This program FIT10.FOR finds the best chi-square fit to the yearly AIDS incidence estimates from 1979 to 1990. This Fortran program was coded by Herb Hethcote and Jim Van Ark. It is used in Chapter 10 of the book, "MODELING HIV TRANSMISSION AND AIDS IN THE UNITED STATES", to obtain fits to AIDS data for homosexual men and for IVDUs in aggregations of 15 subregions. The AIDS incidence data are given in vector form with names such as NE2TAB.T.M corresponding to the notation in Table 10.1. After the AIDS data vector is entered, the parameter values are specified by the user (see Tables 3.1 and 6.1). For each parameter value, the user can accept the default value or choose a new value. Then the user chooses two dates: the reduction starting year and month and the reduction stopping year. The nonlinear minimization program BCONF from IMSL is used to obtain the values of PAS, RDN and ETA which give the best chi-square fit to the AIDS incidence data. For each set of parameter values, BCONF calls the subroutine EPI, which simulates the HIV epidemic and AIDS cases using the difference equations corresponding to Figure 3.1. For each set of two dates, the program displays the values of the three parameter values and the chi-square value corresponding to the best fit. By trying different combinations of the two dates, the user can minimize the chi-square value.

```
INTEGER N
PARAMETER (N = 3)
DIMENSION G(20),WRH(19),IPARAM(7),RPARAM(7),P(N),PGUESS(N),
$ PSscale(N),PLB(N),PUB(N),DAIDS(1975:1990)
COMMON FH,R,QV,QA,XMU,DLT,PHI,THT,N,G,QH,WRH,NYSTRT,NMSTRT,
$ IYEAR,IMONTH,LYEAR,NYSTOP,DAIDS
EXTERNAL EPI,U4INF,UMACH,BCONF
CHARACTER*10 FILEO

THE AIDS INCIDENCE FILE NAME IS ENTERED AND THE DATA IS STORED IN DAIDS
PRINT*, 'INPUT A FILENAME (IN SINGLE QUOTES) FOR AIDS INCIDENCE'
PRINT*, 'BE SURE TO INCLUDE THE .M EXTENSION'
READ*, FILEO
2 DO 1 I = 1975,1978
   DAIDS(I) = 0.
   OPEN(UNIT=9,FILE=FILEO,STATUS='OLD')
   READ(9,*) (DAIDS(I),I=1979,1990)
   PRINT*, 'DATA IN THE AIDS VECTOR STARTING IN 1975 IS',DAIDS

   FLAG = 0
   CAIDS = 0
   DO 4 I = 1975,1990
      PRCUM = CAIDS
      CAIDS = CAIDS + DAIDS(I)
      IF (FLAG.EQ.0.AND.CAIDS.GE.40) THEN
         IYEAR = I - 7
         IMONTH = INT(12*(40-PRCUM)/(CAIDS-PRCUM)+.5)
      END IF
```


FLAG = 1
ENDIF
4 CONTINUE
NSIZE = INT(7.0*CAIDS/10000+.5)*10000
C IO = 6 CORRESPONDS TO MONITOR OUTPUT
IO = 6
C STANDARD PARAMETERS WILL BE LISTED HERE.
C LATER THE USER WILL BE ASKED IF HE/SHE WANTS TO CHANGE THEM.
FH = .1
R = 10
XMU = .000532
DLT = .05/12.
PHI = .05/12.
M = 7
G(1) = .0764
G(2) = .0665
G(3) = .0499
G(4) = .0429
G(5) = .0408
G(6) = .0529
G(7) = .0555
DO 5 I = 8, 20
5 G(I) = 0
C THE GAMMA VALUES NEED TO BE ADJUSTED SO THAT OUR DISCRETE
C MODEL WORKS (GAMMA IS CONTINUOUS).
DO 10 I = 1, 7
10 G(I) = (1 - EXP(-G(I)))
QH = .05
WRH(1) = 2.
WRHA = 1
WRHP = 1.5
WRHM = 7.5
LYEAR = 1990
C SETTING PARAMETERS FOR IMSL MINIMIZATION PROGRAM BCONF
PLB(1) = .01
PLB(2) = .01
PLB(3) = 0.
PUB(1) = 10
PUB(2) = 1.5
PUB(3) = 1.
PSCALE(1) = 1
PSCALE(2) = 1
PSCALE(3) = 1
FSCALE = 1
ITP = 0
RPARAM(1) = .001
RPARAM(2) = .001
C PRINT*, '/'
PRINT*, 'THE DEFAULT PARAMETERS VALUES ARE LISTED BELOW,'
PRINT*, 'YOU MAY CHANGE THEM OR NOT AS YOU CHOOSE,'
PRINT*, 'ANSWER 1 FOR change OR 2 FOR no change,'
PRINT*, '/'
C POPULATION PARAMETER VALUES
6 PRINT*, 'THE CRUDE APPROXIMATION OF ',NSIZE,' AS THE STARTING '
PRINT*, 'POPULATION SIZE IS 7.0 TIMES THE TOTAL AIDS CASES',
$' THROUGH 1990'
READ*, INPUT
IF (INPUT.NE.2) THEN
PRINT*, 'INPUT NSIZE = '
READ*, NSIZE
ENDIF
PRINT*, 'VERY ACTIVE FRACTION FH = ', FH
PRINT*, 'DEFAULT ACTIVITY RATIO R = ', R
READ*, INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'INPUT FH AND R'
  READ*, FH, R
ENDIF
SIZE = NSIZE*1.
QV = FH*SIZE
QA = (1-FH)*SIZE
PRINT*, 'XMU = ', XMU, ', DLT = ', DLT, ', PHI = ', PHI
READ*, INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'XMU, DLT, PHI = '
  READ*, XMU, DLT, PHI
ENDIF
THT = PHI*QV/QA
C READ STARTING YEAR AND MONTH, THEN ENDING YEAR
PRINT*, 'A CRUDE APPROXIMATION OF THE EPIDEMIC STARTING DATE IS '
PRINT*, '7 YEARS BEFORE THE CUMULATIVE AIDS CASES REACH 40.'
PRINT*, 'THE STARTING YEAR IS IYEAR = ', IYEAR
PRINT*, 'THE STARTING MONTH NUMBER IS IMONTH = ', IMONTH
READ*, INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'IYEAR, IMONTH = '
  READ*, IYEAR, IMONTH
ENDIF
PRINT*, 'THE ENDING YEAR IS LYEAR = ', LYEAR
READ*, INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'NEW LYEAR = '
  READ*, LYEAR
ENDIF
C M IS THE NUMBER OF INFECTIOUS STAGES IN THE MODEL,
WHERE STAGE 1 IS THE HIV INCUBATION PHASE, STAGES 2 to INT(M/2)
FORM THE ASYMPTOMATIC PHASE, STAGES INT(M/2)+1 to M-1 FORM THE
PRE-AIDS PHASE, STAGE M IS AIDS, AND STAGE M+1 IS DEATH.
PRINT*, 'THE NUMBER OF STAGES IS M = ', M
READ*, INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'NEW M = '
  READ*, M
ENDIF
C G IS THE VECTOR OF EXPONENTIAL WAITING TIMES gamma FOR THE STAGES
PRINT*, 'THE VALUES FOR gamma FOR THE STAGES ARE '
PRINT*, (G(I), I=1,M)
READ*, INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'INPUT ', M, ' NEW gamma VALUES.'
  READ*, (G(I), I=1,M)
C THE GAMMA VALUES NEED TO BE ADJUSTED SO THAT OUR DISCRETE
C MODEL WORKS (GAMMA IS CONTINUOUS).
DO 15 I = 1, M
  G(I) = (1 - EXP(-G(I)))
15
PROBABILITY OF TRANSMISSION FOR AN ASYMPTOMATIC PERSON (STAGES 2 - M/2) IS QH.

