710
	10^{-4}	10^{-1}	9.85×10^{-2}	1.19×10^{-1}	-110,140
		10^{-2}	7.24×10^{-3}	1.36×10^{-2}	118,640
		10^{-3}	5.01×10^{-4}	2.90×10^{-3}	181,370
		10^{-4}	6.26×10^{-5}	1.60×10^{-3}	195,480
		0	7.7×10^{-34}	9.91×10^{-4}	203,750

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
8	1	10^{-1}	2.93×10^{-2}	1.09×10^{-2}	130,610
		10^{-2}	1.15×10^{-3}	**5.48×10^{-6}**	**237,560**
		10^{-3}	2.10×10^{-4}	2.90×10^{-4}	218,200
		10^{-4}	1.89×10^{-5}	1.30×10^{-3}	199,370
		0	0	9.93×10^{-4}	203,710
	10^{-1}	10^{-1}	2.93×10^{-2}	1.09×10^{-2}	130,610
		10^{-2}	1.88×10^{-3}	1.40×10^{-4}	247,060
		10^{-3}	3.58×10^{-4}	2.50×10^{-3}	184,800
		10^{-4}	1.11×10^{-7}	9.72×10^{-4}	204,040
		0	0	9.93×10^{-4}	203,710
	10^{-2}	10^{-1}	2.93×10^{-2}	1.09×10^{-2}	130,610
		10^{-2}	1.06×10^{-3}	1.50×10^{-3}	196,240
		10^{-3}	1.04×10^{-4}	2.93×10^{-4}	218,110
		10^{-4}	8.92×10^{-5}	3.18×10^{-4}	217,400
		0	0	7.28×10^{-4}	208,240
	10^{-3}	10^{-1}	2.93×10^{-2}	1.09×10^{-2}	130,610
		10^{-2}	7.60×10^{-3}	3.90×10^{-3}	173,010
		10^{-3}	7.05×10^{-4}	1.30×10^{-3}	199,230
		10^{-4}	5.70×10^{-5}	7.15×10^{-4}	208,470
		0	0	5.03×10^{-4}	212,800
	10^{-4}	10^{-1}	2.93×10^{-2}	1.09×10^{-2}	130,610
		10^{-2}	9.63×10^{-3}	4.50×10^{-3}	168,290
		10^{-3}	9.34×10^{-4}	1.30×10^{-3}	199,510
		10^{-4}	9.77×10^{-5}	5.84×10^{-4}	211,050
		0	0	3.17×10^{-4}	217,410
9	1	10^{-1}	6.96×10^{-3}	2.70×10^{-3}	287,110
		10^{-2}	6.96×10^{-3}	2.70×10^{-3}	287,110
		10^{-3}	5.89×10^{-5}	5.68×10^{-4}	211,380
		10^{-4}	5.89×10^{-5}	5.68×10^{-4}	211,380
		0	7.70×10^{-34}	9.93×10^{-4}	203,710

No. of Neuron	Learning Rate	Error Goal	SSE of Training	SSE of Testing	Output
9	10^{-1}	10^{-1}	9.49×10^{-15}	9.93×10^{-4}	203,710
		10^{-2}	9.49×10^{-15}	9.93×10^{-4}	203,710
		10^{-3}	9.49×10^{-15}	9.93×10^{-4}	203,710
		10^{-4}	9.49×10^{-3}	9.93×10^{-4}	203,710
		0	3.77×10^{-32}	9.93×10^{-4}	203,710
	10^{-2}	10^{-1}	9.85×10^{-2}	7.98×10^{-2}	517,630
		10^{-2}	5.17×10^{-3}	1.60×10^{-3}	275,640
		10^{-3}	7.74×10^{-4}	1.36×10^{-5}	231,530
		10^{-4}	8.46×10^{-5}	1.70×10^{-3}	194,510
		0	6.24×10^{-32}	9.93×10^{-4}	203,710
	10^{-3}	10^{-1}	9.77×10^{-2}	7.90×10^{-2}	516,350
		10^{-2}	9.13×10^{-3}	4.10×10^{-3}	299,230
		10^{-3}	5.83×10^{-4}	5.43×10^{-5}	277,850
		10^{-4}	7.80×10^{-6}	8.25×10^{-4}	206,500
		0	7.70×10^{-34}	9.93×10^{-4}	203,710
	10^{-4}	10^{-1}	9.68×10^{-2}	7.82×10^{-1}	514,810
		10^{-2}	8.42×10^{-3}	3.60×10^{-2}	295,450
		10^{-3}	4.52×10^{-4}	1.05×10^{-4}	224,970
		10^{-4}	6.44×10^{-8}	9.77×10^{-4}	203,960
		0	7.70×10^{-34}	9.93×10^{-4}	203,710

Table C.4 - Results of using Training Data (1980-1991:1992) and Testing Data (1981-1992:1993) (cont.)

