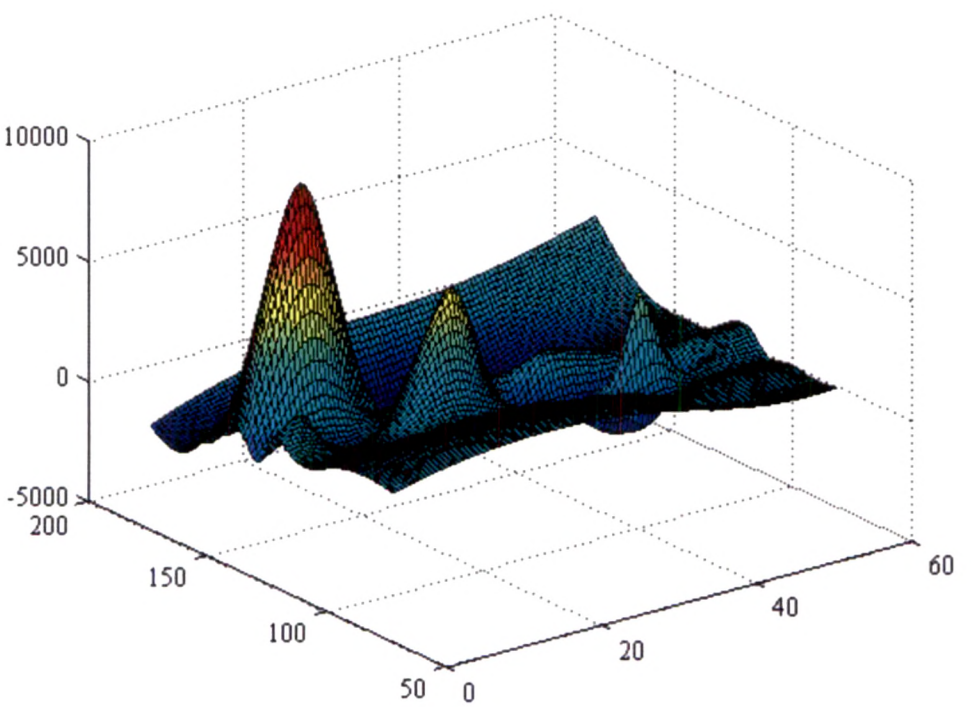
APPENDIX



CHAPTER 3

TABLE: A.3.1 [40]
STANDARD WEEKS ACCORDING TO DATES:

Standard Week No	Dates	Standard Week No	Dates
1	1 - 7January	27	2-8
2	8-14	28	9-15
3	15-21	29	16-22
4	22 - 28	30	23-29
5	29- 4 February	31	30-5August
6	5 - 11	32	6-12
7	12- 18	33	13-19
8	19- 25	34	20-26
9	26- 4 March	35	27-2September
10	5- 11	36	3-9
11	12 - 18	37	10-16
12	19 - 25	38	17-23
13	26 - 1April	39	24-30
14	2 - 8	40	1-7October
15	9 -15	41	8-14
16	16 - 22	42	15-21
17	23 - 29	43	22 28
18	30 - 6 May	44	29 4Novemebr
19	7 - 13	45	5 - 11
20	14 - 20	46	12 - 18
21	21 - 27	47	19 - 25
22	28-3June	48	26 - 2 December
23	4-10	49	3 - 9
24	11-17	50	10 - 16
25	18-24	51	17 - 23
26	25-1July	52	24 - 31

CHAPTER 3

TABLE: A- 3.2
AVERAGED (1982-2004) SOIL TEMPERATURE DATA

Sr. No.	ST5 (MN)	ST10 (MN)	ST20 (MN)	ST5 (AN)	ST10 (AN)	ST20 (AN)
1	15.67	19.23	21.92	33 32	26 44	23 35
2	15 65	19.22	21.83	33 10	26 21	23.27
3	14 93	18 83	21 62	33.75	26 33	23 11
4	15.88	19 52	22.19	35.40	27.11	23 70
5	16 03	19.83	22.70	36.29	27.88	24 10
6	16.32	20 35	23 24	37.56	28 59	24.60
7	16 94	21 00	23.80	38 08	29.22	25 28
8	17.93	21.85	24 74	39.15	30.38	26.20
9	18.8	22.76	25.60	40 90	31.47	27.10
10	20 22	23.92	26.44	42 48	32 83	27 93
11	22 08	25.53	27.92	44.16	34 67	29.51
12	22.69	26.34	28.76	45 36	35.72	30 41
13	24 17	27.50	30.01	46.86	36 89	31.44
14	25.28	28 47	30.91	48.08	38.26	32 45
15	26.20	29 36	31.84	48 86	39.28	33 49
16	27.31	30.18	32.50	49 30	40 13	34 31
17	28.89	31.43	34.22	50 59	41 76	35.80
18	30 09	32.51	35 32	50.93	42 42	36.72
19	31.11	33 39	35.89	50.91	42 66	37 29
20	31.95	33 98	36.46	50.75	42.89	37 79
21	32 39	34.02	36 53	50.77	43 09	38.07
22	32.74	34 42	37.02	50.28	42 92	38.39
23	33.22	34.83	37.18	49.53	42.78	38.53
24	32 04	33.53	35 96	45.57	40.70	37.35
25	30.96	32.17	34.23	43.35	38 58	35 98
26	30 35	31.49	33.57	40.61	37.02	34 96
27	29 28	30 03	31.85	38 35	35.43	33 48
28	28 95	29.76	31 41	37.66	34 90	32.91
29	28.09	29.02	30 56	35.64	33 56	31.97
30	27.59	28.45	29 96	34.82	32.72	31 16
31	27.58	28.35	29.76	34.71	32 63	31.01
32	26 90	27.81	29.15	34 17	32.10	30 33
33	27 35	28.17	29 73	36 51	33.40	31 11
34	27.40	28 25	29 88	36.74	33.72	31 50
35	27 52	28.37	30 00	37.33	33 84	31 75
36	27.71	28.70	30.41	39 17	35.07	32.48
37	28.27	29.21	31.04	40.35	36 50	33.41
38	28.56	29.91	31.79	41 76	37 27	34 18

Cont ..

