APPENDIX-2

This first software package is useful to fit the following models to the grouped binary data.

1. Linear logistic model,
2. complementory log log model,
3. log log model.

This package is developed for the data set containing at most thirty observations on each variable. This limit can be extended by making proper changes in the 'DIMENSION' statements. This package is applicable only when the model parameters not exceeding ten.

APPENDIX-2(B)

```
************************************************************************
              *** PROGRAM FOR FITTING BINARY DATA ***
************************************************************************
      PROGRAM   FITBINO
      DIMENSION                    N(30),SUCC(30),PROP(30),ETA(30),P(30),Z(30),W(30,30),
     *          X(30,10),BTA(10),PROPNE(30),ETANEW(30),ZNEW(30),
     *          BTANEW(10),A(10,10),B(10),C(10,10),T2(30)
      CHARACTER          PARA*9,DECI6*1,SELECT1*6,SELECT2*6,SELECT3*6,SELECT4*6
      CHARACTER            CHOICE*4,DECI1*1,DECI2*1,DECI3*1,DECI4*1,DECI5*2,
     *  SEL2*1
      CALL    INITAL(W,X)
      CALL   ENT    (NUM,N,SUCC)
      CALL     PROC1(NUM,IPARA,X)
      WRITE (5,*) 'WHICH MODEL YOU WANT TO FIT ? (with LOGIT or LOGLOG
     *or Complementory LOGlog transformation)'
      WRITE (5,*) 'ENTER LOGIT or LOGLOG or CLOG'
      READ  (5,23)    SELECT1
23     FORMAT   (A6)
22          IF  ((SELECT1. EQ. 'LOGIT')  .OR.    (SELECT1. EQ. 'logit'))  THEN
        CALL                LOGIT1(SELECT1,NUM,N,IPARA,X,SUCC,PROP,BTA,SE,DEV,P)
      ELSE     IF     ((SELECT1. EQ. 'LOGLOG'). OR. (SELECT1. EQ. 'loglog'))      THEN
       CALL                LOGLOG1(SELECT1,NUM,N,IPARA,X,SUCC,PROP,BTA,SE,DEV,P)
      ELSE     IF     ((SELECT1. EQ. 'CLOG'). OR. (SELECT1. EQ. 'clog'))      THEN
       CALL                CLOG1(SELECT1,NUM,N,IPARA,X,SUCC,PROP,BTA,SE,DEV,P)
       ELSE
```

```
            WRITE (5,*) 'ENTER  LOGIT  OR  LOGLOG  OR  CLOG'
            READ  (5,29)    SELECT1
            GOTO  22
          ENDIF
          WRITE (5,*) 'DO YOU WANT TO  FIT  ANY  MODEL  FURTHER  ?  (Y/N)'
          READ  (5,24)    SEL2
24          FORMAT(A1)
26         IF  ((SEL2  .EQ.  'Y'). OR. (SEL2  .EQ.  'y'))  THEN
            WRITE (5,*) 'ENTER  LOGIT  OR  LOGLOG  OR  CLOG'
            READ  (5,29)    SELECT1
            GO TO  22
         ELSE  IF  ((SEL2  .EQ.  'N'). OR. (SEL2  .EQ.  'n'))  THEN
                GO TO  25
             ELSE
                  WRITE (5,*)  'ENTER  Y  OR  N'
               READ  (5,24)    SEL2
               GO TO  26
          ENDIF
25         STOP
          END
*************************************************************************
          SUBROUTINE                EASY(SELECT1,CHOICE,W,X,NUM,N,SUCC,IPARA,P,T2,
         *     PROP,BTA,C)
          DIMENSION                 W(30,30),X(30,10),N(30),SUCC(30),P(30),
         *          T2(30),PROP(30),BTA(10),C(10,10)
          CHARACTER      CHOICE*4,SELECT1*6
108         WRITE(5,*)'ENTER  YOUR  CHOICE  .  .  .  (ME/C/E/L/P/PR/PI/OV)'
          READ(*,109)CHOICE
109         FORMAT(A4)
          IF((CHOICE  .EQ. 'C'). OR. (CHOICE  .EQ.  'c'))  GO  TO  501
          IF((CHOICE  .EQ. 'E'). OR. (CHOICE  .EQ.  'e'))  GO  TO  502
          IF((CHOICE  .EQ. 'L'). OR. (CHOICE  .EQ.  'l'))  GO  TO  503
          IF((CHOICE  .EQ. 'P'). OR. (CHOICE  .EQ.  'p'))  GO  TO  504
          IF((CHOICE  .EQ. 'PR'). OR. (CHOICE  .EQ.  'pr'))  GO  TO  505
          IF((CHOICE  .EQ.  'OV'). OR. (CHOICE  .EQ. 'ov'))  GO  TO  506
          IF((CHOICE  .EQ.  'ME'). OR. (CHOICE  .EQ.  'me'))  GO  TO  507
          IF((CHOICE  .EQ.  'PI'). OR.'(CHOICE  .EQ.  'pi'))  GO  TO  508
          WRITE(5,*)'CORRECT  YOUR  CHOICE'
          GO TO  108
507       CALL  MENU1
          GO TO  108
501         CALL  INITAL(W,X)
          CALL  ENTNUM,N,SUCC)
          GOTO  102
508         CALL  PROC1(NUM,IPARA,X)
          GO TO  108
```

```
502          CALL    EDEET(NUM,N,SUCC,X,IPARA)
         GO TO   108
503          CALL    LEEST(N,SUCC,NUM,X,IPARA)
         GO TO   108
505              CALL       PRI(NUM,SUCC,P,TS,PROP,N,IPARA,BTA,C)
         GOTO   108
504          IF   ((SELECT1. EQ. 'LOGIT')   . OR.      (SELECT1. EQ. 'logit'))      THEN
          CALL                    PROC(SELECT1,X,NUM,N,SUCC,IPARA,PROP,BTA,C,TS,P)
         ELSE      IF       ((SELECT1. EQ. 'LOGLOG'). OR. (SELECT1. EQ. 'loglog'))        THEN
          CALL                    PROC3(SELECT1,X,NUM,N,SUCC,IPARA,PROP,BTA,C,TS,P)
            ELSE
          CALL                    PROC2(SELECT1,X,NUM,N,SUCC,IPARA,PROP,BTA,C,TS,P)
         ENDIF
         GO TO   108
506       RETURN
         END
*************************************************************************************
C   ******* A SUBROUTINE FOR LINEAR LOGISTIC MODEL    **************
*************************************************************************************
         SUBROUTINE                    LOGIT1(SELECT1,NUM,N,IPARA,X,SUCC,PROP,BTA,SE,DEV,P)
         DIMENSION                          N(30),SUCC(30),PROP(30),ETA(30),P(30),Z(30),W(30,30),
     *                   X(30,10),BTA(10),PROPNE(30),ETANEW(30),ZNEW(30),
     *                    BTANEW(10),A(10,10),B(10),C(10,10),TS(30)
         CHARACTER         PARA*9,DECI6*1,SELECT1*6