\[ \text{PRINT}*, 'THE PROBABILITY OF TRANSMISSION BY A STAGE-2', 'INFECTIVE IS QH = ', QH \]
\[ \text{READ}*, \text{INPUT} \]
\[ \text{IF (INPUT.NE.2)} \text{ THEN} \]
\[ \text{PRINT}*, 'INPUT QH = ' \]
\[ \text{READ}*, QH \]
\[ \text{ENDIF} \]

PROBABILITY OF TRANSMISSION IN OTHER PHASES HAS W(I) FACTOR.

\[ \text{PRINT}*, 'SINCE THE WEIGHT FACTORS W(I) AND RELATIVE ACTIVITY', 'FACTORS rho APPEAR ONLY AS A PRODUCT, THEY ARE INPUT THAT', 'WAY. THE PRODUCTS FOR HIV INCUBATION, ', 'ASYMPTOMATIC PRE-AIDS, AND AIDS PHASES ARE ', 'WRH(1), WRHA, WRHP, WRHM \]
\[ \text{READ}*, \text{INPUT} \]
\[ \text{IF (INPUT.NE.2)} \text{ THEN} \]
\[ \text{PRINT}*, 'INPUT WRH(1), WRHA, WRHP, AND WRHM ' \]
\[ \text{READ}*, WRH(1), WRHA, WRHP, WRHM \]
\[ \text{ENDIF} \]

OUTPUT OF PARAMETER VALUES IN THE MODEL

\[ \text{WRITE}*(IO,*) 'PROGRAM FIT10 FOR ' \]
\[ \text{WRITE}*(IO,*) 'COMPUTER SIMULATION OF HIV AND AIDS IN A POPULATION' \]
\[ \text{WRITE}*(IO,*) 'THE SIZE OF THE POPULATION IS ', NSIZE \]
\[ \text{WRITE}*(IO,*) 'THE VERY ACTIVE FRACTION IS ', FH \]
\[ \text{WRITE}*(IO,*) 'THE ACTIVITY RATIO IS ', R \]
\[ \text{WRITE}*(IO,*) 'THE NATURAL MORTALITY RATE XMU IS ', XMU \]
\[ \text{WRITE}*(IO,*) 'THE TURNOVER RATE DLT IS ', DLT \]
\[ \text{WRITE}*(IO,*) 'THE CHANGE RATE PHI FROM VERY ACTIVE TO ACTIVE', 'IS ', PHI \]
\[ \text{WRITE}*(IO,*) 'THE WEIGHT FACTORS FOR INFECTIVITY ARE', 'WRH(1), WRHA, WRHP, WRHM \]
\[ \text{WRITE}*(IO,*) 'THE PROBABILITY OF TRANSMISSION IS QH = ', QH \]

TABLE HEADING HERE

\[ \text{WRITE}*(IO,*) ' ' \]
\[ \text{WRITE}*(IO,*) ' ' \]
\[ \$'******************************************************************************' \]
\[ \text{WRITE}*(IO,*) ' ' \]
\[ \text{WRITE}*(IO,900) \]
900 FORMAT(8X,'M NYSTRT NYSTOP PAS RDCTN ETA CHISQ')
\[ \text{WRITE}*(IO,*) ' ' \]

8 CALL U4INF(IPARAM,RPARAM)
\[ \text{PRINT}*, 'INPUT REDUCTION STARTING DATE, NYSTRT, NMSTR = ' \]
\[ \text{READ}*, NYSTRT, NMSTR \]
\[ \text{PRINT}*, 'THE LAST YEAR OF THE REDUCTION IS NYSTOP = ' \]
\[ \text{READ}*, NYSTOP \]
\[ \text{PRINT}*, 'INPUT INITIAL GUESSES FOR PAS & RDCTN' \]
\[ \text{READ}*, PGUESS(1), PGUESS(2) \]
\[ \text{PRINT}*, 'INPUT INITIAL GUESS FOR ETA' \]
\[ \text{READ}*, PGUESS(3) \]

THE HIV INCUBATION PHASE (STAGE 1) AND THE AIDS PHASE (STAGE M) HAVE FIXED GIVEN TRANSITION RATES. THE STAGES IN THE ASYMPTOMATIC
C PHASE HAVE EQUAL LENGTH, AND THE STAGES IN THE PRE-AIDS PHASE
C HAVE EQUAL LENGTH.
IM2 = M/2
WRH(M) = WRHM
DO 20 I = 2, IM2
20 WRH(I) = WRHA
DO 22 I = IM2+1, M-1
22 WRH(I) = WRHP
CALL BCONF(EPI,N,PGUESS,ITP,PLB,PUB,PSCALE,FScale,IPARAM,
$ RPARAM,P,CHISQ)
PRINT*, 'NUMBER OF FUNCTION & GRADIENT EVALUATIONS = ',
$ IPARAM(3),IPARAM(5)
950 FORMAT(1X,3I5,4F10.4)
WRITE(IO,950)NYSTRT,NMSTRT,NYSTOP,P(1),P(2),P(3),CHISQ
PRINT*, 'DO YOU WISH TO DO IT AGAIN? (2 = yes)'
READ*,INPUT
IF (INPUT.EQ.2) THEN
   PRINT*, 'DO YOU WISH ONLY TO CHANGE nystrt,nmstrt,nystop, '
   'pas,rdctn & eta?'
   READ*,INPUT
   IF (INPUT.EQ.2) GOTO 8
GOTO 6
ENDIF
END

************************************************************
SUBROUTINE TO SIMULATE HIV EPIDEMIC
SUBROUTINE EPI(N,P,CHISQ)
DIMENSION X(20),Y(20),Z(20),DX(20),DY(20),DZ(20),G(20),
$ WRH(19),DAIDS(1975:1990),P(N)
COMMON FH,R,QV,QA,XMU,DLT,PHI,THT,M,G,QH,WRH,NYSTRT,NMSTRRT,
$ IYEAR,IMONTH,LYEAR,NYSTOP,DAIDS
PAS = P(1)
RDCTN = P(2)
ETA = P(3)
PHS = PAS/(1 + FH*(R-1))
RDCTMO = RDCTN**(1./12.)
INITIALIZING ON IMONTH OF IYEAR
START = 1
DO 50 I = 1,M+1
   X(I) = 0
   Y(I) = 0
   Z(I) = 0
50   Z(I) = START
   SV = QV - X(1)
   SA = QA
STARTING THE ITERATION, WITH STEP SIZE = 1 MONTH
NMONT = IMONTH
LASTK = IYEAR - IYEAR
PRAIDS = 0
CHISQ = 0
DO 600 K = 0, LASTK
   NYEAR = IYEAR + K