CHAPTER 3

TABLE: A-3.2 (cont..)

39	28.79	30 17	32.16	42 82	37 81	34 57
40	28 26	29 95	32 18	43 62	38.21	34 72
41	27 35	29.20	31 41	42 72	37 22	33 95
42	25 79	28 09	30.52	42 34	36 65	33 20
43	24 71	27 43	29 86	41.79	35.67	32 27
44	23.49	26 54	28 97	41 24	34.53	31 31
45	22.20	25 42	27 88	39 79	33.15	30 04
46	20 66	24.05	26 68	39 59	32 36	29.02
47	19 99	23 47	26 09	38 28	31 31	28 10
48	18 87	22 68	25 29	36 93	30 08	27.02
49	17.81	21 50	24 17	35 86	29 10	25 96
50	17 26	20 72	23 50	35 00	28 34	25 24
51	16 80	20 30	23.08	34.60	27 74	24.65
52	15 76	19 50	22 35	33 49	26 70	23 76

CHAPTER 3

TABLE A-3.3

MULTIPLICANDS IN HA FOR 3 HARMONICS. $x=\left(\frac{2*\pi}{P}*t\right)$; $t=no.of\ SW.$

Sr.No	cosx	cos2x	cos3x	sinx	sin2x	sin3x	Sr.No	cosx	cos2x	cos3x	sinx	sin2x	sin3x
1	0 9927	0 9709	0 935	0 1205	0 2393	0.3546	27	-0 9927	0 9709	-0.935	-0 1205	0 2393	-0.3546
2	0 9709	0 8855	0 7485	0 2393	0 4647	0.6631	28	-0 9709	0.8855	-0 7485	-0 2393	0 4647	-0 6631
3	0 935	0 7485	0 4647	0.3546	0 6631	0 8855	29	-0.935	0 7485	-0 4647	-0 3546	0 6631	-0 8855
4	0.8855	0 5681	0 1205	0 4647	0 823	0 9927	30	-0 8855	0 5681	-0 1205	-0 4647	0 823	-0 9927
5	0.823	0 3546	-0 2393	0 5681	0 935	0.9709	31	-0 823	0 3546	0 2393	-0 5681	0 935	-0 9709
6	0 7485	0 1205	-0.5681	0 6631	0 9927	0 823	32	-0 7485	0.1205	0 5681	-0 6631	0 9927	-0 823
7	0 6631	-0 1205	-0 823	0 7485	0 9927	0 5681	33	-0 6631	-0 1205	0 823	-0 7485	0 9927	-0 5681
8	0 5681	-0 3546	-0 9709	0 823	0 935	0 2393	34	-0 5681	-0 3546	0 9709	-0 823	0.935	-0 2393
9	0 4647	-0 5681	-0 9927	0 8855	0 823	-0 1205	35	-0.4647	-0 5681	0 9927	-0 8855	0 823	0 1205
10	0 3546	-0.7485	-0 8855	0 935	0 6631	-0 4647	36	-0 3546	-0 7485	0 8855	-0 935	0 6631	0 4647
11	0 2393	-0 8855	-0 6631	0 9709	0 4647	-0 7485	37	-0 2393	-0 8855	0 6631	-0 9709	0 4647	0 7485
12	0 1205	-0 9709	-0 3546	0 9927	0 2393	-0 935	38	-0 1205	-0 9709	0 3546	-0 9927	0 2393	0 935
13	0	-1	0	1	0	-1	39	0	-1	0	-1	0	1
14	-0 1205	-0 9709	0 3546	0 9927	-0 2393	-0.935	40	0 1205	-0 9709	-0 3546	-0.9927	-0 2393	0 935
15	-0 2393	-0 8855	0 6631	0 9709	-0 4647	-0 7485	41	0 2393	-0 8855	-0 6631	-0 9709	-0 4647	0 7485
16	-0 3546	-0 7485	0 8855	0 935	-0 6631	-0 4647	42	0 3546	-0 7485	-0 8855	-0 935	-0.6631	0.4647
17	-0.4647	-0 5681	0 9927	0.8855	-0 823	-0 1205	43	0 4647	-0 5681	-0.9927	-0 8855	-0 823	0 1205
18	-0 5681	-0 3546	0 9709	0 823	-0 935	0 2393	44	0 5681	-0 3546	-0 9709	-0.823	-0 935	-0 2393
19	-0 6631	-0 1205	0 823	0 7485	-0 9927	0 5681	45	0 6631	-0 1205	-0 823	-0 7485	-0 9927	-0.5681
20	-0 7485	0 1205	0 5681	0 6631	-0 9927	0 823	46	0.7485	0.1205	-0 5681	-0.6631	-0 9927	-0 823
21	-0 823	0 3546	0 2393	0 5681	-0 935	0 9709	47	0 823	0 3546	-0.2393	-0 5681	-0 935	-0.9709
22	-0 8855	0 5681	-0 1205	0 4647	-0 823	0 9927	48	0 8855	0 5681	0 1205	-0 4647	-0 823	-0 9927
23	-0 935	0.7485	-0 4647	0.3546	-0 6631	0 8855	49	0 935	0 7485	0 4647	-0 3546	-0 6631	-0 8855
24	-0 9709	0 8855	-0.7485	0 2393	-0 4647	0 6631	50	0 9709	0 8855	0 7485	-0 2393	-0 4647	-0 6631
25	-0 9927	0 9709	-0 935	0 1205	-0 2393	0.3546	51	0 9927	0 9709	0.935	-0 1205	-0 2393	-0 3546
26	-1	1	-1	0	0	0	52	1	1	1	0	0	0