         CHARACTER                  CHOICE*4,DECI1*1,DECI2*1,DECI3*1,DECI4*1,DECI5*2
         CALL  MENU
         CALL                    EASY(SELECT1,CHOICE,W,X,NUM,N,SUCC,IPARA,P,TS,PROP,BTA,C)
506       RETURN
         END
*************************************************************************************
        SUBROUTINE       INITAL(W,X)
        DIMENSION          W(30,30),X(30,10)
        DO   210    I=1,30
        DO   220    J=1,30
        W(I,J)=0
220      CONTINUE
        DO   230    J=1,10
        X(I,J)=0
230      CONTINUE
210      CONTINUE
        RETURN
        END
*************************************************************************************
        SUBROUTINE     ENT(NUM,N,SUCC)
```

```
      DIMENSION        N(30),SUCC(30)
      WRITE (5,*)'ENTER   THE   TOTAL   NUMBER   OF   SAMPLES'
      READ     (5,*)NUM
      WRITE (5,*)'ENTER   THE   SAMPLE   SIZES   OF   DIFFERENT   SAMPLES'
      READ      (5,*)       (N(I),I=1,NUM)
      WRITE (5,*)'ENTER THE   NUMBER   OF   SUCCESSES   IN   DIFFERENT   SAMPLES'
      READ      (5,*)       (SUCC(I),I=1,NUM)
      DO   121   I=1,NUM
      IF    (    SUCC(I). EQ. FLOAT(N(I))     THEN
          SUCC(I)=          FLOAT(N(I))-0.5
        ELSE
            IF   (SUCC(I). EQ. 0)     THEN
          SUCC(I)=0.5
      END  IF
      ENDIF
121    CONTINUE
      RETURN
      END
C*************************************************************************
       SUBROUTINE              CHECK(NUM,N,SUCC,IPARA,X,T3,EPS,PROP,T2)
       DIMENSION                 N(30),SUCC(30),T3(30),PROP(30),X(30,10)
       CHARACTER       DECI2*1,DECI1*1
       WRITE(5,*)'HAVE YOU GIVEN THE   CHOICE   C   OR   c   ?    (Y/N)'
        READ  (5,99)     DECI2
18              IF   ((DECI2. EQ. 'N'). OR. (DECI2. EQ. 'n'))    THEN
           CALL      ENT(NUM,N,SUCC)
         ELSE    IF      ((DECI2. EQ. 'Y'). OR. (DECI2. EQ. 'y'))       THEN
                GO TO   98
         ELSE
            WRITE (5,*)   'ENTER   Y   OR   N'
         READ(5,99)       DECI2
         GO TO   18
         ENDIF
98      WRITE(5,*)'HAVE YOU   GIVEN   THE   CHOICE   PI   OR   pi   ?   (Y/N)'
         READ   (5,99)     DECI1
99         FORMAT(A1)
98              IF   ((DECI1. EQ. 'N'). OR. (DECI1. EQ. 'n'))    THEN
           CALL      PROC1(NUM,IPARA,X)
         ELSE    IF      ((DECI1. EQ. 'Y'). OR. (DECI1. EQ. 'y'))       THEN
                GO TO   94
         ELSE
            WRITE (5,*)   'ENTER   Y   OR   N'
         READ(5,99)       DECI1
         GO TO   98
         ENDIF
94      DO   200   I=1,NUM
```

```
            PROP(I)=SUCC(I)/FLOAT(N(I))
            T3(I)=PROP(I)
300          CONTINUE
            EPS=.00001
            T2=1
            RETURN
            END
*************************************************************************
           SUBROUTINE                    PROC(SELECT1,X,NUM,N,SUCC,IPARA,PROP,BTA,C,T3,P)
          DIMENSION                          N(30),SUCC(30),PROP(30),ETA(30),P(30),Z(30),W(30,30)
         *,X(30,10),BTA(10),PROPNE(30),ETANEW(30),ZNEW(30),
         *ETANEW(10),A(10,10),B(10),C(10,10),T3(30)
            CHARACTER            DECI1*1,DECI2*1,CHOICE*4,SELECT1*6
             CALL              CHECK(NUM,N,SUCC,IPARA,X,T3,EPS,PROP,T2)
200          DO 20     I=1,NUM
             ETA(I)=ALOG(PROP(I)/(1.0-PROP(I)))
             P(I)=FLOAT(N(I))*PROP(I)*(1.0-PROP(I))
             Z(I)=ETA(I)+(SUCC(I)-FLOAT(N(I))*PROP(I))/P(I)
20           CONTINUE
            DO   110   I=1,NUM
            DO 110     J=1,NUM
            IF(I.NE.J)      THEN
                W(I,J)=0
              ELSE
                W(I,J)=P(I)
              ENDIF
110          CONTINUE
            CALL             COMP(W,X,Z,IPARA,NUM,BTA,ETANEW,A,C)
            DO 160     I=1,NUM
            T=EXP(ETANEW(I))
            PROPNE(I)=T/(1.0+T)
160          CONTINUE
            DO   170   I=1,NUM
            IF((ABS(PROPNE(I)-PROP(I)).GE.EPS).AND.(T2.LT.50))                    THEN
                DO 180     J=1,NUM
                PROP(J)=PROPNE(J)
180              CONTINUE
            T2=T2+1.0
                GO TO  200
            ENDIF
170          CONTINUE
            RETURN
            END
*************************************************************************
           SUBROUTINE  MENU
           WRITE(5,99)
```

```
99              FORMAT(/////29X,'LOGISTIC-REGRESSION-MODELS'/)
          CALL  MENU1
          RETURN
          END
*****************************************************************************
          SUBROUTINE   MENU1
          WRITE(5,98)
98                FORMAT(24X,'CHOICE',19X,'TYPE'/)
          WRITE(5,100)
100            FORMAT(20X,2H1. ,2X,'enter          Cell          frequencies',12X,'C'/)
          WRITE(5,101)
101                    FORMAT(20X,2H2. ,12X,'Edit',22X,'E'/)
          WRITE(5,102)
102                     FORMAT(20X,2H3. ,9X,'Processing',19X,'P'/)
          WRITE(5,103)
103                     FORMAT(20X,2H4. ,10X,'PRinting',20X,'PR'/)
          WRITE(5,104)
104                    FORMAT(20X,2H5. ,12X,'List',22X,'L'/)
          WRITE(5,105)
105                  FORMAT(20X,2H6. ,12X,'OVer'22X,'OV'/)
          WRITE       (5,107)
107                 FORMAT(20X,'8. ',1X,'enter     number     of       Parameters',11X,'PI'/)