C J IS THE NUMBER OF THE MONTH
DO 500 J = NMONT, 12
C ACTIVE HOMOSEXUALS HAVE PH PARTNERS PER MONTH
C VERY ACTIVE HOMOSEXUALS HAVE R*PH PARTNERS PER MONTH
IF (NYEAR.LT.NYSTRT) THEN
    PH = PHS
ELSEIF (NYEAR.EQ.NYSTRT.AND.J.LT.NMSTRT) THEN
    PH = PHS
ELSEIF (NYEAR.LE.NYSTOP) THEN
    PH = PHS*RDCTMO**((NYEAR-NYSTRT-1)*12+13-NYSTRT+J)
ELSE
    PH = PHS*RDCTMO**((NYSTOP-NYSTRT)*12+13-NYSTRT)
ENDIF
C CALCULATING THE INCIDENCES
ASUM = 0
VSUM = 0
DO 100 I=1,M
ASUM = ASUM + WRH(I)*Y(I)
100 VSUM = VSUM + WRH(I)*R*X(I)
SUM = ASUM + VSUM
DNM = QA - Y(M+1) + R*(QV - X(M+1))
AINC = PH*QH*((1 .- ETA)*ASUM*SA/(QA - Y(M+1)) + ETA*SUM*SA/DNM)
VINC = PH*QH*((1 .-ETA)*VSUM*SV/(QV-X(M+1)) + ETA*SUM*R*SV/DNM)
C CALCULATING THE DIFFERENCES
DSV = (DLT+XMU)*(QV-SV)-VINC-PHI*SV+THT*SA
DSA = (DLT+XMU)*(QA-SA)-AINC+PHI*SV-THT*SA
DX(1) = VINC-(G(1)+XMU+DLT+PHI)*X(1)+THT*Y(1)
DY(1) = AINC-(G(1)+XMU+DLT+THT)*Y(1)+PHI*X(1)
DZ(1) = (DLT+XMU)*X(1)+Y(1)-(G(1)+XMU)*Z(1)
DO 200 I=2,M
DX(I) = G(I-1)*X(I-1)+THT*Y(I)-(G(I)+XMU+PHI+DLT)*X(I)
DY(I) = G(I-1)*Y(I-1)+PHI*X(I)-(G(I)+XMU+THT+DLT)*Y(I)
DZ(I) = (DLT+XMU)*X(I-1)+Y(I-1)-(G(I)+XMU)*Z(I)
DZ(M) = DZ(M) - G(M-1)*Z(M-1)
ZAIDS = ZAIDS + G(M-1)*Z(M-1)
DX(M+1) = G(M)*X(M)+THT*Y(M+1)-(XMU+PHI+DLT)*X(M+1)
DY(M+1) = G(M)*Y(M)+PHI*X(M+1)-(XMU+THT+DLT)*Y(M+1)
DZ(M+1) = (DLT+XMU)*(X(M)+Y(M+1)) + G(M)*Z(M)
DZ(M+1) = DZ(M) + XMU*(X(M) + Y(M) + Z(M))
C UPDATING EACH CLASS
SV = SV + DSV
SA = SA + DSA
DO 300 I=1,M+1
X(I) = X(I) + DX(I)
Y(I) = Y(I) + DY(I)
300 Z(I) = Z(I) + DZ(I)
C CHECKING CONSERVATION IN QV AND QA
CKQV = SV
CKQA = SA
DO 400 I = 1, M+1
CKQV = CKQV + X(I)
400 CKQA = CKQA + Y(I)
IF (ABS(CKQV-QV)/QV + ABS(CKQA-QA)/QA.GT.1.E-4) THEN
    PRINT*,'CONSERVATION CHECK NOT SATISFIED'
    PRINT*,QV,CKQV,QA,CKQA
500 CONTINUE
C YEARLY OUTPUT
DEATHS = X(M+1) + Y(M+1) + Z(M+1)
AIDS = DEATHS + X(M) + Y(M) + Z(M)
AIDINC = AIDS - PRAIDS
IF(NYEAR.GE.1978.AND.NYEAR.LE.1990)THEN
   CHISQ = CHISQ + (DAIDS(NYEAR)-AIDINC)**2 / AIDINC
ENDIF
PRAIDS = AIDS
600 NMONTH = 1
RETURN
END

Listing of IVDU10.FOR

This program IVDU10.FOR is used for fitting to heterosexual and perinatal AIDS data and also for producing tables of simulation values. This program was coded by Herb Hethcote and Jim Van Ark. It is used in Chapter 10 of the book, "MODELING HIV TRANSMISSION AND AIDS IN THE UNITED STATES", to do fitting and to produce Tables 10.5, 10.6, 10.8, 10.9, 10.12 and 10.15. The program HOMO10.FOR for producing Tables 10.2, 10.3, 10.4, 10.7, 10.10, 10.11, 10.13 and 10.14 for homosexual men is similar, but simpler since there are no heterosexual partners. For an aggregated population, the AIDS incidence data from 1979 to 1990 for IVDUs, heterosexual cases and perinatal cases are input to the program as vectors such as NE2TABT.M, NESTABT.M AND NECTABT.M. After the parameter values found by FIT1O.FOR for the best fit to the AIDS data for IVDUs are entered into this program, the user runs the program in terminal mode to find the value of the parameter PAP, the average number of new heterosexual partners per month, which gives the best fit. This PAP value is found by a user-directed iterative search to minimize the chi-square value of the fit to the heterosexual AIDS data. After the value of PAP has been found, the fecundity FC is found by a user-directed iterative search to minimize the chi-square value of the fit to the perinatal AIDS data. When the best fitting values of PAP and FC have been found, then the printer mode is used to produce a table of parameter values followed by simulation values for the HIV epidemic and AIDS cases in IVDUs (I), their heterosexual partners (P), and perinatal cases in children (C). The program also produces external files of the bimonthly HIV and AIDS incidence values for making MATLAB graphs from 1974 to 1990 using the program GRIVDU10.M.