(i)PROGRAMME TO COMPUTE SOIL TEMPERATURES (ST) AT THE DEPTH 10CM (AFTER NOON-2004) BY HARMONIC ANALYSIS.

```
% p = period, data file name = son10, m = number of harmonics,
%sqrt(wwe)= Amplitude and rmse1 = RMSE
%file name
clear all
p=52,
son10;
a=ason10;
as=a(:,22)

k=0;
for i=1:1:20,
 k=k+1;
 aa(:,k)=a(:,i);
end

ast=(mean(aa'))';
m=4;
no=52;
z=((2*pi)/p),

for t=1:1:p;
    w(t,:)=t*z;
end

for i=1:1:m;
  ww(:,i)=i*w;
end

c1x=cos(ww);
s1x=sin(ww);

for i=1:m,
   cc1(:,i)=ast  *c1x(:,i);
   cs1(:,i)=ast .*s1x(:,i);
 end

 dc=2*(sum(cc1))/no,
 dds=2*(sum(cs1))/no;
```

```
for ı=1.m,
   we(·,ı)=(dc(.,i)^2),
   wee(.,ı)=(dds( ,ı)^2),
   wwe=we+wee,
end
 va=var(as);
 va1=2*va;
 vw=(wwe  /(va1))*100;
 g1=sum(vw)

 for i=1:m;
       q( ,i)=ı*z;
 end

t=1 p,
tq=t'*q;
tsq=sın(tq);
tcq=cos(tq);

for ı=1.m,
  eq(·,i)=dds(:,i)*tsq(:,i);
  eeq(·,i)=dc(.,i)*tcq(:,i);
end

wq=eq+eeq,

ry=[mean(as)+sum(wq')]';
[as  ry];
diff1=[as - ry],
d=max(abs([as - ry])),
d1=diff1 .^2,
d11=sum(d1)/52;
rmse1=sqrt(d11)
 i=1:1:p;
plot(i,as,'*',i ,ry')
tıtle('ST (Afternoon) At Depth 10 cm  Actual(*) and Predicted By HA,year-2004 ' )
xlabel('Week Number 1 to 52  of the year 2004');
ylabel('Soıl temperature 0c' );
```

CHAPTER 3

(ii) PROGRAMME TO COMPUTE SOIL TEMPERATURES (ST) AT 20CM (AN-2004) DEPTH BY ANNs

TRAINING PROGRAMME

```
% input is time point 1 to 21 years and output is ST at 20cm depths for 1 to 52
weeks
clear all;
son20;
k=0;

for i=1 1.21;
   k=k+1;
   aa(:,k)=ason20(:,i);
end

b=[ason20(:,22)];

ii=1:1:21;
nd=[ii ./norm(ii)];
p1=[b ./norm(b)],
p3=[nd]
o4=aa  /norm(aa);
s=[p3];
t=[o4];
s1=100;
% the number of hidden neurons
%now the network initializes its weights and biases as;
NNTWARN OFF
[w1,b1,w2,b2]=initff(s,s1,'tansig',t,'tansig');
%the output of the network is given by:
disp_freq=100;
max_epoch=1000000;
err_goal=0.00000000000000001;
lr=0 001;
momentum=0.5,
err_ratio=1.04;
tp=[disp_freq max_epoch err_goal lr momentum err_ratio];
```

CHAPTER 3

```
[w1,b1,w2,b2,epoch,tr]=trainbpm(w1,b1,'tansig',w2,b2,'tansig',s,t,tp);
u=simuff(s,w1,b1,'tansig',w2,b2,'tansig');
uu2=u  *norm(aa),
acc=uu2;
ii1=1:1 52;
SUBPLOT(2,1,2), plot(ii1,(ason20(:,21)),'*',ii1,(acc(:,21)))
title('Actual(*) and Predicted by ANN ST At 20 cm (AN)for 2004' ),
xlabel (' Week number of year 2004');
ylabel('Soil Temperature 0c' );
```

