LAMPIRAN

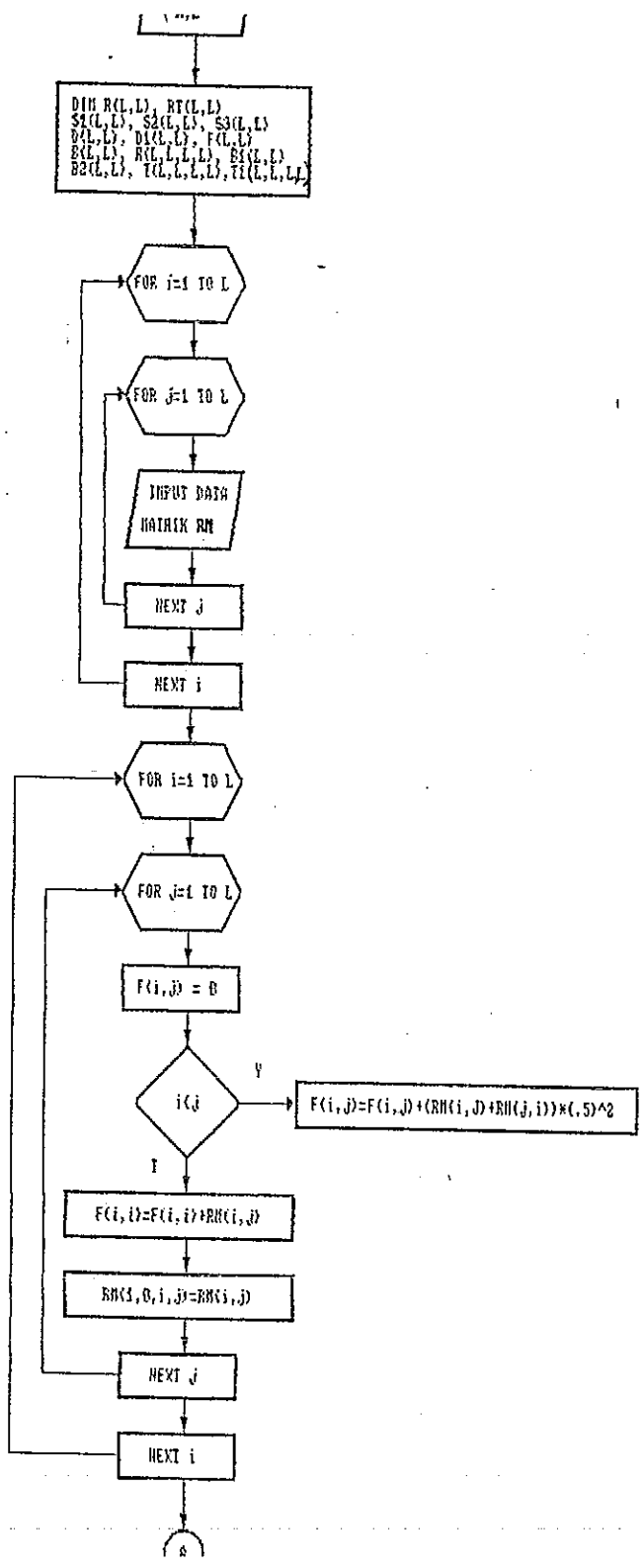
menggunakan program komputer untuk menghitung koefisien inbreeding dan koefisien kinship dari sejumlah individu, diperlukan beberapa masukan sebagai berikut :

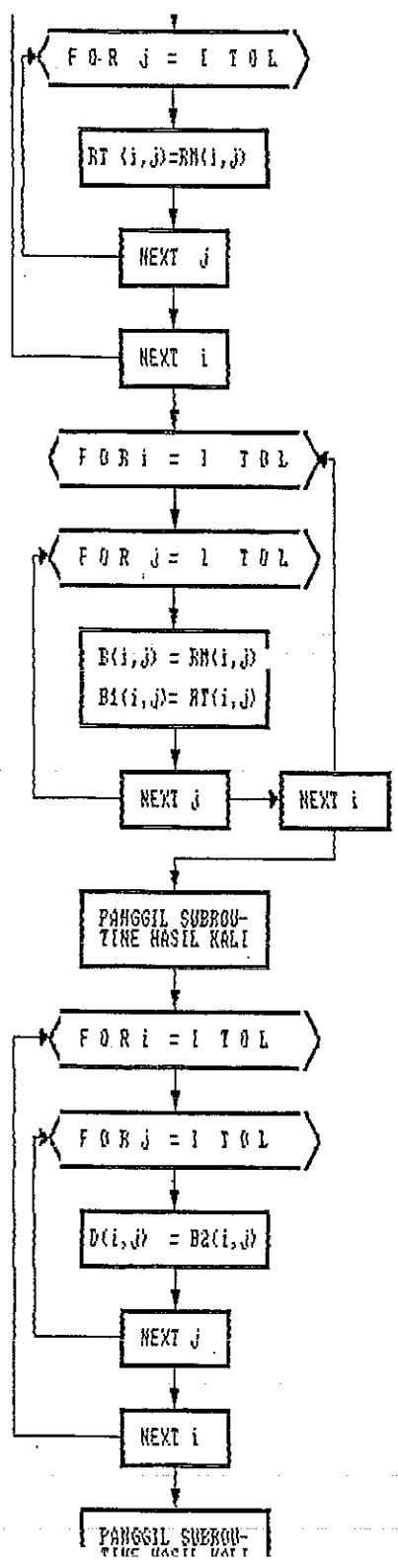
L - menyatakan jumlah individu dalam suatu silsilah.