          WRITE       (5,108)
108            FORMAT(28X,'and     Incidense      matrix'/)
          WRITE(5,106)
106                   FORMAT(20X,2H7. ,12X,'MENU',21X,'ME'/)
          RETURN
          END
*****************************************************************************
505               SUBROUTINE      PRI(NUM,SUCC,P,T2,PROP,N,IPARA,BTA,C)
          DIMENSION                              BTA(10),C(10,10),SUCC(30),T2(30),PROP(30),N(30),P(30)
          CHARACTER       PARA*9,DECI5*2
          WRITE(5,*)'DO  YOU   WANT   THE   OUT-PUT   ON   SCREEN   OR   PRINTER   ?(S/PRI
          READ   (*,243)      DECI5
243         FORMAT(A2)
244           IF     ((DECI5. EQ. 'S'). OR. (DECI5. EQ. 's'))       THEN
              MOOD=5
          ELSE       IF      ((DECI5. EQ. 'PRI'). OR. (DECI5. EQ. 'pri'))        THEN
                     MOOD=6
          ELSE
                WRITE(*,*)'ENTER   S   OR      PRI'
                READ   (*,243)      DECI5
                GO  TO   244
          ENDIF
          IF     (MOOD. EQ. 6)     OPEN      (6,FILE='PRN')
          DO   192   I=1,NUM
```

```
      WRITE(MOOD,*)          T3(I),PROP(I)
192    CONTINUE
       S1=0
       S2=0
       S3=0
       DO 360    I=1,NUM
       S1=S1+SUCC(I)*ALOG(T3(I)/PROP(I))
       S2=S2+(FLOAT(N(I))-SUCC(I))*ALOG((1.0-T3(I))/(1.0-PROP(I)))
       S3=S3+(FLOAT(N(I))*(T3(I)-PROP(I)))**2/P(I)
360    CONTINUE
       DEV=2.0*(S1+S2)
       WRITE      (MOOD,*)'_____________________________________________'
       WRITE      (MOOD,901)
901          FORMAT(5HSR. NO,1X,1H|,2X,8HESTIMATE,2X,1H|,14HSTANDARD      ERROR,
     *       1X,1H|,9HPARAMETER,1H|)
       WRITE      (MOOD,*)'_____________________________________________'
       DO  230    I=1,IPARA
       WRITE      (5,105)I
105    FORMAT (24HENTER CODE FOR PARAMETER,I2,2X,22HUSING ATMOST 9 LETT
     *RS)
       READ (5,103)    PARA
103      FORMAT(A9)
       WRITE        (MOOD,902)          I-1,BTA(I),(C(I,I))**0.5,
     *PARA
230    CONTINUE
      WRITE      (MOOD,*)'_____________________________________________'
902                FORMAT          (2X,I2,2X,1H|,1X,F12.7,1X,1H|,1X,E12.5,1X,1H|,A9,1H|/)
       WRITE(MOOD,904)DEV
904        FORMAT(10X,11HDEVIANCE   =    ,F12.7)
       RETURN
       END
*************************************************************************
       SUBROUTINE          EDEET(NUM,N,SUCC,X,IPARA)
       DIMENSION           N(30),SUCC(30),X(30,10)
       CHARACTER                DECI1*1,DECI2*1,DECI3*1,DECI4*1,DECI5*1,DECI6*1
       WRITE(5,*)'HAVE YOU GIVEN THE CHOICE C OR c ? (Y/N)'
       READ (5,99)    DECI6
18          IF ((DECI6.EQ.'N').OR.(DECI6.EQ.'n'))  THEN
            CALL      ENT(NUM,N,SUCC)
          ELSE    IF      ((DECI6.EQ.'Y').OR.(DECI6.EQ.'y')      THEN
              GO TO  93
          ELSE
              WRITE (5,*)  'ENTER  Y  OR  N'
          READ(5,99)      DECI6
          GO TO  18
          ENDIF
```

```
95      WRITE(5,*)'HAVE   YOU   GIVEN   ANY   OF   THE   CHOICES   (PI/L/P)   ?   (Y/N)'
          READ   (5,99)     DECI5
99          FORMAT(A1)
98               IF   ((DECI5. EQ. 'N'). OR. (DECI5. EQ. 'n'))    THEN
             CALL      PROC1(NUM,IPARA,X)
            ELSE    IF      ((DECI5. EQ. 'Y'). OR. (DECI5. EQ. 'y'))       THEN
                  GO TO  94
            ELSE
                WRITE (5,*)   'ENTER   Y   OR   N'
            READ(5,99)       DECI5
            GO TO  98
            ENDIF
94      WRITE (5,*)'DO YOU WANT TO CHANGE   TOTAL   NUMBER   OF   SAMPLES    ?(Y/N
          READ   (5,701)      DECI1
701       FORMAT(A1)
700         IF    ((DECI1. EQ. 'Y'). OR. (DECI1. EQ. 'y'))      THEN
            WRITE      (5,702)NUM
702         FORMAT('THE   CURRENT   NUMBER   OF   SAMPLES   IS',2X,I2)
            WRITE(5,*)'ENTER   TOTAL   NUMBER   OF    SAMPLES'
            READ   (5,*)   NUM
          ELSE       IF         ((DECI1. EQ. 'N'). OR. (DECI1. EQ. 'n'))THEN
                   GO TO  702
                 ELSE
                  WRITE   (5,*)'ENTER   Y   OR   N'
                  READ   (5,701)      DECI1
                  GO TO  700
          ENDIF
702       WRITE (5,*)'DO YOU WANT TO   CHANGE   ANY   SAMPLE   SIZE   ?    (Y/N)'
          READ   (5,701)      DECI2
704           IF     ((DECI2. EQ. 'Y'). OR. (DECI2. EQ. 'y'))      THEN
             WRITE (5,*)'SAMPLE SIZE OF WHICH SAMPLE   YOU   WANT   TO   CHANGE    ?'
             READ   (5,*)    I
             WRITE     (5,705)       I,N(I)
705            FORMAT   ('THE   CURRENT   SAMPLE   SIZE   OF   THE   SAMPLE',I2,'IS',2X,
     *   I5,/)
             WRITE (5,*)   'ENTER   THE   CORRECTED   SAMPLE    SIZE'
             READ   (5,*)      N(I)
          ELSE       IF         ((DECI2. EQ. 'N'). OR. (DECI2. EQ. 'n'))THEN
                   GO TO  706
                 ELSE
                  WRITE   (5,*)'ENTER   Y   OR   N'
                  READ   (5,701)      DECI2
                  GO TO  704
          ENDIF
          GO TO  702
706       WRITE (5,*)'DO YOU WANT TO CHANGE   THE   NUMBER   OF   SUCCESSES   CORRES
```

```
      * NDING TO ANY   SAMPLE   ?   (Y/N)'
        READ   (5,701)      DECI3
707          IF     ((DECI3. EQ. 'Y'). OR. (DECI3. EQ. 'y'))      THEN
             WRITE (5,*)'SUCCESES OF WHICH SAMPLE   YOU   WANT   TO   CHANGE   ?'