CHAPTER 4

(i)PROGRAMME TO COMPUTE ONE DAY EXTREME RAINFALL BY GUMBEL AND FISHER&TIPETT TYPE-II DISTRIBUTION.

```
% Program to compute extreme rainfall and return period for 58 stations.
% for Gumbel, Fisherr and Tipett type -II
% t = return period, ae = extreme rainfall from the DS
% file name extr1,devi1
clear all;
extr1;
devi1,
ae=ext( ,2),
zr=log(ae),
rx = (ae),
rlnx = (zr),
sd =sdgf(·,1);
tsd=sdgf(·,2);
asd1=(0.78 .*sd),
asd12=(0 78  *tsd),
a=1.0 ./asd1,
ta =1 0 ./asd12;
u=rx-(0.45 .*sd);
tu =rlnx-(0.45 .*tsd);
mrf=ext(:,1),
lgmrf=log(mrf)
q1=mrf-u,
q3=a .*q1,
fx1=exp(-q3),
fx=exp(-fx1);
q2=1-fx;
et=1 ./q2,
prg=(1 ./et)  *100,
% prg is the probability of getting extreme one day rainfall by Gumbel dist.
% et is the predicted return period by Gumbel dist

q11=lgmrf-tu;
q31=ta  *q11;
fx11=exp(-q31),
fx1=exp(-fx11),
q21=1-fx1,
 et1=1 ./q21,
prf=(1 ./et1) .*100,
```

```
% et1 is the predicted return period by fisher &tippet type -IIdist.
% prf is the probability of getting extreme one day rainfall by Fisher&tipett
% type -II dist
% sext and sezt standard error during the computation.
%gxt and fxt are estimated rainfall for the given T by Gumbel and F.T. Type-II
%dist. ,respectively

  for i=1.1·58,
ytg(i) =-log(log(et(i)/(et(i)-1))),
ytf(i) =-log(log(et1(i)/(et1(i)-1)));
aa1(i)=sqrt(1 /a(i));
aa2(i)=sqrt(1 /ta(i));
sext(i)=aa1(i) .*((1 17+(0.966 .*ytg(i))+(1.099 .*(ytg(i) ^2))) /n(i));
sezt(i)=aa2(i) *((1.17+(0.966 *ytf(i))+(1.099 .*(ytf(i) .^2))) ./n(i)),
   end

% t given return period
t=[5 10 15 20 25 50 100];
pq=(t ./(t-1));
yt =-log(log(pq)),

for i=1.1:7;
    ytt(:,i)=yt(i) ./a;
    gxt(·,i)=u+ytt(.,i);
    ytt1(·,i)=yt(i) ./ta;
     fxt1(.,i)=tu+ytt1(.,i),
      fxt=exp(fxt1);
end
```

(ii) PROGRAMME TO COMPUTE RETURN PERIODS (T) BY ANNs

```
   % THIS IS A TRAINING PROGRAMME.
clear all;
rfex18;
i=1.1:20,
nd=[i/(norm(i)+1)],
p1=[ext20c(·,1)]';
p2=[ext20c(.,3)],
p3=[ nd;(p1) /(norm((p1))+1) ]
o4=(p2) ./(norm((p2))+1);
s=[p3];
t=[o4]',
s1=147
% the number of hidden neurons
```

```
%now the network initializes its weights and biases as;
NNTWARN OFF
[w1,b1,w2,b2]=initff(s,s1,'logsig',t,'logsig');
%the output of the network is given by:
disp_freq=100;
max_epoch=1000000;
err_goal=0.001
lr=0.01;
momentum=0.3;
err_ratio=1.04;
tp=[disp_freq max_epoch err_goal lr momentum err_ratio];
[w1,b1,w2,b2,epoch,tr]=trainbpm(w1,b1,'logsig',w2,b2,'logsig',s,t,tp);
u=simuff(s,w1,b1,'logsig',w2,b2,'logsig');
uu2=u*(norm((p2))+1)
[p2'  (uu2)]
k=1:1:20;
plot(k,p2,'*',k, (uu2)');
title('Actual(*) and calculated Return Period for One day Extreme RainfallBy
ANN ' );
xlabel('District:Su(1-5), Bhch(6-12), Panl(13-19),Bod(20),Sabar21-25),Ahemd(26-
29),Kheda(30,32-34), Anand(31), ');
ylabel('Rainfall(mm)' );
```

% THIS IS AN OUTPUT PROGRAMME.

```
%file name rfex18
rfex18;
i1=40:1:58,
nd1=[i1/(norm(i1)+1)];
p11=[ext19(:,1)]';
p21=[ext19(:,3)];
 p31=[ nd1, (p11) ./(norm((p11))+1) ]
 s=[p31];
u1=simuff(s,w1,b1,'logsig',w2,b2,'logsig');
u1u2=u1*(norm(p21)+1)
[p21'  (u1u2)]
kk=1 1:19
plot(kk,p21,'*',kk, (u1u2'));
title('Actual(*) and Predicted Return Period for One day Extreme Rainfall By
ANN ' );
xlabel(' District Ahmedabad, Kheda, Anand, Deesa, Kachha, Rajkot and
Saurastra');
ylabel('Rainfall(mm)' );
```

(iii) PROGRAMME TO COMPUTE WEEKLY PROBABILITIES BY GAMMA DISTRIBUTION.

```
%program for gamma distribution
% mlnx,mx-means, rf is wekly rainfall
%'probability of rf is  pr1x
% file name rn
  clear all;
zero;
   rn;
   n=21;
   %x is in foot
   x=rn1'  /(25 4);

   x1=mean(x);
   mx=mean(x1),
   x2=mean(log(x1)),
   mlnx=mean(x2);
    y=log(mx)-mlnx;
   y1=4 .*y;
   y2=y1 ./3,
   y3=sqrt(1+y2);
    aen1=(1+y3) ./y1;
   aey1=aen1 ./mx,
    esn1=(3  *aen1)/n;
    en1=aen1-esn1;
    ey1=en1 ./mx;
   gn=gamma(en1);
   %x2=0.5inch
   x2=1.27;
    ds=gammainc(x2,en1)
   pd=zr ./48;
   pq=1-pd,
   pq1=pq*(ds)';
    pdd=(pd+pq1) ,
prb1=(1-pdd)  *100

 c=lt(x,1 27),
   cc=(sum(c) ./48),
acp=(1-cc) .*100,
acpp=acp';
df=acpp-(prb1)
```

```
i=22·1·42 ;

subplot(2,1,1),plot(i,prb1,'-*',i,acpp,'-mo')
xlabel('Difference of Actual and GDM  PBs at 1 27" RF'),
ylabel('Probability (%)');
title('Comparision Between Actual(o 48 yrs) and GDM (*)Weekly PBs at 1 27"
RF')
subplot(2,1,2),plot(i,abs(df),'r+')
 xlabel('SW from 22 to 42');
 ylabel('Difference of PBs(%)');
```