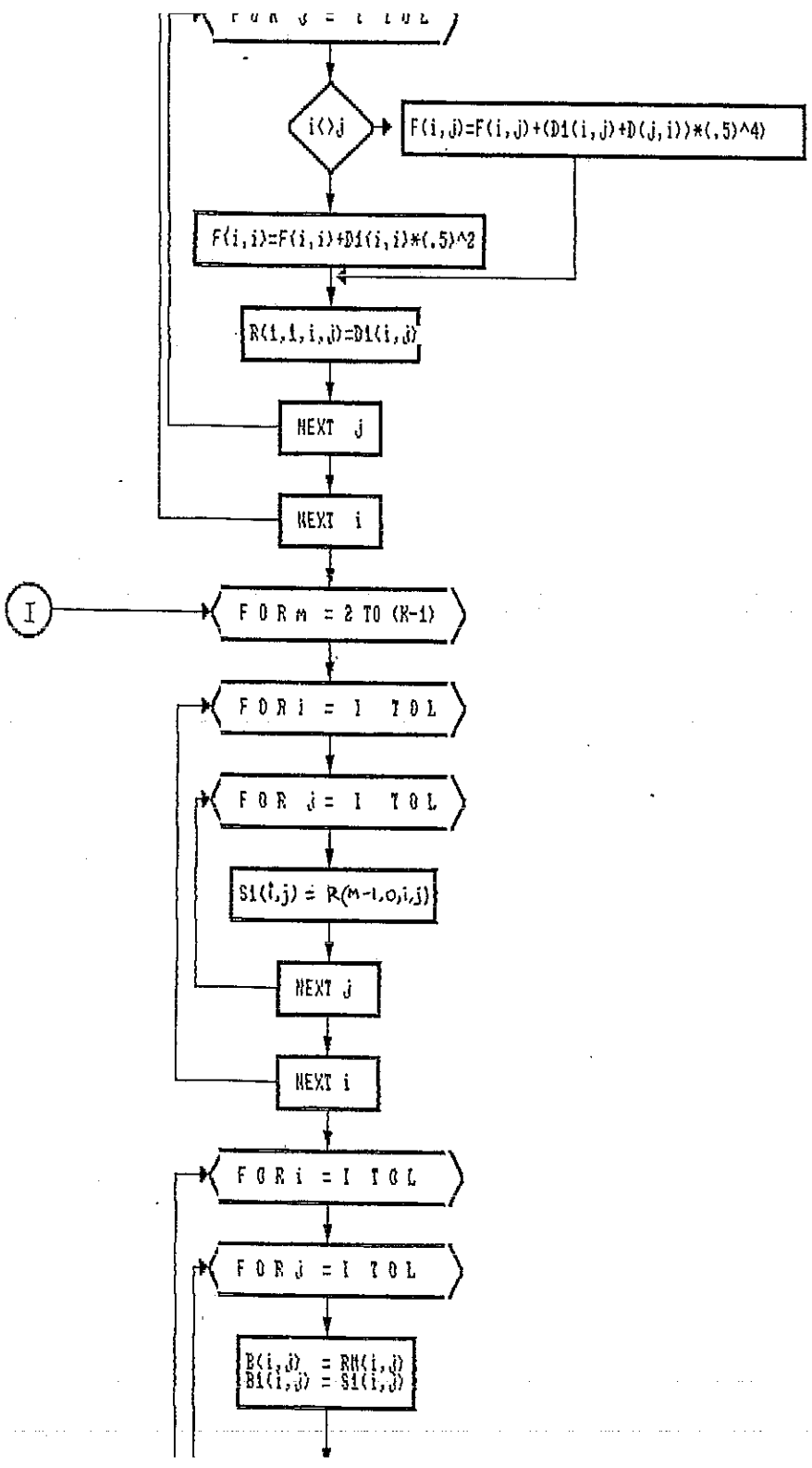
K - menyatakan banyaknya tingkatan generasi dari suatu silsilah.

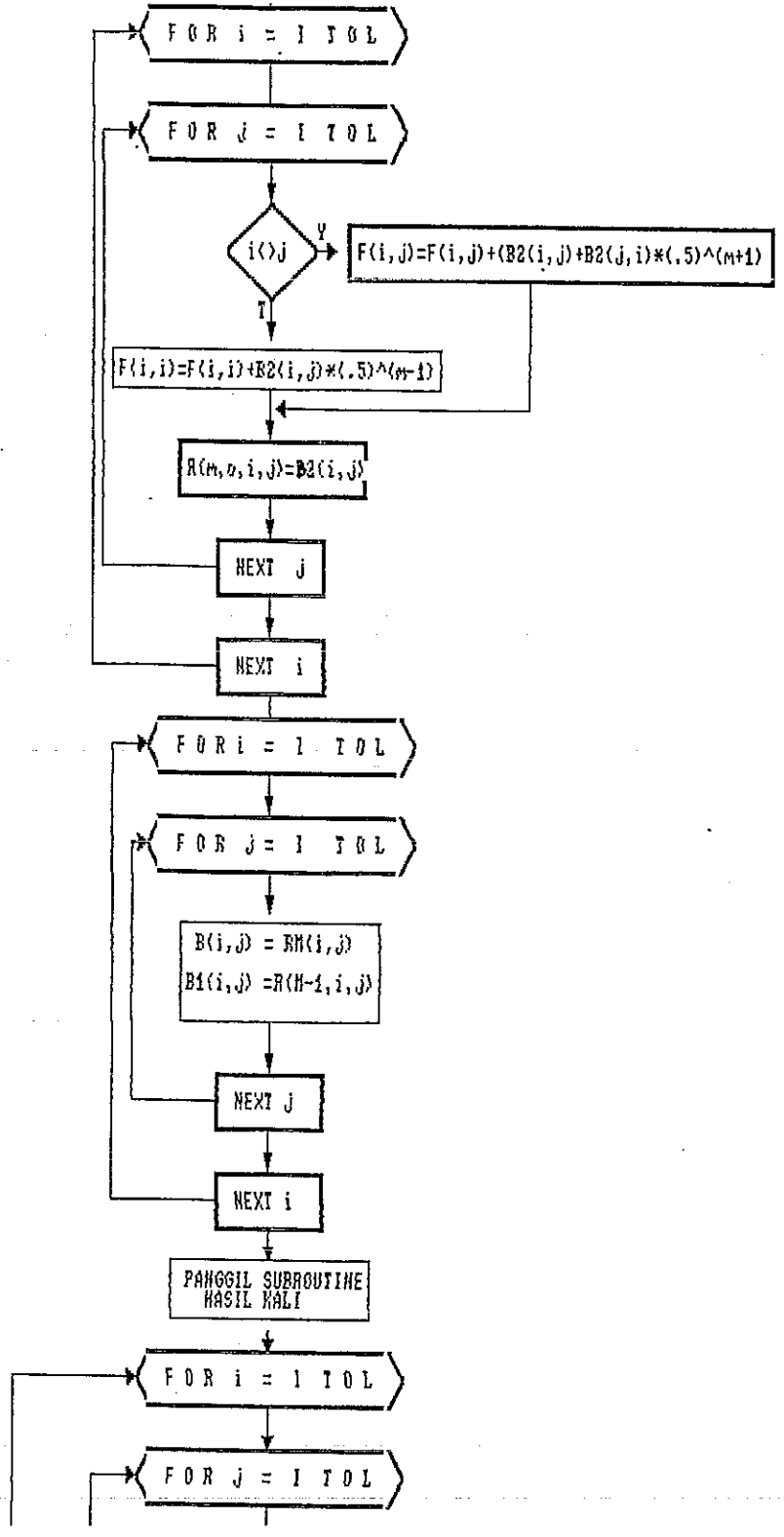
RM - matrik relasi dari graph berarah.