             READ   (5,*)    I
             WRITE     (5,708)       I,SUCC(I)
708          FORMAT   ('THE   CURRENT   SUCCESSES   OF   THE    SAMPLE',I2,2X,'IS',F8. 2/)
             WRITE   (5,*)   'ENTER   THE   CORRECTED   SUCCESSES'
             READ (5,*)          SUCC(I)
        ELSE        IF         ((DECI3. EQ. 'N'). OR. (DECI3. EQ. 'n'))THEN
                 GO TO   711
                ELSE
                 WRITE   (5,*)'ENTER   Y   OR   N'
                 READ   (5,701)      DECI3
                 GO TO   707
        ENDIF
        GO TO   706
711     WRITE (5,*)'DO YOU WANT TO CHANGE   ANY   ELEMENT   OF   THE   INCIDENSE   M
      *   RIX    ?(Y/N)'
        READ   (5,701)      DECI4
712          IF     ((DECI4. EQ. 'Y'). OR. (DECI4. EQ. 'y'))     THEN
             WRITE (5,*)'WHICH ELEMENT OF THE MATRIX   YOU   WANT   TO   CHANGE    ?'
             WRITE      (5,60)
60            FORMAT(/)
             WRITE (5,*)'ENTER ROW   NUMBER   AND   COLUMN   NUMBER   SERIALLY'
             READ   (5,*)     I,J
             WRITE      (5,714)        I,J,X(I,J)
714                  FORMAT   ('THE   CURRENT   X(',I2,',',I2,')   =     ',F10. 4)
             WRITE   (5,*)   'ENTER   THE   CORRECTED   ELEMENT'
             READ     (5,*)      X(I,J)
          ELSE        IF         ((DECI4. EQ. 'N'). OR. (DECI4. EQ. 'n'))THEN
                 GO TO   715
                ELSE
                 WRITE   (5,*)'ENTER   Y   OR   N'
                 READ   (5,701)      DECI4
                 GO TO   712
        END   IF
        GO TO   711
715      RETURN
        END
*************************************************************************
        SUBROUTINE          LEEST(N,SUCC,NUM,X,IPARA)
        DIMENSION            N(30),SUCC(30),X(30,10)
        CHARACTER            DECI5*5,DECI1*1,DECI2*1,DECI3*1
        WRITE(5,*)'HAVE YOU GIVEN THE   CHOICE   C   OR   c   ?    (Y/N)'
         READ   (5,99)      DECI3
```

```
10              IF   ((DECI3. EQ. 'N'). OR. (DECI3. EQ. 'n'))    THEN
              CALL      ENT(NUM,N,SUCC)
            ELSE    IF      ((DECI3. EQ. 'Y'). OR. (DECI3. EQ. 'y'))      THEN
                  GO TO  98
            ELSE
                WRITE (5,*)  'ENTER   Y   OR   N'
            READ(5,99)      DECI3
            GO TO  10
            ENDIF
98        WRITE(5,*)'HAVE YOU  GIVEN  THE  CHOICE  PI  OR  pi  ?  (Y/N)'
            READ  (5,99)     DECI1
99           FORMAT(A1)
98              IF   ((DECI1. EQ. 'N'). OR. (DECI1. EQ. 'n'))    THEN
              CALL       PROC1(NUM,IPARA,X)
            ELSE    IF      ((DECI1. EQ. 'Y'). OR. (DECI1. EQ. 'y'))      THEN
                  GO TO  711
            ELSE
                WRITE (5,*)  'ENTER   Y   OR   N'
            READ(5,99)      DECI1
            GO TO  98
            ENDIF
711       WRITE (5,*)'DO   YOU   WANT   ANY  LIST   ?  '  (Y/N)'
           READ(5,701)DECI2
701          FORMAT(A1)
700            IF     ((DECI2. EQ. 'Y'). OR. (DECI2. EQ. 'y'))     THEN
           WRITE   (5,*)'WHICH   LIST   YOU   WANT?  (sample   SIZES      /SUCcesses/INCI
      *   ense      matrix)'
          READ(5,702)DECI3
702          FORMAT(A5)
708                 IF((DECI3. EQ. 'SIZES'). OR. (DECI3. EQ. 'sizes'))     THEN
           WRITE       (5,715)
715             FORMAT   ('SAMPLE   NO. '2X,'SIZES')
           DO   710   I=1,NUM
           WRITE     (5,703)       I,N(I)
710          CONTINUE
703             FORMAT   (4X,I2,5X,I5)
         ELSE      IF      ((DECI3. EQ. 'SUC'). OR. (DECI3. EQ. 'suc'))      THEN
                WRITE       (5,716)
716                FORMAT   ('SAMPLE    NO. '2X,'SUCCESSES')
                DO 704     I=1,NUM
                WRITE     (5,712)        I,SUCC(I)
704              CONTINUE
712              FORMAT    (4X,I2,5X,F8. 2)
              ELSE      IF      ((DECI3. EQ. 'INCI'). OR. (DECI3. EQ. 'inci'))        THEN
                DO 705    I=1,NUM
                DO   707   J=1,IPARA
```

```
                WRITE    (5,*)      X(I,J)
707              CONTINUE
705              CONTINUE
          ELSE
          WRITE (5,*)'ENTER   SIZES   OR   SUC   OR   INCI'
          READ   (5,702)     DECI5
          GO TO   708
          ENDIF
          ELSE        IF         ((DECI2. EQ. 'N'). OR. (DECI2. EQ. 'n'))THEN
          GO TO   712
                  ELSE
                   WRITE   (5,*)'ENTER   Y   OR   N'
                   READ   (5,701)      DECI2
                   GO TO   700
          ENDIF
          GO TO   711
712        RETURN
          END
*************************************************************************
          SUBROUTINE        PROC1(NUM,IPARA,X)
          DIMENSION       X(30,10)
          WRITE(5,*)'ENTER THE NUMBER   OF   PARAMETERS   IN   THE    MODEL'
          READ(5,*)       IPARA
          WRITE(5,*)'ENTER   THE   INCIDENSE   MATRIX   ROW     WISE'
          READ(5,*)                    ((X(I,J),J=1,IPARA),I=1,NUM)
          RETURN
          END
*************************************************************************
          SUBROUTINE              COMP(W,X,Z,IPARA,NUM,BTA,ETANEW,A,C)
          DIMENSION                        A(10,10),W(30,30),X(30,10),Z(30),BTA(10),