THIS IS APPROGRAMME TO COMPUTE PBs BY ANN

```
file name:nnraingm
 clear all,
rsprob;
p1=[pcb( ,1)]';
p2=[pcb(·,2)]',
i=10;
nd=[0 1 ;0.2]'
 p3=[ nd] ,
 o4=[p1  /norm(p1),p2 ./norm(p2)]';
 t1=[p1 ,p2]';
s=[p3];
t=[o4];
s1=140
% the number of hidden neurons
%now the network initializes its weights and biases as;
NNTWARN OFF
[w1,b1,w2,b2]=initff(s,s1,'tansig',t,'tansig');
%the output of the network is given by.
disp_freq=100;
max_epoch=1000000;
err_goal=0 00000000000000000001
lr=0.001;
momentum=0.5;
err_ratio=1.04;
tp=[disp_freq max_epoch err_goal lr momentum err_ratio],
[w1,b1,w2,b2,epoch,tr]=trainbpm(w1,b1,'tansig',w2,b2,'tansig',s,t,tp),
u=simuff(s,w1,b1,'tansig',w2,b2,'tansig'),
uu21=u(:,1) .*norm(p1),
uu22=u(:,2)  *norm(p2);
aq=[uu21 uu22]
```

```
k=1 1 21,
plot(k,(t1),'*',k,aq),
title('Actual(*) and calculated By ANN Weekly Rainfall from standard week 31 to
41' );
xlabel('31 to 41');
ylabel('weekly Rainfall(mm)' );
```

4) PROGRAMME TO COMPUTE AND COMPARE THE WEEKLY PROB. BY GMD AND ANNS

```
% inputs are RF at 10 and 20 % probability level
%output is RF at 30 and 40 % probability level

clear all;
rsprob,
p1=[pcb(:,1)]';
p2=[pcb(.,2)]',
i=10,
nd=[0 1 ;0 2]'
 p3=[ nd] ;
 o4=[p1 ./norm(p1);p2  /norm(p2)]';
 t1=[p1 ,p2]',
s=[p3],
t=[o4];
s1=140
% the number of hidden neurons
%now the network initializes its weights and biases as;
 [w1,b1,w2,b2]=initff(s,s1,'tansig',t,'tansig'),
%the output of the network is given by:
disp_freq=100;
max_epoch=1000000;
err_goal=0.00000000000000000001
lr=0 001;
momentum=0.5;
err_ratio=1 04;
tp=[disp_freq max_epoch err_goal lr momentum err_ratio];
[w1,b1,w2,b2,epoch,tr]=trainbpm(w1,b1,'tansig',w2,b2,'tansig',s,t,tp);
u=simuff(s,w1,b1,'tansig',w2,b2,'tansig'),
uu21=u(·,1) .*norm(p1);
uu22=u(·,2)  *norm(p2);
aq=[uu21 uu22]
```

```
k=1·1.21;
plot(k,(t1),'*',k,aq);
title('Actual(*) and calculated By ANN Weekly Rainfall from standard week 31 to
41' ),
xlabel('31 to 41'),
ylabel('Probabılıty' ),
%x2=[0.1 0.2 0.5 1 2 3 5 7 10 15 20 25],
p4=[pcb(·,9)]';
p5=[pcb(.,10)]',
nd1=[0.1,0.15]
 p31=[ nd1] ;
oo4=[p4;p5]',
 s1=[p31]',
u1=sımuff(s1,w1,b1,'tansig',w2,b2,'tansıg'),
uu211=u1(:,1) .*norm(p4);
uu221=u1(:,2)  *norm(p5);
aq1=[uu211 uu221]

uu21=u1  *norm(p1)
[oo4  aq1]
k=1.1.21;
plot(k,(oo4),'*',k,aq1);
title('GDM(*) and Predicted Probabilıty By ANN For Weekly RF 10.0" and 15.0"'
);
xlabel('Number of Week   22to 42'),
ylabel('Probabılity' );
```

CHAPTER 5

1) PREDICTION OF ANNUAL RAINFALL BY DFS AND ANN

i) PROGRAMME TO COMPUTE Z= (X^2 +Y^2) BY DFS

```
%file name exsump
%  z =f(x,y)= z= (x^2 +y^2 ): to find out the coefficients,  x=[1:2:125]; and
 % y =[5.2·130];

clear all,
qax=[1·2 125];
x=qax/max(qax),
qay=[5·2 130];
y=qay/max(qay);
for ı=1.1.63,
  ze(i)=[(x(i)^2 +y(i)^2)];
end
for ı=1:1.63,
  zze(ı)=[(qax(i)^2 +qay(i)^2)],
end
z=ze/max(ze),
no =63,
m= 4  ;
n= 4;
iw=1/4*ones(no),
 iw1=iw(1, ),
for i=1·1·m,
  for j=1.1 n,
  s(i, )=i*x;
  s1(j,:)=j*y,
  cx=cos(s);
  cy=cos(s1);
  sx=sın(s),
  sy=sin(s1),
end
end
re=[cx/2,cy/2];
re1=[sx/2,sy/2],
yy=[cy;sy];
xx=[cx;sx];
for ıı=1.no,
```

```
   p=0,
  for jj=1:2*m,
     for kk=1:2*n;
      p=p+1;
 r3(p,ii)=xx(jj,ii)*yy(kk,ii);
end
  end
end
de =[ iw1;re;re1; r3]' ;
 u=pinv(de);
 o=u*z';
 op=de*o,
 [zze' op*max(zze)]

 i=1:1:no;
 plot(i,zze,'*', i,op*max(zze))
 xlabel('1.2:125  m=16 and n=16  ')
 ylabel('5·2:130')
 title('calculated z= (x² +y² )')
```