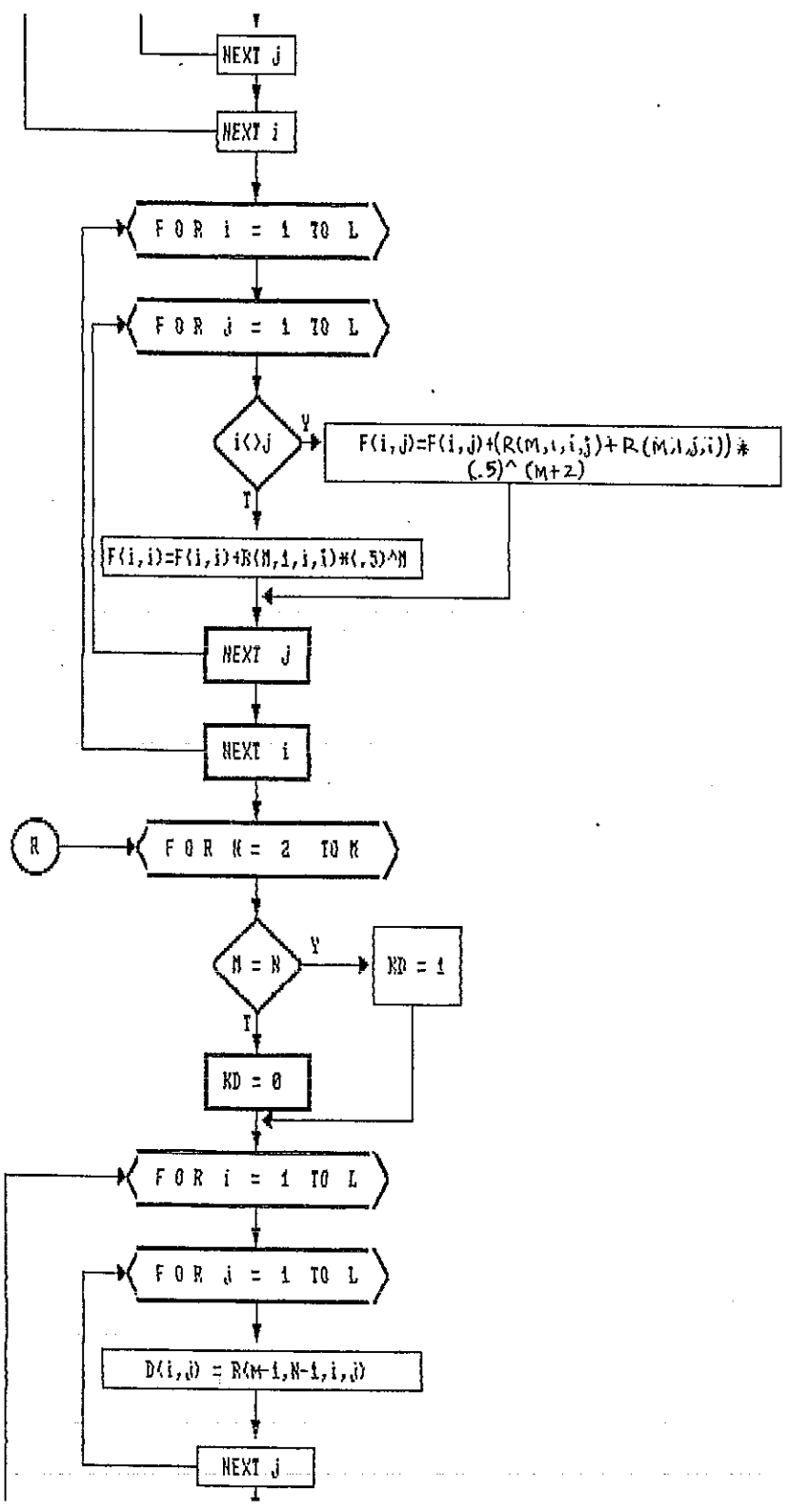
Pada halaman berikut, penulis sajikan diagram alur dan program komputernya.

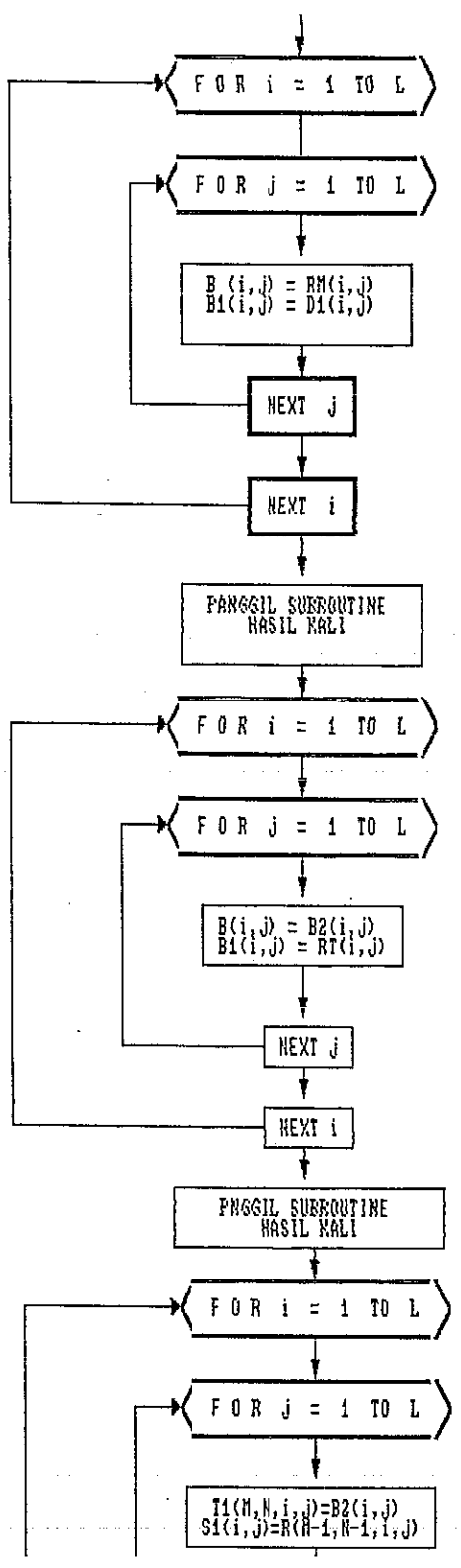

DIM R(L,L), RT(L,L)
S1(L,L), S2(L,L), S3(L,L)
B(L,L), D1(L,L), F(L,L)
B(L,L), R(L,L,L,L), B1(L,L)
B2(L,L), T(L,L,L,L),T1(L,L,L,L)
FOR i=1 TO L
FOR j=1 TO L
INPUT DATA
MATRIK RM
NEXT j
NEXT i
FOR i=1 TO L
FOR j=1 TO L
F(i,j) = 0
i<j
Y
F(i,j)=F(i,j)+(RM(i,J)+RM(j,i))*(.5)^2
T
F(i,i)=F(i,i)+RM(i,j)
RM(1,0,i,j)=RM(i,j)
NEXT j
NEXT i