DIMENSION X(20),Y(20),Z(20),DX(20),DY(20),DZ(20),CA(20),GP(20),
& NAIVDU(102),NHIVDU(102),NAHTRO(102),NHHTRO(102),NAPED(102),
& NHPED(102),YP(20),ZP(20),DYP(20),DZP(20),YC(20),DYC(20)
CHARACTER*10 FILE0I,FILE1I,FILE2I,FILE0H,FILE1H,FILE2H,
& FILE0C,FILE1C,FILE2C

THE AIDS INCIDENCE FILE NAMES ARE ENTERED AND THE DATA ARE STORED IN VECTORS
PRINT*,’INPUT A FILENAME (IN SINGLE QUOTES) FOR IVDU INCIDENCE’
PRINT*,’BE SURE TO INCLUDE THE .m EXTENSION’
NOTE: INPUT FILE ALWAYS STARTS IN 1979!
INYEAR = 1979
DO 5 N = 1975, INYEAR-1
DIVDU(N) = 0.
DHTRO(N) = 0.
DPED(N) = 0.
OPEN(UNIT=9, FILE=FILEOI, STATUS='OLD')
READ(9,*) (DIVDU(N), N=INYEAR, 1990)
PRINT*, 'DATA IN IVDU VECTOR STARTING IN 1975 IS', DIVDU
PRINT*, 'INPUT THE FRACTION OF IVDUs WHO ARE WOMEN'
READ*, PIW
PRINT*, 'INPUT THE FILENAME (SINGLE QUOTES) FOR HTRO INCIDENCE'
PRINT*, 'BE SURE TO INCLUDE THE .m EXTENSION'
READ*, FILEOH
OPEN(UNIT=9, FILE=FILEOH, STATUS='OLD')
READ(9,*) (DHTRO(N), N=INYEAR, 1990)
PRINT*, 'DATA IN HTRO VECTOR STARTING IN 1975 IS', DHTRO
PRINT*, 'INPUT THE FRACTION OF HETEROSEXUALS WHO ARE WOMEN'
READ*, PHW
PRINT*, 'INPUT THE FILENAME (IN SINGLE QUOTES) FOR PED INCIDENCE'
PRINT*, 'BE SURE TO INCLUDE THE .m EXTENSION'
READ*, FILEOC
OPEN(UNIT=9, FILE=FILEOC, STATUS='OLD')
READ(9,*) (DPED(N), N=INYEAR, 1990)
PRINT*, 'DATA IN PED VECTOR STARTING IN 1975 IS', DPED

THE DEFAULT NAMES FOR THE EXTERNAL DATA FILES TO BE WRITTEN TO
ARE GIVEN HERE; ONE CAN CHANGE THESE NAMES AT THE TIME OF WRITING.

FILE1I = 'MTGRF1.M'
FILE2I = 'MTGRF2.M'
FILE1H = 'MTGRF3.M'
FILE2H = 'MTGRF4.M'
FILE1C = 'MTGRF5.M'
FILE2C = 'MTGRF6.M'
DATA NAIVDU /102*0/, NHIVDU /102*0/
DATA NAHTRO /102*0/, NHHTRO /102*0/
DATA NAPED /102*0/, NHPED /102*0/

PARAMETERS WILL BE LISTED HERE. LATER USER WILL BE ASKED ABOUT
CHANGING.

NSIZE = 150000
NSIZEP = NSIZE/2
FH = .1
R = 10
XMU = .000532
DLT = .05/12.
PHI = .05/12.
ETA = .5
M = 7
GA(1) = .0764
GA(2) = .0665
GA(3) = .0499
GA(4) = .0429
GA(5) = .0408
GA(6) = .0529
GA(7) = .0555
DO 7 I = 8, 20
THE GAMMA VALUES NEED TO BE ADJUSTED SO THAT OUR DISCRETE MODEL WORKS (GAMMA IS CONTINUOUS)

DO 9 I=1,M
9 GA(I) = (1-EXP(-GA(I)))

THE POPULATION PARAMETER VALUES

PRINT*, 'THE IVDU & HTRO POPULATION SIZES ARE ', NSIZE, NSIZEP
READ*, INPUT
IF (INPUT.NE.2) THEN
   PRINT*, 'INPUT NSIZE & NSIZEP = '
   READ*, NSIZE, NSIZEP
ENDIF
PRINT*, 'VERY ACTIVE FRACTION FH = ', FH
PRINT*, 'DEFAULT ACTIVITY RATIO R = ', R
READ*, INPUT
IF (INPUT.NE.2) THEN
   PRINT*, 'INPUT FH AND R'
   READ*, FH, R
ENDIF
SIZE = NSIZE*1.
QV = FH*SIZE
QA = (1-FH)*SIZE
QAP = NSIZEP*1.
PRINT*, 'XMU = ', XMU, ', DLT = ', DLT, ', PHI = ', PHI
READ*, INPUT
IF (INPUT.NE.2) THEN
PRINT*,'XMU, DLT, PHI = '
READ*,XMU,DLT,PHI
ENDIF
THT = PHI*QV/QA

C M IS THE NUMBER OF INFECTIOUS STAGES IN THE MODEL, WHERE
C STAGE 1 IS THE HIV INCUBATION PHASE, STAGES 2 to INT(M/2) FORM THE
C ASYMPTOMATIC PHASE, STAGES INT(M/2)+1 to M-1 FORM THE PRE-AIDS
C PHASE, STAGE M IS AIDS, AND STAGE M+1 IS DEATH.
PRINT*,'THE NUMBER OF INFECTIOUS STAGES IS M = ',M
READ*,M
IF (INPUT.NE.2) THEN
  PRINT*,'INPUT NUMBER OF STAGES, M = '
  READ*, M
ENDIF

C ADJUSTMENT FOR gamma's FOR PEDIATRIC CASES.
C THE HIV INCUBATION PHASE (STAGE 1) AND THE AIDS PHASE (STAGE M)
C HAVE FIXED GIVEN TRANSITION RATES. THE STAGES IN THE
C ASYMPTOMATIC PHASE HAVE EQUAL LENGTH, AND THE STAGES IN THE PRE-
C AIDS PHASE HAVE EQUAL LENGTH. GP IS FOR PEDIATRIC gamma's.
GP(1) = G1
IM2=INT(M/2)
DO 18 I = 2, IM2
  GP(I) = G2*(IM2-1)
DO 19 I=IM2+1, M-1
  GP(I) = G3*(M-1-IM2)
GP(M) = GM

C THE GAMMA VALUES NEED TO BE ADJUSTED SO THAT OUR DISCRETE MODEL
C WORKS (GAMMA IS CONTINUOUS)
DO 21 I = 1, M
  GP(I)=(1-EXP(-GP(I)))
C NOW CHECK THE ADULT gamma's.
PRINT*,'THE gamma's FOR ADULTS ARE ',(GA(I), I = 1, M)
READ*,M
IF (INPUT.NE.2) THEN
  PRINT*,°INPUT ',M,' NEW gamma VALUES .'
  READ*, (GA(I), I = 1, M)
  DO 23 I = 1, M
    GA(I)=(1-EXP(-GA(I)))
ENDIF

C PROBABILITIES OF TRANSMISSION FOR ASYMPTOMATIC ARE QH FOR
C NEEDLE-SHARING, QHP FOR HETEROSEXUAL PARTNERS AND QC FOR CHILDREN
PRINT*,'THE PROBABILITIES OF TRANSMISSION BY ASYMPTOMATIC', '$' INFECTIVES ARE QH, QHP, QC = ',QH,QHP,QC
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*,'INPUT QH, QHP & QC = '
  READ*,QH,QHP,QC
ENDIF