ii) THIS IS AN OUT PUT PROGRAMME TO COMPUTE THE VALUES FROM THE DERIVED COEFFICIENT MATRIX.

z =(x² +y²); where x =[1:2:150] and y=[5:2:154];

```
qax1=[1:2.150];
x1=qax1/max(qax1);
qay1=[5:2:154];
y1=qay1/max(qay1);
no1= 75;

for i=1:1:no1,
  z12(i)=[ (qax1(i)^2 +qay1(i)^2 )];
end

iw=1/4*ones(no1);
 iw1=iw(1, );

for i=1:1:m;
  for j=1.1.n;
  s12(i,:)=i*x1,
  s11(j,:)=j*y1;
  cx1=cos(s12);
```

```
  cy1=cos(s11),
  sx1=sin(s12),
  sy1=sin(s11),
end
end
re1=[cx1/2;cy1/2];
re11=[sx1/2;sy1/2];
yy1=[cy1;sy1],
xx1=[cx1,sx1],

for ii=1:no1;
    p=0;
  for jj=1 2*m,
     for kk=1·2*n,
      p=p+1,
 r31(p,ii)=xx1(jj,ii)*yy1(kk,ii),
end
  end
end

de1 =[ iw1,re1,re11, r31]' ;

  op1=de1*o,
  op12=op1*max(z12)

 [z12'  op12]
 i=1.1.no1;
 plot(i,z12,'*', i,op12)
 xlabel('1.2·150  m=4 and n=4 file exsump')
 ylabel('5:2 154')
 title('z= (x^2 +y^2 )')
```

iii) THIS IS A PROGRAMME TO COMPUTE THE VALUES OF z=(-3y/(x^2 +y^2+1)).

```
 % Here, x=[1.2 125], y=[5:2:130]
clear all;
qax=[1.2.125];
 x=qax/max(qax),
qay=[5.2·130],
 y=qay/max(qay);

 for i=1:1.63,
```

```
   au(i)= 3*(y(i))
    aw1(ı)=[-au(i)];
    aw2(i)=(( x(i)^2+ y(i)^2)+1);
  zze1(i)=aw1(i) ./aw2(i);
end

z=zze1/max(zze1);
no =63;
m= 20 ;
n= 20;
iw=1/4*ones(no);
ıw1=iw(1,:);

for i=1:1 m;
  for j=1:1:n;
  s(i,:)=i*x;
  s1(j,:)=j*y;
  cx=cos(s),
  cy=cos(s1);
  sx=sin(s);
  sy=sın(s1);
end
end

re=[cx/2;cy/2];
re1=[sx/2,sy/2];
yy=[cy;sy];
xx=[cx;sx];
for ii=1:no;
    p=0;

  for jj=1:2*m;
     for kk=1:2*n;
      p=p+1;
 r3(p,ii)=xx(jj,ii)*yy(kk,ıi);
end
  end
end

de =[ iw1;re;re1, r3]' ,
 u=pinv(de);
 o=u*z';
 op=de*o;
```

```
opp=op*max(zze1)
 [zze1' opp]

i=1:2:125,
plot(i,zze1,'*', ı,opp)
xlabel('1:2 125  m=20 and n=20 file exsump123 ')
ylabel('5.2 130')
tıtle('calculated z=(-3y/(x^2 +y^2+1)))')
```

iv) THIS IS A PROGRAMME TO PREDICT THE ARF BY DFS:-

```
clear all,
maymax592003r;
ra592003,
ra582002;
no=45,
no=P,
cn=pı/no;
a1=myr03  /1,
qax=(a1 .*cn)';
b1=ora2 ./20;
qay=(b1 .*cn)';

ac=ira3 .;
z1ze=(ac)';
m=((p-1)/2)+2
n=12

iw=1/4*ones(no);
 iw1=iw(1, );
for i=1.1.m,
  for j=1:1:n;
  s(i,:)=i*qax;
  s1(j,.)=j*qay,
  cx=cos(s);
  cy=cos(s1),
  sx=sin(s),
  sy=sın(s1),
end
end
re=[cx/2;cy/2],
re1=[sx/2;sy/2];
yy=[cy;sy],
xx=[cx,sx],
```

```
for ii=1·no;
    p=0;
  for ıj=1 2*m;
     for kk=1 2*n,
      p=p+1;
 r3(p,ii)=xx(jj,ii)*yy(kk,ıi);
end
  end
end
de =[ iw1,re;re1,r3]' ;
 u=pınv(de),
 o=u*z1ze';

maymax602004r,
ra602004;
ra592003,

a1b=myr04 ./1;
qax1=(a1b .*cn)',
b1b=ira3 ./20;
qay1=(b1b  *cn)';
%ac1 output file
ac1=ra04 ,
iw=1/4*ones(no),
 iw1=ıw(1,:),
for i=1:1·m,
  for j=1 1.n;
  s(i,·)=i*qax1;
  s1(ȷ,.)=j*qay1;
  cx=cos(s);
  cy=cos(s1);
  sx=sin(s),
  sy=sın(s1);
end
end
re=[cx/2,cy/2];
re1=[sx/2;sy/2],
yy=[cy;sy];
xx=[cx;sx],
for ıı=1 no;
    p=0,
  for jj=1:2*m;
     for kk=1:2*n;
```

```
      p=p+1;
 r3(p,ii)=xx(jj,ii)*yy(kk,ii),
end
  end
end
de1 =[ iw1;re;re1,r3]' ;

  opq1=(de1*o);
  opt=(opq1),
 [ac1 opq1]

 i=1960:1·2004,
 plot(ı,opq1,'*', i,ac1)
 xlabel('Year  m=10 and n=11  ')
 ylabel('Annual Raınfall (mm)')
 tıtle('Predicted (*) Annual Raınfall By DFS')
```