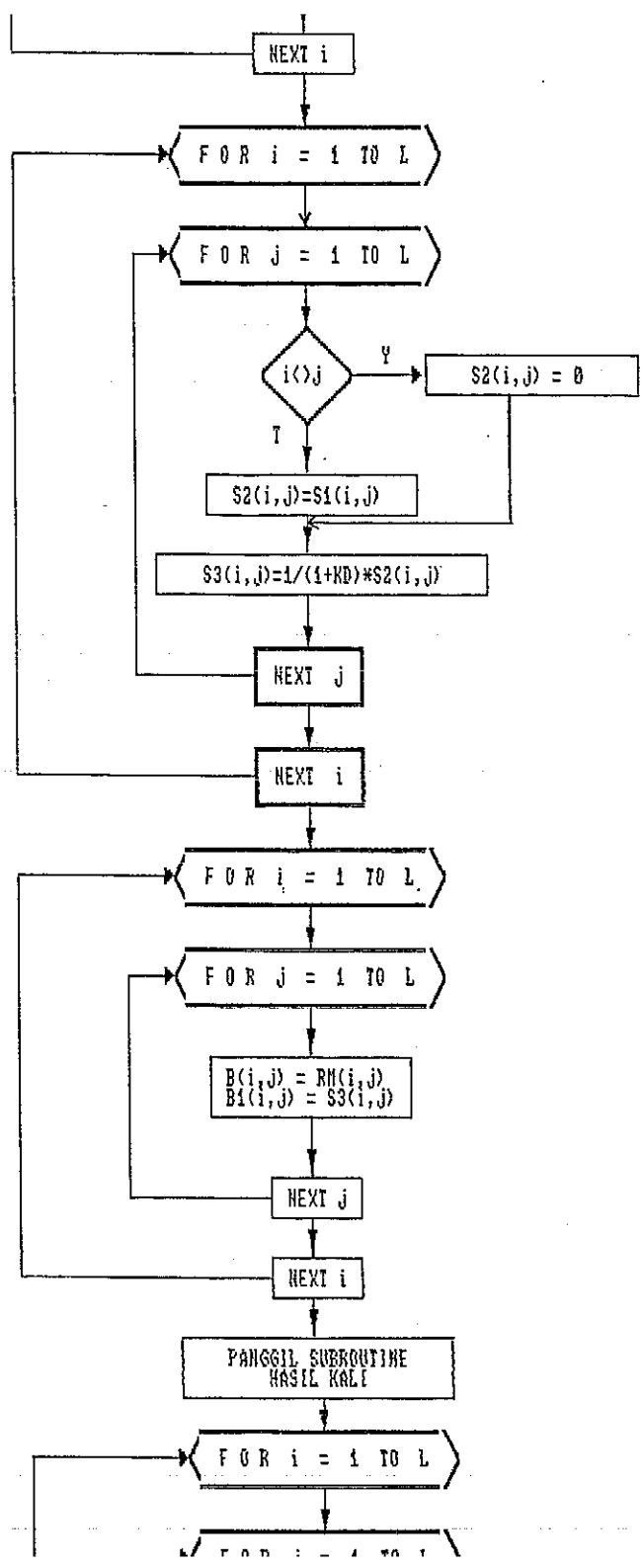

FOR j = 1 TO L
RT (i,j)=RN(i,j)
NEXT j
NEXT i
FOR i = 1 TO L
FOR j = 1 TO L
B(i,j) = RN(i,j)
B1(i,j)= RT(i,j)
NEXT j
NEXT i
PANGGIL SUBROU-
TINE HASIL KALI
FOR i = 1 TO L
FOR j = 1 TO L
D(i,j) = B2(i,j)
NEXT j
NEXT i
PANGGIL SUBROU-

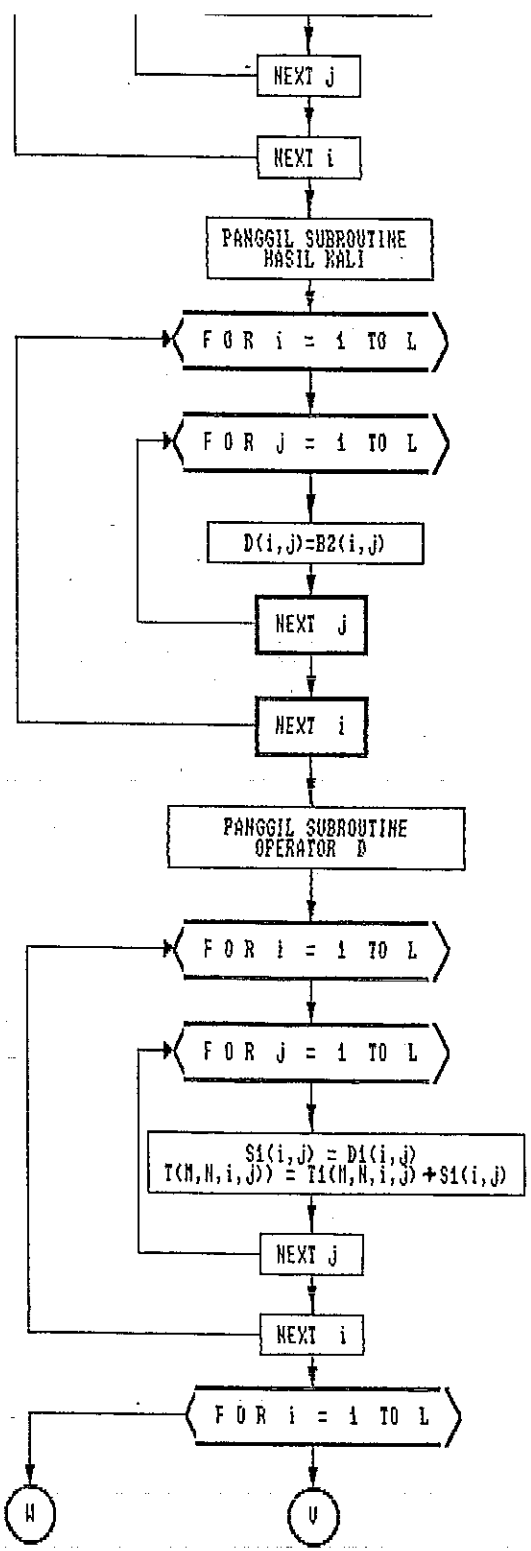

FOR j = 1 TO L
i<>j
F(i,j)=F(i,j)+(D1(i,j)+D(j,i))*(.5)^4)
F(i,i)=F(i,i)+D1(i,i)*(.5)^2
R(1,1,i,j)=D1(i,j)
NEXT j
NEXT i
I
FOR m = 2 TO (K-1)
FOR i = 1 TO L
FOR j = 1 TO L
S1(i,j) = R(m-1,o,i,j)
NEXT j
NEXT i
FOR i = 1 TO L
FOR j = 1 TO L
B(i,j) = RH(i,j)
B1(i,j) = S1(i,j)