PRINT*,'SINCE THE WEIGHT FACTORS W(I) AND RELATIVE ACTIVITY', '$' FACTORS rho APPEAR ONLY AS A PRODUCT, THEY ARE INPUT THAT', '$' WAY. THE PRODUCTS FOR HIV INCUBATION, ',
$' ASYMPTOMATIC PRE-AIDS, AND AIDS PHASES ARE ',
$ WRH(1),WRHA,WRHP,WRHM
READ*,INPUT
IF (INPUT.NE.2) THEN
PRINT*,'INPUT WRH(1), WRHA, WRHP, AND WRH(M)'
READ*,WRH(1),WRHA,WRHP,WRHM
ENDIF
DO 20 I = 2, IM2
  WRH(I) = WRHA
DO 22 I = IM2+1,M-1
  WRH(I) = WRHP
WRH(M) = WRHM
C
C MIXING BETWEEN ACTIVITY LEVELS IN PREFERRED MIXING WITH ETA AS
C THE EXTERNAL FRACTION, AND (1 - ETA) AS THE INTERNAL FRACTION
PRINT*,'THE EXTERNAL MIXING FRACTION IS ETA = ',ETA
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*,'THE EXTERNAL MIXING FRACTION ETA ='
  READ*,ETA
ENDIF
C
C READ STARTING YEAR AND MONTH, THEN ENDING YEAR
PRINT*,'THE STARTING YEAR IS IYEAR = ',IYEAR
PRINT*,'THE STARTING MONTH NUMBER IS IMONTH = ',IMONTH
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*,'IYEAR, IMONTH = '
  READ*,IYEAR,IMONTH
ENDIF
PRINT*,'THE ENDING YEAR IS LYEAR = ',LYEAR
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*,'NEW LYEAR = '
  READ*,LYEAR
ENDIF
C
C THE INITIAL NUMBER OF INFECTIVES IN THE POPULATION IS START.
C THEY WILL ALL BE PUT IN THE VERY ACTIVE CLASS EVENTUALLY.
PRINT*,'THE INITIAL NUMBER OF INFECTIVES, START = ',START
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*,'START = '
  READ*,START
ENDIF
C
C NEEDLE-SHARING BEHAVIOR PARAMETERS (RDCTN = YEARLY REDUCTION
C STARTING IN NYSTRT, NMSTRT AND ENDING IN NYSTOP.)
PRINT*,'THE STARTING TIME FOR REDUCTION(NYSTRT,NMSTRT) = ',
$ NYSTRT,NMSTRT
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*,'INPUT NYSTRT,NMSTRT = '
  READ*,NYSTRT,NMSTRT
ENDIF
PRINT*,'THE LAST YEAR FOR THE REDUCTION IS NYSTOP = ', NYSTOP
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*,'INPUT NYSTOP = '
  READ*,NYSTOP
ENDIF
32 PRINT*,'THE AVERAGE NUMBER OF NEEDLE-SHARING PARTNERS PER',
$ ' MONTH BEFORE ',NYSTRT,NMSTRT,' IS PAS = ',PAS,' AND THE',
$ ' DEFAULT YEARLY REDUCTION IS RDCTN = ',RDCTN,' UNTIL DEC, ',

$NYSTOP
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'NEW PAS, RDCTN = '
  READ*,PAS,RDCTN
ENDIF

PHS = PAS/(1+FH*(R-1))
RDCTMO = RDCTN**(1./12.)
PRINT*, 'THE AVERAGE NUMBER OF NEW IVDU PARTNERS PER MONTH ',
$'IS ',PAP
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'NEW PAP = '
  READ*,PAP
ENDIF

THE PROPORTION PC OF HIV CHILDREN DEVELOP AIDS EARLY FROM YCE TO
Y(M) WITH RATE CONSTANT B. THE OTHERS MOVE MORE RAPIDLY THROUGH
THE M STAGES WITH G(I) MULTIPLIED BY A.
PRINT*, 'FOR 1-PC CHILDREN, gamma s ARE MULTIPLIED BY A = ',A
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'NEW A = '
  READ*,A
ENDIF
PRINT*, 'EARLY AIDS FRACTION PC & RATE CONSTANT B = ', PC,B
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'NEW PC,B = '
  READ*,PC,B
ENDIF

THE FECUNDITY OF IVDU & HETEROSEXUAL WOMEN IS FC
PRINT*, 'THE FECUNDITY IS FC = ',FC
READ*,INPUT
IF (INPUT.NE.2) THEN
  PRINT*, 'NEW FC = '
  READ*,FC
ENDIF

NMONTH = IMONTH

C INITIALIZING ON IMONTH OF IYEAR
DO 50 I = 1,M+1
X(I) = 0
Y(I) = 0
Z(I) = 0
YP(I) = 0
ZP(I) = 0
50 YC(I) = 0
YCE = 0
X(1) = START
SV = QV - X(1)
SA = QA
SAP = QAP

OUTPUT OF PARAMETER VALUES IN THE MODEL
WRITE(IO,*) 'TABLE'
WRITE(IO,*) ' 'WRITE(IO,*)'FILE01,FILE01,FILE01,FILE01,FILE01,FILE01'
WRITE(IO,*)'***************************************************°
WRITE(IO,*)'PROGRAM OUTPUT FOR IVDU10.FOR BY H. W. HETHCOTE'
WRITE(IO,*)'COMPUTER SIMULATION OF HIV AND AIDS IN AN',
$' IVDU POPULATION'
WRITE(IO,*)'
WRITE(IO,*)'THE IVDU & HTRO POPULATION SIZES ARE ',NSIZE,NSIZEP
WRITE(IO,*)'THE VERY ACTIVE FRACTION IS ',FH
WRITE(IO,*)'THE ACTIVITY RATIO IS ',R
WRITE(IO,*)'THE NATURAL MORTALITY RATE XMU IS',XMU
WRITE(IO,*)'THE INTERCHANGE RATE FROM THE VERY ACTIVE',
$' CLASS TO THE ACTIVE CLASS IS'
WRITE(IO,*) PHI,' AND THE TURNOVER RATE IS DLT = ',DLT
WRITE(IO,*)'THE NUMBER OF INFECTIOUS STAGES IS M = ',M
WRITE(IO,*)'THE G PARAMETERS FOR THE TRANSFER BETWEEN',
$' ADULT STAGES ARE ',(GA(I), I = 1, M)
WRITE(IO,*)'THE WEIGHTS OF TRANSMISSION PER INFECTIOUS ',
$'PARTNER TIMES THE FRACTION STILL'
WRITE(IO,*)'SEXUALLY ACTIVE FOR THE STAGES ARE WRH(I) = ',
$(WRH(I), I = 1, M)
WRITE(IO,*)'THE PROBABILITIES OF TRANSMISSION ARE QH, QHP &',
$' QC = ',QH,QHP,QC
WRITE(IO,*)'THE EXTERNAL MIXING FRACTION IS ETA = ',ETA
WRITE(IO,*)'THE AVERAGE NUMBER OF NEEDLE-SHARING PARTNERS PER ',
$'MONTH IS ',PAS,' BEFORE ',NYSTRT,NMSTRT,' THEN IT IS ',
$'REDUCED EACH YEAR BY A FACTOR OF ',RDCTN,' UNTIL DEC, ',NYSTOP
WRITE(IO,*)'THE FRACTION OF IVDU WHO ARE WOMEN IS ',PIW
WRITE(IO,*)'THE FRACTION OF HETEROSEXUALS WHO ARE WOMEN IS ',PHW
WRITE(IO,*)'THE AVERAGE NUMBER OF IVDU PARTNERS OF HETERO',
$'SEXUALS PER MONTH IS',PAP
WRITE(IO,*)'THE FRACTION',PC,' OF CHILDREN PROGRESS RAPIDLY TO',
$' AIDS WITH RATE CONSTANT',B,'. OTHERS MOVE THROUGH M STAGES',
$'WITH SPEED FACTOR',A
WRITE(IO,*)'THE FECUNDITY FC (CHILDREN/MONTH) IS',FC
WRITE(IO,*)'THE STARTING YEAR AND MONTH ARE ',IYEAR,IMONTH
WRITE(IO,*)'THE STARTING NUMBER OF VERY ACTIVE INFECTIVES IS',