v) THIS IS A PROGRAMME TO COMPUTE THE ARF BY ANNs

```
% inputs are PARF and MAT
clear all;
ra582000,
ra592001,
maymax592001r,

i=1·1:43;
nd=[i/norm(ı)];
p1=[myr01]',
ı1=ra11 ./1,
 rnn=[i1  /norm(ra11)]';

 p3=[nd;rnn  , (p1  /norm(p1)) ]
%nd' p1  /norm(p1)  ra11 ./norm(ra11)],
o4=ra1  /norm(ra1),
s=[p3];
t=[o4]';
s1=147
% the number of hidden neurons
%now the network initialızes its weights and bıases as;
NNTWARN OFF
[w1,b1,w2,b2]=ınıtff(s,s1,'tansig',t,'tansıg'),
%the output of the network ıs given by:
disp_freq=100,
```

```
max_epoch=1000000;
err_goal=0.0007
lr=0 001,
momentum=0 3,
err_ratio=1.04,
tp=[disp_freq max_epoch err_goal lr momentum err_ratio];
[w1,b1,w2,b2,epoch,tr]=trainbpm(w1,b1,'tansig',w2,b2,'tansig',s,t,tp);
u=simuff(s,w1,b1,'tansig',w2,b2,'tansig');
ux=u' .*norm(ra1);
ux1=ux;
[ra1 ux1]

k=1959:1:2001
plot(k,ra1,k,ux,'*');
title('Actual(*) and calculated By ANN Annual Rainfall from 1959 to 2001' ),
xlabel('1959 to 2005');
ylabel('Rainfall(mm)' );
```

CHAPTER 6

1) PREDICTION OF HOURLY TEMPERATURES BY LOGAN MODEL, DFS AND ANNs

```
%this progrmme is to calculate Hrly AT julian days 87,102,113 2006
clear all;
templog
a=2 69,
b=1.423;
c=-1 725;

%tx=28.0,
%tn=15.8,
%tnn=06,
i=5 1 18,
k2=8;
k3=9;
k1=7
 jan1=ju86(i,.);
 tx=jan1(:,k2),
 tn=jan1( ,k3),
ju=113,
tr=i;
%latt=23.580c
lat=0.4;
jd=((ju-77))/365
jd1=sin((2*pi)*jd);
d1=0.4014*jd1,
d2=tan(d1);
latr=((tan(lat))*d1)^2;
tm1=sqrt([1-latr])
tm2=[-(tan(lat))*d2];
tm=tm1/tm2,
u=(atan(tm)),
u1=u/(pi),
y=abs(24*u1);
tb=(12-(y/2))+c,

m=0 21;
m1=pi .*m;
y1=y+2*a;
ys=sin(m1  /y1);
```

```
thr1=(tx-tn),
thr2=(thr1 .*ys');
thrd=thr2+tn,

tr1=19.1·24;

ts=thrd(14, )
z=24-y;
te=(12+(y/2));
n=tr1+(24+te);
tnt=ju86(tr1,k3),
as=ts-tnt;
ab=b .*n;
az=ab /z;
axp=exp(-az),
asxp=(as) .*axp'
tpn1=(tnt+asxp) ;

tr2=1:1:4;

nn=(24+te)+tr2,
tnn=ju86(tr2,k3);

asn=ts-tnn;
abn=b .*nn;
azn=abn/z;
axpn=exp(-azn);
asxpn=(asn) *axpn'
tpnn=(tnn+asxpn) ,

act1=[ju86(.,k1)]
 prd1=[ tpnn,thrd ;tpn1;]
op=[act1 prd1]
av=(ju86(·,k2)+ju86( ,k3))/2;
ı=1.1 24,
plot(ı,op(.,1),'-o',i,op( ,2),'g-*',ı,av,'-r+')
xlabel(' 113 Julian Day , Hour· 1 to 24')
ylabel('Air Temperature 0c')
title('Actual,Predicted(*) And ((maxAT+mınAT)/2, +) Aır temperature Of 113 JD
By Logan Model')
rmse=sqrt(sum((prd1-act1) ^2)/24)
me=mean(act1),
prer=(rmse/me)*100
```

```
rmse1=sqrt(sum((av-act1)  ^2)/24)
me=mean(act1),
prer1=(rmse1/me)*100
```