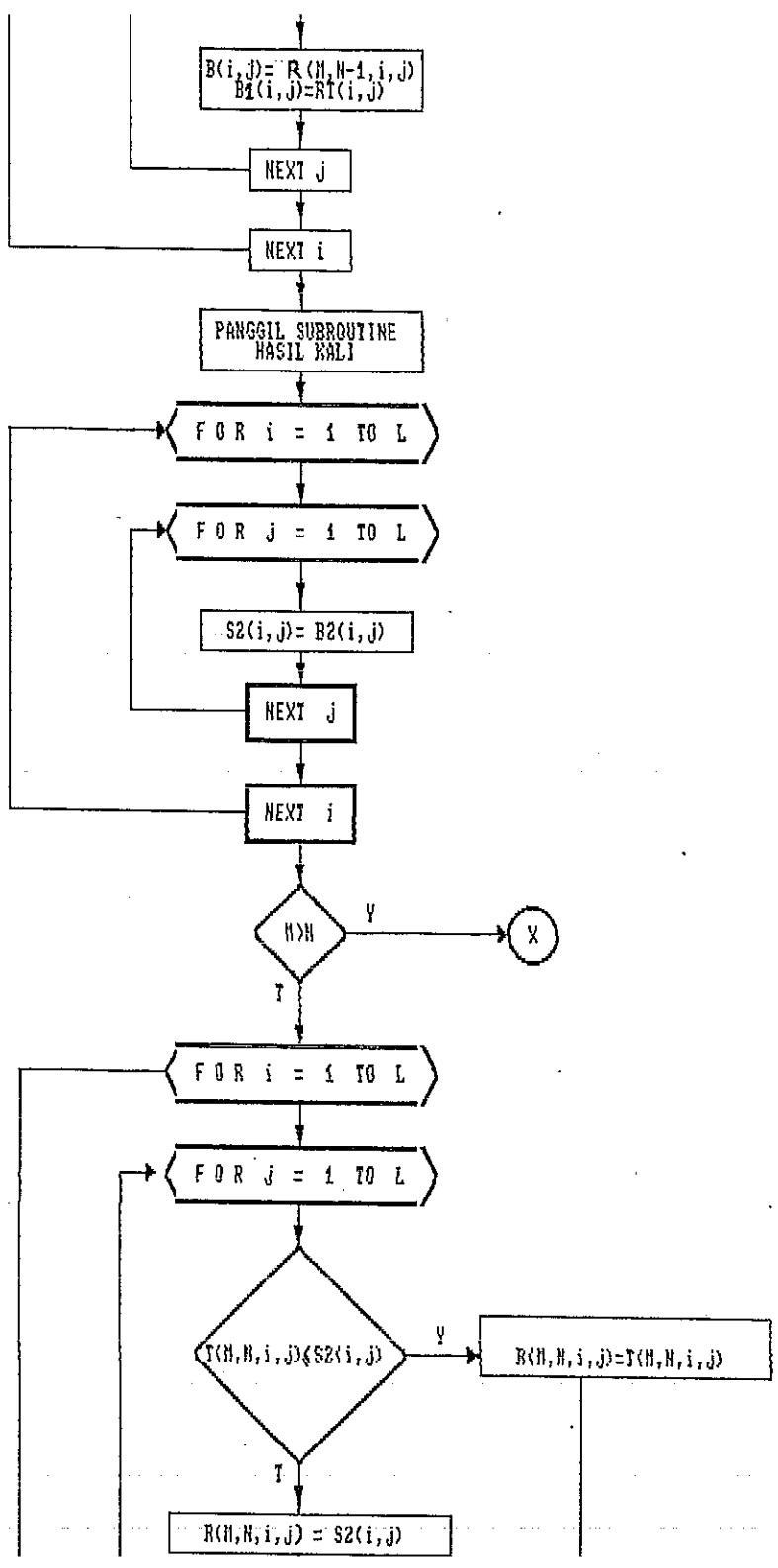

FOR i = 1 TOL
FOR j = 1 TOL
i<>j
Y
F(i,j)=F(i,j)+(B2(i,j)+B2(j,i)*(.5)^(m+1)
T
F(i,i)=F(i,i)+B2(i,j)*(.5)^(m-1)
R(m,o,i,j)=B2(i,j)
NEXT j
NEXT i
FORi = 1 TOL
FOR j = 1 TOL
B(i,j) = RM(i,j)
B1(i,j) =R(M-1,i,j)
NEXT j
NEXT i
PANGGIL SUBROUTINE
HASIL KALI
FOR i = 1 TOL
FOR j = 1 TOL