C

C TABLE HEADING HERE
WRITE(IO,*)'*******************************
WRITE(IO,*)'
WRITE(IO,*)'THE SIMULATED INCIDENCES ARE GIVEN ON THE NEXT PAGE'
WRITE(IO,850)
850 FORMAT('1')
WRITE(IO,*)FILEOI,FILEOI,FILEOI,FILEOI,FILEOI
WRITE(IO,*)'*******************************
WRITE(IO,900)
900 FORMAT(1X,'YEAR FRACTNAL PREV ',
$'YR AIDS INC AIDS(SIMULATION)'
WRITE(IO,901)
901 FORMAT(1X,'CLASS INC PREV ALL V_A ACT ',
$' DATA SIM PREV DTHS OUTSF')
WRITE(IO,*)'

C

C STARTING THE ITERATION, WITH STEP SIZE = 1 MONTH
LASTK = LYEAR - IYEAR
PRAIDS = 0
PRDTHS = 0
PZRAID = 0
ZAIDS = 0
CHISQ = 0
PRAIDP = 0
PRDTHP = 0
DO 600 K=0,LASTK
SUMAIN = 0
SUMVIN = 0
SUMAIP = 0
SUMAIC = 0
NYEAR = IYEAR + K

J IS THE NUMBER OF THE MONTH
DO 500 J=NMONTH,12

ACTIVE IVDU'S HAVE PH PARTNERS PER MONTH
VERY ACTIVE IVDU'S HAVE R*PH PARTNERS PER MONTH
IF (NYEAR.LT.NYSTRT) THEN
   PH = PHS
ELSEIF (NYEAR.EQ.NYSTRT.AND.J.LT.NMSTRT) THEN
   PH = PHS
ELSEIF (NYEAR .LE.NYSTOP) THEN
   PH = PHS*RDCTMO**((NYEAR-NYSTRT-I)*12+13-NMSTRT+J)
ELSE
   PH = PHS*RDCTMO**((NYSTOP-NYSTRT)*12+13-NMSTRT)
ENDIF

CALCULATING THE MONTHLY INCIDENCES
ASUM = 0
VSUM = 0
SUMP = 0
SUMC = 0
DO 100 I=1,M
   ASUM = ASUM + WRH(I)*Y(I)
   VSUM = VSUM + WRH(I)*R*X(I)
   SUMP = SUMP + WRH(I)*(X(I)+Y(I))
100 SUMC = SUMC + WRH(I)*YP(I)
   SUM = ASUM + VSUM
   DNM = QA - Y(M+1) + R*(QV - X(M+1))
   AINC = PH*QH*((1.-ETA)*ASUM*SA/(QA-Y(M+1))+ETA*SUM*SA/DNM)
   VINC = PH*QH*((1.-ETA)*VSUM*SV/(QV-X(M+1))+ETA*SUM*R*SV/DNM)
   AINCP = PAP*QHP*SUMP*SAP/(QAP-YP(M+1))
PIW OF IVDU & PHW OF HETEROSEXUALS ARE WOMEN
   AINCC = FC*QC*(PIW*SUMP+PHW*SUMC)
SUMAIN = SUMAIN + AINC
SUMVIN = SUMVIN + VINC
SUMAIP = SUMAIP + AINCP
SUMAIC = SUMAIC + AINCC

FIRST LOAD THE VECTORS FOR GRAPHING !
{NOTICE THAT THIS ROUTINE WILL LOAD DATA ON THE EVEN MONTHS.}
IF (NYEAR.GE.1974.AND.NYEAR.LE.1990) THEN
   IF(INT(J/2)*2.EQ.J) THEN
      N4 = (NYEAR - 1974) * 6 + INT(J/2)
      NALVDU(N4)=GA(M-1)*(X(M-1)+Y(M-1))
      NHIVDU(N4) = AINC + VINC
      NAHTRO(N4)=GA(M-1)*YP(M-1)
      NHHTRO(N4) = AINCP
      NAPED(N4)=A*GP(M-1)*YC(M-1)+B*YCE
\[ \text{NHPED}(N4) = \text{AINCC} \]

ENDIF

ENDIF

CALCULATING THE DIFFERENCES

\[ DSV = (DLT+XMU)*(QV-SV)-\text{VINC}-\text{PHI}*SV+THT*SA \]

\[ DSA = (DLT+XMU)*(QA-SA)-\text{AINC}+\text{PHI}*SV-THT*SA \]

\[ DSAP = (DLT+XMU)*(QAP-SAP)-\text{AINCP} \]

\[ DX(1) = \text{VINC} - (\text{GA}(1)+XMU+DLT+\text{PHI})*X(1)+THT*Y(1) \]

\[ DY(1) = \text{AINC} - (\text{GA}(1)+XMU+DLT+THT)*Y(1)+\text{PHI}*X(1) \]

\[ DZ(1) = \text{DLT}*(X(1)+Y(1))-(\text{GA}(1)+XMU)*Z(1) \]

\[ DYP(1) = \text{AINCP} - (\text{GA}(1)+XMU+DLT)*Y(1) \]

\[ DZP(1) = DLT*YP(1)-(\text{GA}(1)+XMU)*ZP(1) \]

\[ DYC(1) = (1-\text{PC})*\text{AINCC} - A*GP(1)*YC(1) \]

DO 200 I=2,M

\[ DX(I) = \text{GA}(I-1) * X(I-1) + THT * Y(I) - (\text{GA}(I)+XMU+\text{PHI}+DLT) * X(I) \]

\[ DY(I) = \text{GA}(I-1) * Y(I-1) + \text{PHI} * X(I) - (\text{GA}(I)+XMU+THT+DLT) * Y(I) \]

\[ DZ(I) = \text{GA}(I-1) * Z(I-1) + DLT * (X(I)+Y(I)) - (\text{GA}(I)+XMU) * Z(I) \]

\[ DYP(I) = \text{GA}(I-1) * YP(I-1) - (\text{GA}(I)+XMU+DLT) * YP(I) \]

\[ DZP(I) = DLT*YP(I)-(\text{GA}(I)+XMU)*ZP(I) \]