APPENDIX D

PROCEDURE

FORECASTING OF THE NEW ISSUED BANKNOTES

WITH NEURAL NETWORK

This is an instruction of how to forecast the new issued banknotes.

Requirements

Hardware (minimum specification) : PC with CPU 80486 and RAM 16 MB

Software: MATLAB with SIMULINK program

Data: Data as mentioned earlier in 7.3.5 should be prepared appropriately and accurately.

User: The user should be able to use MATLAB and basic editors such as Notepad, Write. The user should also have some experiences of forecasting the new issued banknotes and some basic understandings of neural network.

Procedure

The following is procedure of how to forecast the new issued banknotes in 1996 with the Bckprop IV approach. It covers how to input, train, and test the data and make the forecast.

1. Start MATLAB

1.1 Double click the icon "MATLAB with SIMULINK".

2. Input data.

2.1 Click File menu and click New command with M-file option.

2.2 Then a blank window appears on the screen. The following listing is for forecasting the new issued banknotes in 1996. See the MATLAB manual [4] for explanations and details.

```
rand('seed',321457);
P = [ 13.4037
13.5415
13.6430
13.7332
13.8035
13.8705
```

```
13.9407
14.0778
14.2601
14.4345
14.5965
14.7345
14.8537
14.9722
15.1061
8
9
9
8.5
9
8.5
5.5
5.5
6.75
7.25
11
8.5
6.25
5
5
0
0
0
0
0
1
1
0
0
0
0
0
0
0
0];
T = [.3231475];
normc(P);
[R,Q] = size(P);
S1 =8;
[S2,Q] = size(T);
[W10,B10] = rands(S1,R);
W20 = rands(S2,S1)*0.5;
B20 = rands(S2,1)*0.5;
max_epoch =500;
err_goal = 0.1;
lr =1;
lr_inc =1.05;
lr_dec = 0.7;
momentum = 0.95;
err_ratio = 1.04;
TP = [disp_freq max_epoch err_goal lr lr_inc lr_dec momentum err_ratio];
[W1,B1,W2,B2,TE,TR] = trainbpx(W10,B10,'tansig',W20,B20,'purelin',P,T,TP);
disp('Hit <RETURN> to see network error!');
pause, disp('')
```

```
ploterr(TR(1,:));
pause
disp('Hit <RETURN> to see the learning rate!');
pause, disp('')
plotlr(TR(2,:));
pause
A1 = tansig(W1*P,B1);
A2 = purelin(W2*A1+B2);
SSE = sumsqr(T-A2);
fprintf('\nFinal Network Values:\n')
fprintf('Maximum epochs: %.0f\n',max_epoch)
fprintf('Error goal: %g\n',err_goal)
fprintf('Training epochs: %.0f\n',TE)
fprintf('Final sum-squared error: %g\n',SSE);
if SSE <= err_goal
disp('Network reached error goal.')
else
disp('Network did not reach error goal.')
end
```

Listing 1 - Script for training

1.3 Save file by clicking File menu and choose Save command.

3. Train data.

3.1 Double click the icon "MATLAB with SIMULINK".

3.2 Click File menu and click Run command.

3.3 Fill in the file name that contains data and training scripts.

3.4 Then click OK button and wait to see the result of training data.

4. Test data or make the forecast.

4.1 Click in the command area.

4.2 Type in data for testing or forecasting and relevant network functions as in Listing 2 or type all in a file and then copy and paste in the command area which is more convenient.

```
P = [13.5415
13.6430
13.7332
 13.8035
 13.8705
```

```
 13.9407
 14.0778
14.2601
14.4345
14.5965
14.7345
14.8573
14.9722
15.1061
15.2493
9
9
8.5
9
8.5
5.5
5.5
6.75
7.25
11
8.5
6.25
5
5
5
0
0
0
0
1
1
0
0
0
0
0
0
0
0
0];
normc(P);
T = [.371620];
A1 = tansig(W1*P+B1);
A2 = purelin(W2*A1+B2);
SSE = sumsqr(T-A2);
A2
SSE
```

Listing 2 - Script for Testing

The values of weight and bias obtained from training process are used with testing data to earn the forecasting output. If defined, it should appear on the screen at the last scene.

VITA

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