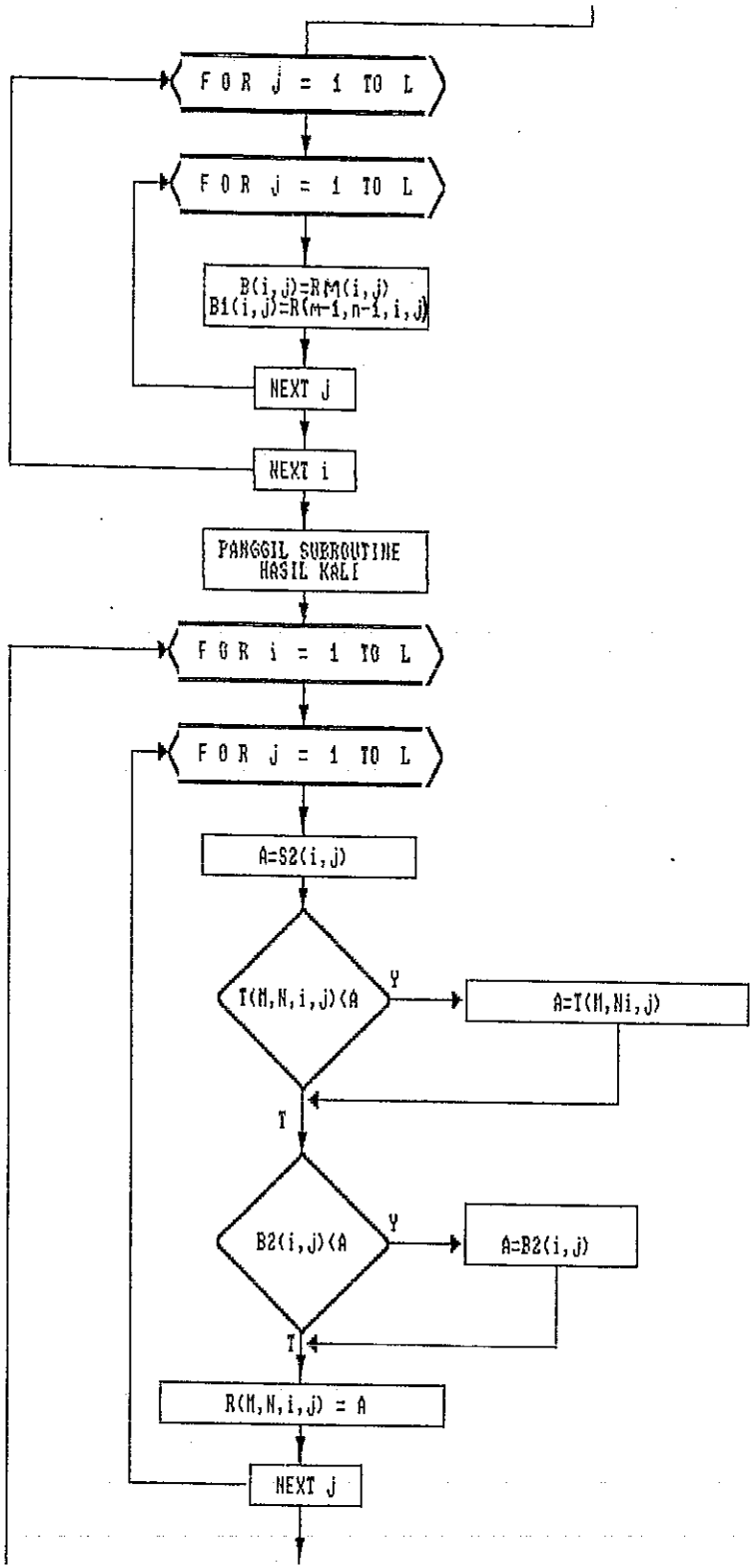

NEXT j
NEXT i
F O R i = 1 TO L
F O R j = 1 TO L
i<>j
Y
F(i,j)=F(i,j)+(R(M,1,i,j)+R(M,1,j,i))*(.5)^(M+2)
T
F(i,i)=F(i,i)+R(M,1,i,i)*(.5)^M
NEXT j
NEXT i
R
F O R M = 2 TO K
M = N
Y
KD = 1
T
KD = 0
F O R i = 1 TO L
F O R j = 1 TO L
D(i,j) = R(M-1,N-1,i,j)
NEXT j

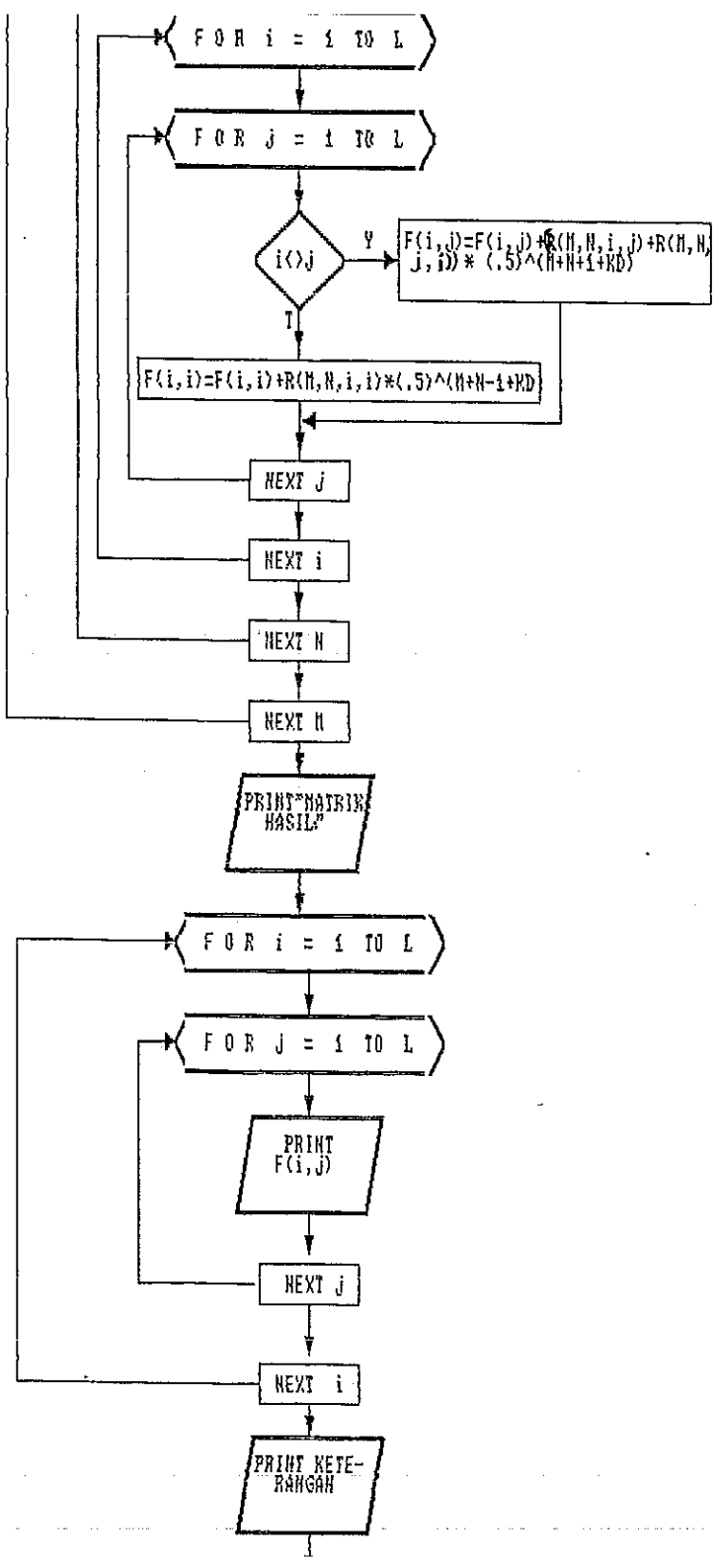

FOR i = 1 TO L
FOR j = 1 TO L
B (i,j) = RM(i,j)
B1(i,J) = D1(i,J)
NEXT j
NEXT i
PANGGIL SUBROUTINE
HASIL KALI
FOR i = 1 TO L
FOR j = 1 TO L
B(i,j) = B2(i,j)
B1(i,J) = RT(i,J)
NEXT j
NEXT i
PANGGIL SUBROUTINE
HASIL KALI
FOR i = 1 TO L
FOR j = 1 TO L
I1(M,N,i,j)=B2(i,j)
S1(i,J)=R(M-1,N-1,i,J)


NEXT i
FOR i = 1 TO L
FOR j = 1 TO L
i<>j
Y
S2(i,j) = 0
T
S2(i,j)=S1(i,j)
S3(i,j)=1/(1+KD)*S2(i,j)
NEXT j
NEXT i
FOR i = 1 TO L
FOR j = 1 TO L
B(i,j) = RM(i,j)
B1(i,j) = S3(i,j)
NEXT j
NEXT i
PANGGIL SUBROUTINE
HASIL KALI
FOR i = 1 TO L