200

\[ DYC(I) = A*GP(I-1)*YC(I-1) - A*GP(I)*YC(I) \]

\[ DZ(M) = DZ(M) - \text{GA}(M-1)*Z(M-1) \]

\[ ZAIDS = ZAIDS + \text{GA}(M-1)*Z(M-1) \]

\[ DZP(M) = DZP(M) - \text{GA}(M-1)*ZP(M-1) \]

\[ ZAIDSP = ZAIDSP + \text{GA}(M-1)*ZP(M-1) \]

\[ DX(M+1) = \text{GA}(M) * X(M) + THT * Y(M+1) - (XMU+\text{PHI}+DLT) * X(M+1) \]

\[ DY(M+1) = \text{GA}(M) * Y(M) + \text{PHI} * X(M+1) - (XMU+THT+DLT) * Y(M+1) \]

\[ DZ(M+1) = (DLT+XMU)*X(M+1)+Y(M+1)+\text{GA}(M)*Z(M) \]

\[ DZ(M+1) = DZ(M+1) + XMU*(X(M)+Y(M)+Z(M)) \]

\[ DYP(M+1) = \text{GA}(M)*YP(M)-(XMU+DLT)*YP(M+1) \]

\[ DZP(M+1) = DLT*YP(M+1) + \text{GA}(M)*ZP(M) + XMU*(YP(M)+ZP(M)) \]

\[ DYC(M) = DYC(M) + B*YCE \]

\[ DYC(M+1) = A*GP(M)*YC(M) \]

UPDATING EACH CLASS

\[ SV = SV + DSV \]

\[ SA = SA + DSA \]

\[ SAP = SAP + DSAP \]

DO 300 I=1,M+1

\[ X(I) = X(I) + DX(I) \]

\[ Y(I) = Y(I) + DY(I) \]

\[ Z(I) = Z(I) + DZ(I) \]

\[ YP(I) = YP(I) + DYP(I) \]

\[ ZP(I) = ZP(I) + DZP(I) \]

300

\[ YC(I) = YC(I) + DYC(I) \]

\[ YCE = YCE + PC*\text{AINCC} - B*YCE \]

CHECKING CONSERVATION IN QV AND QA

\[ CKQV = SV \]

\[ CKQA = SA \]

\[ CKQAP = SAP \]

DO 400 I = 1, M+1

\[ CKQV = CKQV + X(I) \]

\[ CKQA = CKQA + Y(I) \]

400

\[ CKQAP = CKQAP + YP(I) \]

IF (ABS(CKQV-QV)/QV + ABS(CKQA-QA)/QA.GT.1.E-5) THEN

PRINT*, 'CONSERVATION CHECK NOT SATISFIED (IVDU)'

PRINT*, QV, CKQV, QA, CKQA

ENDIF

IF (ABS(CKQAP-QAP)/QAP.GT.1.E-5) THEN
CONSERVATION CHECK NOT SATISFIED (HETERO)
PRINT*,QAP,CKQAP
ENDIF
500 CONTINUE
C
C YEARLY OUTPUT
SUMINC = SUMAIN + SUMVIN
SUMINP = SUMAIP
XPREV = 0
YPREV = 0
ZPREV = 0
YPREVP = 0
ZPREVP = 0
PREVC = YCE
DO 550 I = 1, M
XPREV = XPREV + X(I)
YPREV = YPREV + Y(I)
ZPREV = ZPREV + Z(I)
YPREVP = YPREVP + YP(I)
ZPREVP = ZPREVP + ZP(I)
550 PREVC = PREVC + YC(I)
PREV = XPREV + YPREV
IF (QV.GT.0) FXPREV = XPREV / QV
IF (QA.GT.0) FYPREV = YPREV / QA
FPREV = PREV / NSIZE
PREVP = YPREVP
FPREVP = YPREVP / NSIZEP
DEATHS = X(M+1) + Y(M+1) + Z(M+1)
AIDPRV = X(M) + Y(M) + Z(M)
AIDS = DEATHS + AIDPRV
YRDTHS = DEATHS - PRDTHS
AIDINC = AIDS - PRAIDS
OUTINC = ZAIDS - PRAIDP
DEATHP = YP(M+1) + ZP(M+1)
AIDPRVP = YP(M) + ZP(M)
AIDSP = DEATHP + AIDPRVP
YRDTHP = DEATHP - PRDTHP
AIDINP = AIDSP - PRAIDP
OUTINP = ZAIDSP - PRAIDP
DEATHC = YC(M+1)
AIDPRVC = YC(M)
AIDSC = DEATHC + AIDPRVC
YRDTHC = DEATHC - PRDTHC
AIDNCC = AIDSC - PRAIDC
910 FORMAT(1X,I4,1X,A4,2F8.0,3F5.2,F7.0,5F7.0)
911 FORMAT(1X,I4,1X,A4,2F8.0,3F5.2,'****',5F7.0)
912 FORMAT(7X,A4,2F8.0,F5.2,',' - - ','5F7.0)
913 FORMAT(7X,A4,2F8.0,F5.2,',' - - ****',5F7.0)
914 FORMAT(7X,A4,2F8.0,',' - - ','5F7.0)
915 FORMAT(7X,A4,2F8.0,',' - - ****',5F7.0)
IF (NYEAR.GE.1975.AND.NYEAR.LE.1990.AND.AIDINC.GE.1.E-5) THEN
CHISQ = CHISQ + (DIVDU(NYEAR)-AIDINC)**2 / AIDINC
WRITE(IO,910) NYEAR,'IVDU',SUMINC,PREV,FPREV,FXPREV,FYPREV,
$ DIVDU(NYEAR),AIDINC,AIDPRV,YRDTHS,OUTINC
ELSE
WRITE(IO,911) NYEAR,'IVDU',SUMINC,PREV,FPREV,FXPREV,FYPREV,
$ AIDINC,AIDPRV,YRDTHS,OUTINC
ENDIF
IF (NYEAR.GE.1975.AND.NYEAR.LE.1990.AND.AIDINP.GE.1.E-5) THEN
CHISQP = CHISQP + (DHTRO(NYEAR)-AIDINP)**2 / AIDINP
WRITE(IO,912) 'HTRO',SUMINP,PREVP,FPPREV,DHTRO(NYEAR),
        AIDINP,AIDPRVH,YRDTHP,OUTINP
$ ELSE
        WRITE(IO,913) 'HTRO',SUMINP,PREVP,FPPREV,AIDINP,AIDPRVH,
        YRDTHP,OUTINP
ENDIF
IF (NYEAR.GE.1975.AND.NYEAR.LE.1990.AND.AIDNCC.GE.1.E-5) THEN
        CHISQC = CHISQC + (DPED(NYEAR)-AIDNCC)**2 / AIDNCC
WRITE(IO,914) 'PED',SUMAIC,PREVC,DPED(NYEAR),
        AIDPRVC,AIDNCC,YRDTHC
$ ELSE
        WRITE(IO,915) 'PED',SUMAIC,PREVC,AIDNCC,AIDPRVC,YRDTHC
ENDIF
PRDTHS = DEATHS
PRAIDS = AIDS
PRZAID = ZAIDS
PRDTHP = DEATHP
PRAIDP = AIDSP
PRZAIDP = ZAIDSP
PRDTHC = DEATHC
PRAIDC = AIDSC
600 NMONTH = 1
WRITE(IO,*)'
WRITE(IO,*)'CHISQD = ',CHISQ
WRITE(IO,*)'CHISQP = ',CHISQP
WRITE(IO,*)'CHISQC = ',CHISQC
CHISQT = CHISQ + CHISQP + CHISQC
WRITE(IO,*)'SUM OF CHISQ-D,P,C =',CHISQT
C
CHECK TO SEE IF THE DATA IS TO BE USED FOR GRAPHING.
PRINT*, 'WOULD YOU LIKE TO WRITE DATA FILES TO EXTERNAL ' '
$GRAPHING) FILES? 2 = YES.'
READ*,INPUT
IF (INPUT.EQ.2) THEN
PRINT*, 'THE DEFAULT NAMES FOR IVDU FILES ARE ',FILE1I,FILE2I
READ*,INPUT
IF (INPUT.NE.2) THEN
        PRINT*, 'INPUT NEW DATA FILE NAMES (IN SINGLE QUOTES)' 
        READ*,FILE1I,FILE2I
ENDIF
OPEN(UNIT=10,FILE=FILE1I)
WRITE(10,*)NHIVDU
OPEN (UNIT=10,FILE=FILE2I)
WRITE(10,*)NAIVDU