      *           B(10),ETANEW(30),C(10,10)
          DO   120     J=1,IPARA
          DO   120     K=1,IPARA
          A(J,K)=0
          DO   130    I=1,NUM
          A(J,K)=A(J,K)+W(I,I)*X(I,J)*X(I,K)
          A(K,J)=A(J,K)
130        CONTINUE
120        CONTINUE
          DO   140     J=1,IPARA
          B(J)=0
          DO  150     K=1,NUM
          B(J)=X(K,J)*W(K,K)*Z(K)+B(J)
150        CONTINUE
140        CONTINUE
          CALL        AINV(A,IPARA,C)
```

```
      DO   220    I=1,IPARA
      BTA(I)=0
      DO   220    J=1,IPARA
      BTA(I)=BTA(I)+C(I,J)*B(J)
220    CONTINUE
      DO  350     I=1,NUM
      ETANEW(I)=0
      DO   350    J=1,IPARA
      ETANEW(I)=ETANEW(I)+X(I,J)*BTA(J)
350    CONTINUE
      RETURN
      END
*************************************************************************
      SUBROUTINE        AINV(A,IPARA,C)
      DIMENSION          A(10,10),C(10,10)
      N=IPARA
      DO  10     I=1,N
      DO  10     J=1,N
      IF   (I. EQ. J)    THEN
       C(I,J)=1
      ELSE
         C(I,J)=0
      ENDIF
10     CONTINUE
      DO   160   I=1,N
      T=A(I,I)
      DO   170   J=1,N
      C(I,J)=C(I,J)/A(I,I)
170    CONTINUE
      DO  270     J=1,N
      A(I,J)=A(I,J)/T
270    CONTINUE
      DO  180     K=1,N
      IF  (K. EQ. I)   GOTO    180
         T1=A(K,I)
         DO  190     M=1,N
            C(K,M)=C(K,M)-T1*C(I,M)
            A(K,M)=A(K,M)-T1*A(I,M)
190    CONTINUE
180    CONTINUE
160    CONTINUE
      RETURN
      END
*************************************************************************
C     ***** A SUBROUTINE FOR COMPLMENTORY LOG LOG MODEL  ******
*************************************************************************
```

```
      SUBROUTINE                    CLOG1(SELECT1,NUM,N,IPARA,X,SUCC,PROP,BTA,SE,DEV,P)
      DIMENSION                          N(30),SUCC(30),PROP(30),ETA(30),P(30),Z(30),W(30,30),
     *                    X(30,10),BTA(10),PROPNE(30),ETANEW(30),ZNEW(30),T4(30),
     *                  BTANEW(10),A(10,10),B(10),C(10,10),T3(30)
      DOUBLE   PRECISION   T,Q
      CHARACTER       PARA*9,DECI6*1,CHOICE*4,SELECT1*6
      CHARACTER            DECI1*1,DECI2*1,DECI3*1,DECI4*1,DECI5*1
      CALL  MENU2
      CALL              EASY(SELECT1,CHOICE,W,X,NUM,N,SUCC,IPARA,P,T3,
     *    PROP,BTA,C)
506    RETURN
      END
*************************************************************************
      SUBROUTINE                    PROC2(SELECT1,X,NUM,N,SUCC,IPARA,PROP,BTA,C,T3,P)
      DIMENSION                          N(30),SUCC(30),PROP(30),ETA(30),P(30),Z(30),W(30,30)
     *,X(30,10),BTA(10),PROPNE(30),ETANEW(30),ZNEW(30),
     *                  BTANEW(10),A(10,10),B(10),C(10,10),T3(30)
      CHARACTER        DECI1*1,DECI2*1,SELECT1*6
      CALL             CHECK(NUM,N,SUCC,IPARA,X,T3,EPS,PROP,T2)
      T2=0
200   DO  20   I=1,NUM
      IF      (PROP(I). GT. (1. 0-0. 1E-5))       THEN
          PROP(I)=1. 0-0. 1E-5
        ELSE   IF     (PROP(I). LT. 0. 1E-5)     THEN
             PROP(I)=0. 1E-5
      ENDIF
      T45=         ALOG(1. 0-PROP(I))
      ETA(I)=ALOG(-T45)
      Z(I)=ETA(I)-(T3(I)-PROP(I))/
     *            ((1. 0-PROP(I))*ALOG(1. 0-PROP(I)))
20     CONTINUE
      DO   110   I=1,NUM
      DO  110     J=1,NUM
      IF(I. NE. J)      THEN
           W(I,J)=0
        ELSE
           W(I,J)=FLOAT(N(I))*(1. 0-PROP(I))*(ALOG(1. 0-PROP(I)))**2
     *    /PROP(I)
        ENDIF
110    CONTINUE
      CALL            COMP(W,X,Z,IPARA,NUM,BTA,ETANEW,A,C)
      DO  160     I=1,NUM
      IF     (ETANEW(I). GT. 3)     THEN
           ETANEW(I)=3. 0
      ELSE   IF    (ETANEW(I). LT. -3)      THEN
            ETANEW(I)=-3. 0
```

```
          ENDIF
          T34=EXP(ETANEW(I))
          PROPNE(I)=1. 0-EXP(-T34)
160        CONTINUE
          T2=T2+1. 0
          DO   170   I=1,NUM
          IF((ABS(PROPNE(I)-PROP(I)). GE. EPS). AND. (T2. LT. 500))                THEN
               DO 180    J=1,NUM
               PROP(J)=PROPNE(J)
180             CONTINUE
               GO TO  200
          ENDIF
170        CONTINUE
          DO   171   I=1,NUM
171                 P(I)=FLOAT(N(I))*PROP(I)*(1. 0-PROP(I))
          RETURN
          END
*************************************************************************
          SUBROUTINE   MENU3
          WRITE(5,99)
99           FORMAT(/////25X,'MODEL   WITH   LOGLOG   TRANSFORMATION'/)
          CALL  MENU1
          RETURN
          END
*************************************************************************
          SUBROUTINE   MENU2
          WRITE(5,99)
99          FORMAT(/////25X, MODEL   WITH   COMPLEMENTORY   LOGLOG   TRANSFORMATION'
         *)
          CALL  MENU1
          RFTURN
          END
*************************************************************************
C          ***A***   A SUBROUTINE FOR LOGLOG MODEL      *******
*************************************************************************
          SUBROUTINE                    LOGLOG1(SELECT1,NUM,N,IPARA,X,SUCC,PROP,BTA,SE,DEV,P)
          DIMENSION                          N(30),SUCC(30),PROP(30),ETA(30),P(30),Z(30),W(30,30),
     *                         X(30,10),BTA(10),PROPNE(30),ETANEW(30),ZNEW(30),T4(30),