NEXT j
NEXT i
PANGGIL SUBROUTINE HASIL KALI
F O R i = 1 TO L
F O R j = 1 TO L
D(i,j)=B2(i,j)
NEXT j
NEXT i
PANGGIL SUBROUTINE OPERATOR D
F O R i = 1 TO L
F O R j = 1 TO L
S1(i,j) = D1(i,j)
T(M,N,i,j)) = T1(M,N,i,j) +S1(i,j)
NEXT j
NEXT i
F O R i = 1 TO L
W
V


B(i,j)= R(M,N-1,i,j)
B1(i,j)=R1(i,j)
NEXT j
NEXT i
PANGGIL SUBROUTINE HASIL KALI
F O R i = 1 TO L
F O R j = 1 TO L
S2(i,j)= B2(i,j)
NEXT j
NEXT i
M>N
Y
X
T
F O R i = 1 TO L
F O R j = 1 TO L
T(M,N,i,j)<S2(i,j)
Y
R(M,N,i,j)=T(M,N,i,j)
T
R(M,N,i,j) = S2(i,j)


FOR j = 1 TO L
FOR j = 1 TO L
B(i,j)=R(M(i,j)
B1(i,j)=R(m-1,n-1,i,j)
NEXT j
NEXT i
PANGGIL SUBROUTINE
HASIL KALI
FOR i = 1 TO L
FOR j = 1 TO L
A=S2(i,j)
T(M,N,i,j)<A
Y
A=T(M,Ni,j)
T
B2(i,j)<A
Y
A=B2(i,j)
T
R(M,N,i,j) = A
NEXT j


FOR i = 1 TO L
FOR j = 1 TO L
i<>j
Y
F(i,j)=F(i,j)+R(M,N,i,j)+R(M,N,j,i)) * (.5)^(M+N+1+KD)
T
F(i,i)=F(i,i)+R(M,N,i,i)*(.5)^(M+N-1+KD)
NEXT j
NEXT i
NEXT N
NEXT M
PRINT"MATRIK HASIL"
FOR i = 1 TO L
FOR j = 1 TO L
PRINT F(i,j)
NEXT j
NEXT i
PRINT KETE-RANGAN

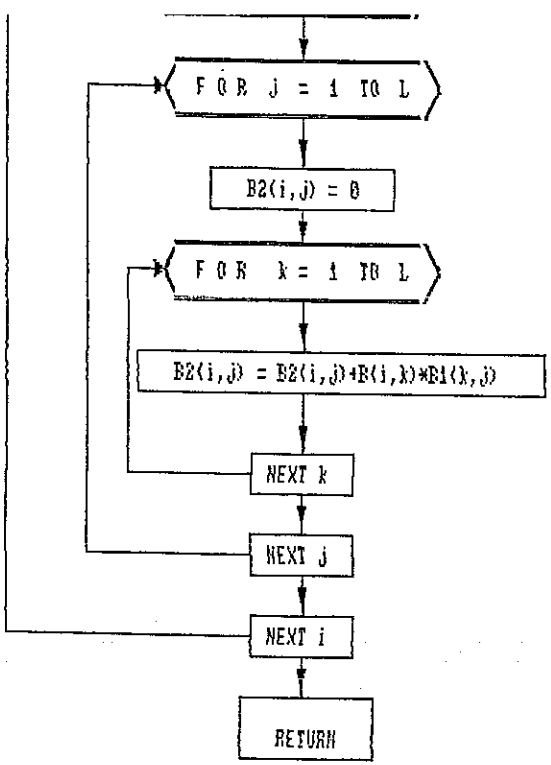
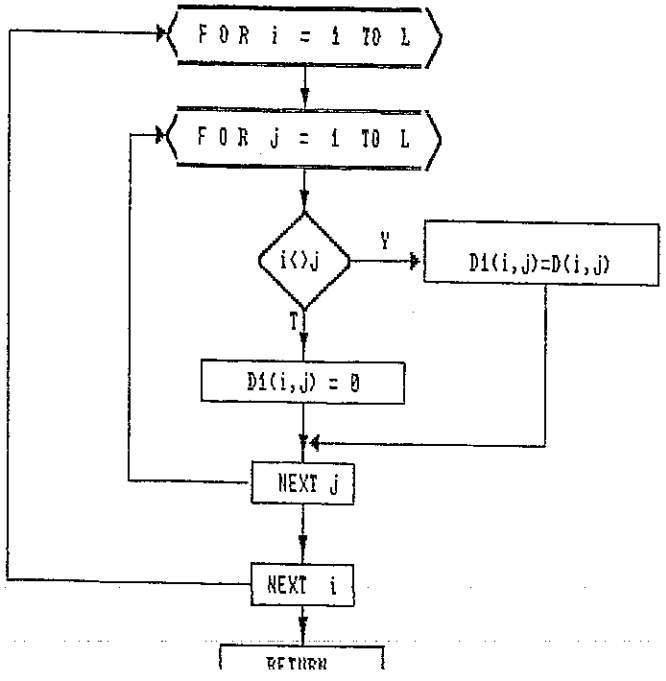