PRINT*, 'THE DEFAULT NAMES FOR HTRO FILES ARE ',FILE1H,FILE2H
READ*,INPUT
IF (INPUT.NE.2) THEN
        PRINT*, 'INPUT NEW DATA FILE NAMES (IN SINGLE QUOTES)' 
        READ*,FILE1H,FILE2H
ENDIF
OPEN(UNIT=10,FILE=FILE1H)
WRITE(10,*)NhHTRO
OPEN(UNIT=10,FILE=FILE2H)
WRITE(10,*)NAHTRO

PRINT*, 'THE DEFAULT NAMES FOR THE PED FILES ARE ',FILE1C,FILE2C
READ*,INPUT
IF (INPUT.NE.2) THEN
...
The program GRIVDU10.M is a MATLAB graphing program using pre-generated vectors for the estimated and simulated HIV and AIDS incidence from 1974 to 1990. The AIDS incidence data vector names (such as NE2TABT, NE5TABT, NECTABT) are entered first. Then the simulation vectors for HIV and AIDS pre-generated by the Fortran program IVDUI0.FOR with default names mtgrf#.m (# =1 to 6) are entered. This program then produces the graphs of the AIDS incidence data and the HIV and AIDS simulation incidences for the IVDUs, heterosexual partners and perinatally-infected children. This program was coded by Herb Hethcote and Jim Van Ark. It is used in Chapter 10 of the book, "MODELING HIV TRANSMISSION AND AIDS IN THE UNITED STATES", to produce Figures 10.18, 10.19, 10.25, 10.27, 10.43 and 10.54.

Input the names of the vectors for inputing data and labeling the graphs.
ml = input(‘Input the vector name for IVDUs (in single-quotes) ‘);
11 = [ml,’ solid’];
m2 = input(‘Input the vector name for HTRO ‘);
12 = [m2,’ dashed’];
m3 = input(‘Input the vector name for PED ‘);
13 = [m3,’ dashdot’];

YO, YOH, YOC are yearly AIDS data for IVDU, HTRO & PED from CDC
file0 = ml;
eval(['load ',file0,'.m'])
eval(['YO = ',file0,';'])
YO = YO*(1/12);
YO = YO(:);
fileOH = m2;
eval(['load ',fileOH,'.m'])
eval(['YOH = ',',file0H,',');
YOH = YOH*(1/12);
YOH = YOH(:,);
file0C = m3;
eval(['load ',',file0C,','m']);
eval(['YOC = ',',file0C,',']);
YOC = YOC*(1/12);
YOC = YOC(:,);% These matrices contain the x - entries for the data points
X0 = 1979+1/2:1:1990+1/2;
X = 1974:1/6:1991 - 1/12;
% Load the simulation vectors for IVDU
disp('Use 2 to accept or 1 to change. ');
inp = input('the default names for IVDU are mtgrf1 & mtgrf2 ');
if inp == 1
    file1 = input('Input file1 name (in single quotes) ');
    file2 = input('Input file2 name '); else
    file1 = 'mtgrf1';
    file2 = 'mtgrf2';
end;
eval(['load ',',file1,','m']);
eval(['load ',',file2,','m']);
eval(['Y1 = ',',file2,','']);
eval(['Z1 = ',',file1,','']);
Y1 = Y1(:,
Z1 = Z1(:,
Y1 = Y1(:,
Z1 = Z1(:,; % Load the simulation vectors for HTRO
inp = input('the defaults for HTRO are mtgrf3 & mtgrf4 '); if inp == 1
    file3 = input('Input file3 name ');
    file4 = input('Input file4 name '); else
    file3 = 'mtgrf3';
    file4 = 'mtgrf4';
end;
eval(['load ',',file3,','m']);
eval(['load ',',file4,','m']);
eval(['Y2 = ',',file4,','']);
eval(['Z2 = ',',file3,','']);
Y2 = Y2(:,
Z2 = Z2(:,
Y2 = Y2(:,
Z2 = Z2(:,; % Load the simulation vectors for PED
inp = input('the defaults for PED are mtgrf5 & mtgrf6 '); if inp == 1
    file5 = input('Input file5 name ');
    file6 = input('Input file6 name '); else
    file5 = 'mtgrf5';
    file6 = 'mtgrf6';
end;
eval(['load ',',file5,','m']);
eval(['load ',file6,'.m']);
eval(['Y3 = ',file6,';'])
eval(['Z3 = ',file5,';'])
Y3 = Y3';
Z3 = Z3';
Y3 = Y3(:);
Z3 = Z3(:);

pack

% Plotting
plot(XO,Y0,'-','X0,Y0,'x','X0,YOH','-','X0,YOH,'x','X0,Y0C','-','X0,...
Y0C,'x','X,Y1,'-','X,Y2,'-','X,Y3,'--','X,Z1,'--','X,Z2,'--','X,Z3,'--')
title('MONTHLY INCIDENCES')
xlabel('Year')
ylabel('Incidence')
text(.2,.82,11,'sc')
text(.2,.76,12,'sc')
text(.2,.7,13,'sc')
text(.6,.8,'HIV','sc')
text(.7,.4,'AIDS','sc')
pause
ni = input('do you wish to print this?(1 = yes) '); if ni == 1
  print
end;