     *                        BTANEW(10),A(10,10),B(10),C(10,10),T3(30)
          DOUBLE   PRECISION   T,Q
          CHARACTER     PARA*9,DECI6*1      ,SELECT1*6
          CHARACTER              CHOICE*4,DECI1*1,DECI2*1,DECI3*1,DECI4*1,DECI5*2
          CALL  MENU3
          CALL                    EASY(SELECT1,CHOICE,W,X,NUM,N,SUCC,IPARA,P,T3,PROP,BTA,C)
504             IF((CHOICE. EQ. 'P'). OR. (CHOICE. EQ. 'p'))      THEN
```

```
          CALL                    PROC3(SELECT1,X,NUM,N,SUCC,IPARA,PROP,BTA,C,T3,P)
         ELSE
             IF((CHOICE.EQ.'OV').OR.(CHOICE.EQ.'ov'))      , GOTO         506
         ENDIF
         CALL                    EASY(SELECT1,CHOICE,W,X,NUM,N,SUCC,IPARA,P,T3,PROP,BTA,C)
506      RETURN
         END
*********************************************************************************
         SUBROUTINE                    PROC3(SELECT1,X,NUM,N,SUCC,IPARA,PROP,BTA,C,T3,P)
        DIMENSION                        N(30),SUCC(30),PROP(30),ETA(30),P(30),Z(30),W(30,30)
       *,X(30,10),BTA(10),PROPNE(30),ETANEW(30),ZNEW(30),
       *                    BTANEW(10),A(10,10),B(10),C(10,10),T3(30)
         CHARACTER          DECI1*1,DECI2*1,SELECT1*6
         CALL               CHECK(NUM,N,SUCC,IPARA,X,T3,EPS,PROP,T2)
         T2=0
200      DO 20    I=1,NUM
         IF      (PROP(I).GT.(1.0-0.1E-5))       THEN
             PROP(I)=1.0-0.1E-5
         ELSE   IF     (PROP(I).LT.0.1E-5)     THEN
                 PROP(I)=0.1E-5
         ENDIF
         T45=        ALOG(PROP(I))
         ETA(I)=-ALOG(-T45)
         Z(I)=ETA(I)-(T3(I)-PROP(I))/
     *             ((PROP(I)*ALOG(PROP(I)))
20        CONTINUE
         DO   110    I=1,NUM
         DO 110     J=1,NUM
         IF(I.NE.J)      THEN
               W(I,J)=0
         ELSE
               W(I,J)=FLOAT(N(I))*(PROP(I))*(ALOG(PROP(I)))**2
      *        /(1.0-PROP(I))
         ENDIF
110       CONTINUE
         CALL              COMP(W,X,Z,IPARA,NUM,BTA,ETANEW,A,C)
         DO 160     I=1,NUM
         IF     (ETANEW(I).GT.3)     THEN
               ETANEW(I)=3.0
         ELSE   IF   (ETANEW(I).LT.-3)      THEN
                ETANEW(I)=-3.0
         ENDIF
         T34=EXP(-ETANEW(I))
         PROPNE(I)=EXP(-T34)
160       CONTINUE
         DO   170    I=1,NUM
```

```
      IF((ABS(PROPNE(I)-PROP(I)). GE. EPS). AND. (T2. LT. 500))          THEN
            DO 180     J=1,NUM
            PROP(J)=PROPNE(J)
180          CONTINUE
            GO TO  200
      ENDIF
170    CONTINUE
      DO   171    I=1,NUM
171                  P(I)=FLOAT(N(I))*PROP(I)*(1. 0-PROP(I))
      RETURN
      END
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
```

This second software is useful to fit the log linear model by Bishop's (1969) approach. This package is developed for three way contingency table with all non zero configurations. This package permits at most seven levels ofthe three factors. This package is also useful to fit log linear model by Nelder & Wedderburn's (1972) approach for the two way contingency tble only.

****

APPENDIX-2(B)

```
**********************************************************************
C          *** PROGRAM OF MODEL FITTING FOR POISSON DATA ***
**********************************************************************
      PROGRAM   FITPOI
      DIMENSION                    EST0(7,7,7),EST(7,7,7),EST1(7,7,7)
     *                            ,EST2(7,7,7),EST3(7,7,7),EST012(7,7),EST113(7,7),EST223(7,7,7)
     *                           ,EST312(7,7,7),SUM1(7),SUM2(7),SUM3(7),SUM12(7,7),SUM13(7,7)
     *                            ,SUM23(7,7),EST4(7,7,7),EST5(7,7,7),EST6(7,7,7),EST7(7,7,7)
     *,EST8(7,7,7),EST9(7,7,7),EST10(7,7,7),EST11(7,7,7),EST12(7,7,7)
     *,EST13(7,7,7),EST14(7,7,7),EST15(7,7,7),
     *                 PROP(30),ETA(30),P(30),Z(30),W(30,30),
     *                     X(30,10),BTA(10),PROPNE(30),ETANEW(30),Y(30),T3(30),
     *                     BTANEW(10),A(10,10),B(10),C(10,10),X1(10,10,10)
      CHARACTER          CHOICE*4,DECI*1,RESULT*8,SELECT1*6,SEL2*1
      CALL     INITI(X1)
      CALL       DIMEN(I1,J1,K1)
      CALL        GETDAT(X1,I1,J1,K1)
      WRITE (5,*) 'WHICH  MODEL  YOU  WANT  TO  FIT  ?  (LOG  LINear/Generalis
     *d  Linear  Model)'
      WRITE (5,*)  'ENTER  LOGLIN  OR  GLM'
      READ  (5,23)    SELECT1
23     FORMAT  (A6)
22       IF  ((SELECT1  .EQ.  'LOGLIN')  .OR.  (SELECT1  .EQ.  'loglin'))  THEN
             CALL            LOGL(X1,I1,J1,K1,SUM1,SUM2,SUM3,SUM12,SUM13
     *     ,SUM23,EST,G1)
      ELSE  IF  ((SELECT1  .EQ.  'GLM')  .OR.  (SELECT1  .EQ.  'glm'))  THEN
             CALL            STBETA(I1,J1,X1,IPARA,BTA,C,DEV)
       ELSE
          WRITE (5,*)  'ENTER  LOGLIN  OR  GLM'
```

```
            READ   (5,29)     SELECT1
            GOTO   22
          ENDIF
          WRITE (5,*) 'DO YOU WANT TO   FIT   ANY   MODEL   FURTHER   ?   (Y/N)'
          READ   (5,24)    SEL2
24          FORMAT(A1)
26         IF   ((SEL2   .EQ.   'Y'). OR. (SEL2   .EQ.   'y'))    THEN
            WRITE (5,*)   'ENTER   LOGLIN   OR    GLM'
            READ   (5,29)     SELECT1
            GO TO   22