Programme to compute HAT by DFS

```
clear all;
templog
inp=[ju86( ,2) ju86(:,3)],
dd=1·1:24;
ra1=ju86(.,1);
no=24;
cn=(1*pı/no),
nx=ju86(:,2);
ny=ju86(·,3);
cn1=nx  *1
qax=(cn1  /100)';
cn2=ny .*1;
qay=(cn2  /(100))';
ac=ra1 .*1;
z1ze=(ac ./100)';
m=1
n=1
iw=1/4*ones(no);
 iw1=ıw(1,.);

for ı=1:1:m;
  for j=1:1:n;
  s(ı,:)=ı*qax,
  s1(j, )=j*qay,
  cx=cos(s),
  cy=cos(s1),
  sx=sin(s);
  sy=sin(s1);
end
end

re=[cx/2;cy/2],
re1=[sx/2,sy/2],
yy=[cy;sy];
xx=[cx;sx],
```

```
for ii=1·no,
    p=0;
for jj=1:2*m,
     for kk=1.2*n;
      p=p+1,
 r3(p,ii)=xx(jj,ii)*yy(kk,ii);
end
end
end

de =[ iw1;re;re1;r3]' ;
 u=pinv(de);
 o=u*z1ze',
 opq=(de*o) .*100;
 [ra1 opq]
```

out put programme:

```
ju87t;
inp1=[ju87(:,2) ju87(:,3)],
nx1=ju87(:,2),
ccn1=nx1 .*1
qax1=(ccn1 ./(100))';
ny1=ju87(:,3),
b1b=ny1 .*1;
qay1=(b1b ./(100))',
ac1=ju87( ,1) ;
iw=1/4*ones(no);
 iw1=iw(1,:);

for ı=1·1:m,
for j=1.1.n;
  s(i,:)=i*qax1;
  s1(j,:)=j*qay1;
  cx=cos(s);
  cy=cos(s1),
  sx=sın(s);
  sy=sin(s1),
end
end

re=[cx/2;cy/2];
```

```
re1=[sx/2,sy/2],
yy=[cy,sy],
xx=[cx;sx];

for ii=1 no;
   p=0,
for jj=1·2*m;
for kk=1:2*n,
      p=p+1;
r3(p,ii)=xx(jj,ii)*yy(kk,ii),
end
end
end

de1 =[ iw1,re;re1,r3]' ,
pq1=(de1*o) *100,
[ac1 opq1]
```

2) PROGRAMME TO COMPUTE RMSE & PAE AND SUBPLOT GRAPH

```
templog, jan1=ju101(·,1) ./1;
at=jan1,
 pt=u' ;
rmse=sqrt(sum((pt-at) ^2)/24)
me=mean(at);
prer=(rmse/me)*100
 jan2=ju86(:,4) /1,
at1=jan2,
 pt1=u1'        ,
rmse1=sqrt(sum((pt1-at1) ^2)/24)
me1=mean(at);
prer1=(rmse/me)*100
ı=1 1·24,
subplot(2,1,1), plot(ı,at,i,u',i,u','-+')
title('Calculated(+) And Predicted (*) HAT By ANN  Using Predictors MaxAT &
MınAT')
ylabel('Air Temparature (0c)')
subplot(2,1,2), plot(i,at1,ı,pt1,ı,pt1,'-*')
xlabel('102 ju day/11 aprıl 2006 · Hour- 1 to 24')
ylabel('Air Temparature (0c)')
```

TABLE: A.6.1
JULIAN DATE CALENDAR
(http://www.fs.fed.us/raws/book/julian.shtml)

Julian Date Calendar (PERPETUAL)													
Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	235	255	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23

24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029		088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

Julian Date Calendar
(FOR LEAP YEARS ONLY)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	061	092	122	153	183	214	245	275	306	336	1
2	002	033	062	093	123	154	184	215	246	276	307	337	2
3	003	034	063	094	124	155	185	216	247	277	308	338	3
4	004	035	064	095	125	156	186	217	248	278	309	339	4
5	005	036	065	096	126	157	187	218	249	279	310	340	5
6	006	037	066	097	127	158	188	219	250	280	311	341	6
7	007	038	067	098	128	159	189	220	251	281	312	342	7
8	008	039	068	099	129	160	190	221	252	282	313	343	8
9	009	040	069	100	130	161	191	222	253	283	314	344	9
10	010	041	070	101	131	162	192	223	254	284	315	345	10
11	011	042	071	102	132	163	193	224	255	285	316	346	11
12	012	043	072	103	133	164	194	225	256	286	317	347	12
13	013	044	073	104	134	165	195	226	257	287	318	348	13
14	014	045	074	105	135	166	196	227	258	288	319	349	14
15	015	046	075	106	136	167	197	228	259	289	320	350	15
16	016	047	076	107	137	168	198	229	260	290	321	351	16
17	017	048	077	108	138	169	199	230	261	291	322	352	17

18	018	049	078	109	139	170	200	231	262	292	323	353	18
19	019	050	079	110	140	171	201	232	263	293	324	354	19
20	020	051	080	111	141	172	202	233	264	294	325	355	20
21	021	052	081	112	142	173	203	234	265	295	326	356	21
22	022	053	082	113	143	174	204	235	266	296	327	357	22
23	023	054	083	114	144	175	205	236	267	297	328	358	23
24	024	055	084	115	145	176	206	237	268	298	329	359	24
25	025	056	085	116	146	177	207	238	269	299	330	360	25
26	026	057	086	117	147	178	208	239	270	300	331	361	26
27	027	058	087	118	148	179	209	240	271	301	332	362	27
28	028	059	088	119	149	180	210	241	272	302	333	363	28
29	029	060	089	120	150	181	211	242	273	303	334	364	29
30	030		090	121	151	182	212	243	274	304	335	365	30
31	031		091		152		213	244		305		366	31