DIAGRAM ALUR SUBROUTINE OPERATOR B :



```
20  REM * Program menghitung koefisien inbreeding dan koe- *
30  REM * fisien kinship                                    *
40  REM ******************************************************
50  CLS:KEY OFF
60  INPUT " Jumlah  individu :";L
70  INPUT " Jumlah tingkatan generasi :";K
80  DIM RM(L,L),RT(L,L),S1(L,L),S2(L,L),S3(L,L),F(L,L)
90  DIM B(L,L),B1(L,L),B2(L,L),D(L,L),D1(L,L),R(L,L,L,L)
100 DIM T(L,L,L,L),T1(L,L,L,L)
110 REM * memasukkan data dari matrik RM *
120 FOR I=1 TO L
130   FOR J=1 TO L
140     PRINT "RM(";I;",";J;")=" ; : INPUT RM(I,J)
150  NEXT J,I
160 FOR I=1 TO L
170  FOR J=1 TO L
180    F(I,J)=0
190    IF I<>J THEN GOTO 220
200     F(I,I)=F(I,J)+(RM(I,J)
210     GOTO 230
220     F(1,J)=F(I,J)+(RM(I,J)+RM(J,I)) * (.5)^2
230    R(1,0,I,J)=RM(I,J)
240  NEXT J,I
250 REM *  mencari matrik transpose *
260 FOR I=1 TO L
270   FOR J=1 TO L
280    RT(I,J)=RM(J,I)
290  NEXT J,I
300 REM * menentukan  unsur-unsur dari matrik 1R1 *
310 FOR I=1 TO L
320   FOR J=1 TO L
330    B(I,J)=RM(I,J)
340    B1(I,J)=RT(I,J)
```

```
370  FOR I=1 TO L
380    FOR J=1 TO L
390     D(I,J)=B2(I,J)
400   NEXT J,I
410  GOSUB 2060
420  REM  * menentukan koefisien inbreeding dan kinship *
430  FOR =1 TO L
440   FOR J=1 TO L
450     IF I<>J THEN GOTO 480
460     F(I,I)=F(I,I)+D1(I,I) * (.5)^2
470     GOTO 490
480     F(I,J)=F(I,J)+(D1(I,J)+D1(J,I)) * (.5)^4
490    R(1,1,I,J)=D1(I,J)
500   NEXT J,I
510  REM * menentukan unsur-unsur dari matrix mR1 *
520  FOR M=2 TO K-1
530.   FOR I=1 TO L
540     FOR J=1 TO L
550      S1(I,J)=R(M-1,0,I,J)
560    NEXT J,I
570    FOR I=1 TO L
580     FOR J=1 TO L
590      B(I,J)=RM(I,J)
600      B1(I,J)=S1(I,J)
610    NEXT J,I
620   GOSUB 1980
630   FOR I=1 TO L
640    FOR J=1 TO L
650     IF I<>J THEN GOTO 680
660      F(I,I)=F(I,I)+B2(I,J) * (.5)^(M-1)
670      GOTO 690
680      F(I,J)=F(I,J)+(B2(I,J)+B2(J,I)) * (.5)^(M+1)
690     R(M,0,I,J)=B2(I,J)
700   NEXT J,I
```

```
740       B1(I,J)=R(M-1,1,I,J)
750     NEXT J,I
760   GOSUB 1980
770     FOR I=1 TO L
780       FOR J=1 TO L
790         R(M,1,I,J)=B2(I,J)
800       NEXT J,I
810     FOR I=1 TO L
820       FOR J=1 TO L
830         IF I<>J THEN GOTO 860
840         F(I,I)=F(I,I)+R(M,1,I,I) * (.5)^M
850           GOTO 870
860         F(I,J)=F(I,J)+(R(M,1,I,J)+R(M,1,J,I))*(.5)^(M+2)
870       NEXT J,I
880   REM * menentukan unsur-unsur dari matrik mRn *
890       FOR N=2 TO  M
900         IF M=N THEN KD=1 ELSE KD=0
910         FOR I=1 TO L
920           FOR J=1 TO L
930             D(I,J)=R(M-1,N-1,I,J)
940       NEXT J,I
950     GOSUB 2060
960     FOR I=1 TO L
970       FOR J=1 TO L
980       B(I,J)=RM(I,J)
990         B1(I,J)=D1(I,J)
1000      NEXT J,I
1010      GOSUB 1980
1020      FOR I=1 TO L
1030        FOR J=1 TO L
1040          B(I,J)=B2(I,J)
1050          B1(I,J)=RT(I,J)
```

```
1080  FOR I=1 TO L
1090   FOR J=1 TO L
1100      T1(M,N,I,J)=B2(I,J)
1110      S1(I,J)=R(M-1,N-1,I,J)
1120   NEXT J,I
1130  FOR I=1 TO L
1140   FOR J=1 TO L
1150    IF I<>J THEN GOTO 1180
1160      S2(I,J)=S1(I,J)
1170      GOTO 1190
1180      S2(I,J)=0
1190     S3(I,J)=1/(1+KD) * S2(I,J)
1200      NEXT J,I
1210    FOR I=1 TO L
1220     FOR J=1 TO  L
1230      B(I,J)=RM(I,J)
1240      B1(I,J)=S3(I,J)
1250   NEXT J,I
1260   GOSUB 1980
1270   FOR I=1 TO L
1280    FOR J=1 TO L
1290      B(I,J)=B2(I,J)
1300      B1(I,J)=RT(I,J)
1310    NEXT J,I
1320   GOSUB 1980
1330   FOR I=1 TO L
1340    FOR J=1 TO L
1350      D(I,J)=B2(I,J)
1360    NEXT J,I
1370   GOSUB 2060
1380   FOR I=1 TO L
1390     FOR J=1 TO L
1400      S1(I,J)=D1(I,J)
1410      T(M,N,I,J)=T1(M,N,I,J)+S1(I,J)
1420   NEXT J,I
1430   FOR I=1 TO L
```

```
1460       B1(I,J)=RT(I,J)
1470     NEXT J,I
1480  GOSUB 1980
1490  FOR I=1 TO L
1500   FOR J=1 TO L
1510      S2(I,J)=B2(I,J)
1520   NEXT J,1
1530  IF M>N THEN GOTO 1620
1540   FOR I=1 TO L
1550    FOR J=1 TO L
1560     IF T(M,N,I,J)<=S2(I,J) THEN GOTO 1590
1570      R(M,N,I,J)=S2(I,J)
1580      GOTO 1600
1590      R(M,N,I,J)=T(M,N,I,J)
1600    NEXT J,I
1610   GOTO 1760
1620    FOR I=1 TO L
1630     FOR J=1 TO L
1640      B(I,J)=RM(I,J)
1650      B1(I,J)=R(M-1,N,I,J)
1660     NEXT J,I
1670   GOSUB 1980
1680  FOR I=1 TO L
1690   FOR J=1 TO L
1700      A=S2(I,J)
1710      IF T(M,N,I,J)<A THEN A=T(M,N,I,J)
1730      IF B2(I,J)<A THEN A=B2(I,J)
1740      R(M,N,I,J)=A
1750    NEXT J,I
1760   FOR I=1 TO L
1770    FOR J=1 TO L
1780      IF I<>J THEN GOTO 1810
1790      F(I,I)=F(I,I)+R(M,N,I,I) * (.55)^(M+N-1+KD)
1800      GOTO 1820
1810      F(I,J)=F(I,J)+(R(M,N,I,J)+R(M,N,J,I))*(.5)^(M+N+1+KD)
1820    NEXT J,I
```

```
1850 PRINT :PRINT "MATRIK HASIL :"
1860 PRINT
1870 FOR I=1 TO L
1880   FOR J=1 TO L
1890       PRINT USING "###.####";F(I,J);
1900    NEXT J
1910    PRINT
1900   NEXT I
1910   PRINT
1920 NEXT I
1930 PRINT
1940 PRINT " Elemen (I,J) menyatakan koefisien kinship antara individu I "
1950 PRINT " dan individu J, sedangkan elemen (I,I) menyatakan koefisien "
1960 PRINT " inbreeding dari individu I. "
1970 END
1980 REM * subroutine mengalikan dua buah matrix yang berukuran n x n *
1990 FOR I=1 TO L
2000  FOR J=1 TO L
2010    B2(I,J)=0
2020    FOR K=1 TO L
2030      B2(I,J)=B2(I,J)+B(I,K) * B1(K,J)
2040 NEXT K,J,I
2050 RETURN
2060 REM * subroutine menggunakan operator D *
2070 FOR I=I TO L
2080   FOR J=1 TO L
2090      IF I<>J THEN GOTO 2120
2100      D1(I,J)=0
2110      GOTO 2130
2120      D1(I,J)D=(I,J)
2130   NEXT J,I
2140 RETURN
```