          ELSE   IF   ((SEL2   .EQ.   'N'). OR. (SEL2   .EQ.   'n'))    THEN
                GO TO   25
             ELSE
                  WRITE (5,*)   'ENTER   Y   OR   N'
               READ   (5,24)    SEL2
               GO TO   26
          ENDIF
25         STOP
          END
*************************************************************************
          SUBROUTINE       INITI(X1)
          DIMENSION        X1(10,10,10)
          DO   5   I=1,10
          DO 5     J=1,10
          DO 5     K=1,10
          X1(I,J,K)=0
5          CONTINUE
          RETURN
          END
*************************************************************************
C         SUBROUTINE FOR FITTING GLM TO THE POISSON DATA
*************************************************************************
          SUBROUTINE            STBETA(NUM,N,X1,IPARA,BTA,C,DEV)
          DIMENSION                   PROP(30),ETA(30),P(30),Z(30),W(30,30),
      *                        X(30,10),BTA(10),PROPNE(30),ETANEW(30),Y(30),T2(30),
      *                      BTANEW(10),A(10,10),B(10),C(10,10),X1(7,7,7)
          T2=1
          CALL      INITAL(W,X)
          NU=N*NUM
          WRITE   (*,*)    NU
          K=1
          DO 3    I=1,NUM
          DO 3    J=1,N
          Y(K)    =      X1(I,J,1)
          K=K+1
```

```
9          CONTINUE
           DO 290     I=1,NUM
           PROP(I)=0
           DO     300      J=(I-1)*N+1,I*N
           PROP(I)=PROP(I)+Y(J)
300        CONTINUE
           PROP(I)=PROP(I)/N
           T3(I)=PROP(I)
290        CONTINUE
           DO 280     I=1,NUM
           IF     (PROP(I). EQ. 0)        PROP(I)=0. 5/N
280        CONTINUE
           WRITE(*,*)'ENTER THE NUMBER   OF   PARAMETERS   IN   THE    MODEL'
           READ(*,*)      IPARA
           WRITE(*,*)'ENTER   THE   INCIDENSE   MATRIX   ROW     WISE'
           READ(*,*)                    ((X(I,J),J=1,IPARA),I=1,NU)
           EPS=. 00001
           DO 320     I=1,NUM
           DO     310      K=(I-1)*N+1,I*N
310             PROP(k)=T3(I)
320        CONTINUE
200       DO   20   I=1,NU
           ETA(I)=ALOG(PROP(I))
           P(I)=PROP(I)
           Z(I)=ETA(I)+(Y(I)-PROP(I))/P(I)
20         CONTINUE
           DO   110    I=1,NU
           DO   110    J=1,NU
           IF(I. NE. J)      THEN
                 W(I,J)=0
             ELSE
                W(I,J)=P(I)
            ENDIF
110          CONTINUE
            DO   120     J=1,IPARA
            DO   120     K=1,IPARA
            A(J,K)=0
            DO   130    I=1,NU
            A(J,K)=A(J,K)+W(I,I)*X(I,J)*X(I,K)
            A(K,J)=A(J,K)
130          CONTINUE
120          CONTINUE
            DO   140     J=1,IPARA
            B(J)=0
             DO 150     K=1,NU
            B(J)=X(K,J)*W(K,K)*Z(K)+B(J)
```

```
150          CONTINUE
140          CONTINUE
             CALL        AINV(A,IPARA,C)
             DO    220     I=1,IPARA
             BTA(I)=0
             DO    220     J=1,IPARA
             BTA(I)=BTA(I)+C(I,J)*B(J)
220          CONTINUE
              DO  950     I=1,NU
             ETANEW(I)=0
             DO    950     J=1,IPARA
             ETANEW(I)=ETANEW(I)+X(I,J)*BTA(J)
950          CONTINUE
             DO    160     I=1,NU
             PROPNE(I)=EXP(ETANEW(I))
160          CONTINUE
             DO    170     I=1,NU
             IF(((ABS(PROPNE(I)-PROP(I)). GE. EPS)). AND. (T2. LT. 50))                    THEN
C            IF    (T2. LT. 50)     THEN
                  DO  180     J=1,NU
                  PROP(J)=PROPNE(J)
180               CONTINUE
             T2=T2+1. 0
             WRITE(*,*)       T2
                 GO TO   200
             ENDIF
170          CONTINUE
             DO    230     I=1,IPARA
             WRITE       (*,900)         (I-1),BTA(I)
900               FORMAT(6HBETA    (,I2,)    =     ',F10. 4)
230          CONTINUE
            S1=0
            S2=0
            DO    932     I=1,NU
            PROP(I)=PROPNE(I)
            WRITE       (5,*)          I,Y(I),PROP(I)
            S1=S1+(Y(I)*ALOG(Y(I)/PROP(I)))
            S2=S2+(Y(I)-PROP(I))
932          CONTINUE
            DEV=2. 0*(S1+S2)
            WRITE(*,910)       DEV
910           FORMAT(11HDEVIANCE    =     ,F12. 4)
             RETURN
            END
*************************************************************************
          SUBROUTINE        AINV(A,IPARA,C)
```

```
      DIMENSION          A(10,10),C(10,10)
      N=IPARA
      DO 10     I=1,N
      DO 10     J=1,N
      IF   (I.EQ.J)    THEN
         C(I,J)=1
       ELSE
          C(I,J)=0
      ENDIF
10     CONTINUE
      DO   160   I=1,N
      T=A(I,I)
      DO   170   J=1,N
      C(I,J)=C(I,J)/A(I,I)
170    CONTINUE
      DO 270     J=1,N
      A(I,J)=A(I,J)/T
270    CONTINUE
      DO 180     K=1,N
      IF (K.EQ.I)   GOTO    180
          T1=A(K,I)
          DO 190     M=1,N
             C(K,M)=C(K,M)-T1*C(I,M)
             A(K,M)=A(K,M)-T1*A(I,M)
190      CONTINUE
180      CONTINUE
160    CONTINUE
      RETURN
      END
*****************************************************************
      SUBROUTINE       INITAL(W,X)
      DIMENSION          W(30,30),X(30,10)
      DO   210   I=1,30
      DO   220   J=1,30
      W(I,J)=0
220    CONTINUE
      DO   230   J=1,10
230      X(I,J)=0
210    CONTINUE
      RETURN
      END
*****************************************************************
C     ***     SUBROUTINE FOR FITTING LOG LINEAR MODEL     ***
*****************************************************************
       SUBROUTINE              LOGL(X1,I1,J1,K1,SUM1,SUM2,SUM3,SUM12,SUM13
```

```
*       ,SUM29,EST,G1)
      DIMENSION                              X1(7,7,7),EST0(7,7,7),EST(7,7,7),EST1(7,7,7),
     *                                  EST2(7,7,7),EST9(7,7,7),EST012(7,7),EST119(7,7),EST229(7,7,7)
     *                                ,EST912(7,7,7),SUM1(7),SUM2(7),SUM3(7),SUM12(7,7),SUM19(7,7)
     *                                  ,SUM29(7,7),EST4(7,7,7),EST5(7,7,7),EST6(7,7,7),EST7(7,7,7)
     *,EST8(7,7,7),EST9(7,7,7),EST10(7,7,7),EST11(7,7,7),EST12(7,7,7)
     *,EST13(7,7,7),EST14(7,7,7),EST15(7,7,7)
      CHARACTER          CHOICE*4,DECI*1,RESULT*9
      WRITE(*,62)
62          FORMAT(/ / / / / / / / / / / / / / / /)
      WRITE(*,*)'FOR   MENU   ENTER     ME'
      WRITE(*,61)
61        FORMAT(/,/)
      WRITE(*,*)' TO INPUT DATA . .   .   ENTER   C   OR    c'
      WRITE(*,61)
108     WRITE(5,*) ENTER   YOUR   CHOICE   .   .   .    (ME/C/E/L/P/PR/OV)'
      READ(*,109)CHOICE
109       FORMAT(A4)
      IF((CHOICE   .EQ. 'C'). OR. (CHOICE   .EQ.   'c'))  GO    TO     501
      IF((CHOICE   .EQ. 'E'). OR. (CHOICE   .EQ.   'e'))  GO    TO     502
      IF((CHOICE   .EQ. 'L'). OR. (CHOICE   .EQ.   'l'))  GO    TO     503
      IF((CHOICE   .EQ. 'P'). OR. (CHOICE   .EQ.   'p'))  GO    TO     504
      IF((CHOICE   .EQ. 'PR'). OR. (CHOICE   .EQ.   'pr'))  GO    TO     505
      IF((CHOICE   .EQ.   'OV'). OR. (CHOICE   .EQ. 'ov'))  GO    TO     506
      IF((CHOICE   .EQ.   'ME'). OR. (CHOICE   .EQ.   'me'))  GO  TO     507
      WRITE(*,*) CORRECT    YOUR      CHOICE'
      GO TO  108
507     CALL  MENU
      GO TO  108
501             CALL       INTIAL(X1,EST,EST1,EST2,EST3,EST4,EST5,EST6,EST012,
     *              EST119,EST229,EST0,EST912,SUM1,SUM2,SUM3,SUM12,SUM19,SUM29
     *                ,EST7,EST8,EST9,EST10,EST11,EST12,EST13,EST14,EST15)
C          CALL    DIMEN(I1,J1,K1)
C           CALL    GETDAT(X1,I1,J1,K1)
      GO TO  108
502        CALL    EDEET(X1,I1,J1,K1)
      GO TO  108
503        CALL    LEEST(X1,I1,J1,K1)
      GO TO  108
504             CALL     SUMM(X1,SUM,SUM1,SUM2,SUM3,SUM12,SUM19,SUM29,I1,J1,K1)
      G1=0
      CALL              ESTI(X1,I1,J1,K1,EST,SUM12,SUM19,SUM29)
      CALL          CALG(X1,EST,I1,J1,K1,G)
      ID=(I1-1)*(J1-1)*(K1-1)
      CALL      TESTING(ID,GTAB)
      IF(G. GE. GTAB)  GO   TO   999
```

```
      CALL              REPLACE(I1,J1,K1,EST,G1,EST,G)
      CALL                ESTI1(I1,J1,K1,SUM19,SUM28,SUM3,EST1)
      CALL              CALG(X1,EST1,I1,J1,K1,G)
      ID1=ID+(I1-1)*(J1-1)
      CALL        TESTING(ID1,GTAB)
      IF(G. GE. GTAB) GO    TO     400
      CALL              REPLACE(I1,J1,K1,EST1,G1,EST,G)
      CALL              ESTI2(I1,J1,K1,SUM28,EST2)
      CALL              CALG(X1,EST2,I1,J1,K1,G)
      ID2=ID1+(I1-1)
      CALL        TESTING(ID2,GTAB)
      IF(G. GE. GTAB) GO    TO     401
      CALL              REPLACE(I1,J1,K1,EST2,G1,EST,G)
      CALL            ESTI3(I1,J1,K1,SUM3,EST3)
      CALL              CALG(X1,EST3,I1,J1,K1,G)
      ID3=ID2+(J1-1)
      CALL        TESTING(ID3,GTAB)
      IF(G. GE. GTAB) GO    TO     402
      CALL              REPLACE(I1,J1,K1,EST3,G1,EST,G)
      CALL           ESTI4(I1,J1,K1,SUM,EST4)
      CALL              CALG(X1,EST4,I1,J1,K1,G)
      ID4=ID3+(K1-1)
      CALL        TESTING(ID4,GTAB)
      IF(G. GE. GTAB) GO    TO     403
      CALL              REPLACE(I1,J1,K1,EST4,G1,EST,G)
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)          OPEN(MOOD,FILE='PRN')
      WRITE(5,71)
71      FORMAT(    9(/))
      WRITE(MOOD,*)'THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'                          LOG     M(I,J,K)=U'
      WRITE(5,71)
      GO TO   398
403    CALL   SEP(MOOD)
      IF(MOOD. EQ. 6)          OPEN(6,FILE='PRN')
      WRITE(5,71)
490     WRITE(MOOD,*)'THE   MODEL   IS-   '
      WRITE(5,61)
      WRITE(6,*)'                                LOG     M(I,J,K)=U+U3(K)'
      GO TO   398
402        CALL       ESTI5(I1,J1,K1,SUM2,EST5)
      CALL              CALG(X1,EST5,I1,J1,K1,G)
      ID5=ID2+(K1-1)
      CALL        TESTING(ID5,GTAB)
      IF(G. GE. GTAB) GO    TO     404
```

```
      CALL              REPLACE(I1,J1,K1,EST5,G1,EST,G)
      CALL     SEP(MOOD)
      IF(MOOD. EQ. 6)          OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(6,*)                              LOG     M(I,J,K)=U+U2(J)'
      WRITE(5,71)
      GO TO   398
404         CALL      ESTI6(I1,J1,K1,SUM2,SUM3,SUM,EST6)
      CALL            CALG(X1,EST6,I1,J1,K1,G)
      ID6=ID2+(J1-1)*(K1-1)
      CALL        TESTING(ID6,GTAB)
      IF(G. GE. GTAB)  GO    TO     405
      CALL              REPLACE(I1,J1,K1,EST6,G1,EST,G)
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)           OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(6,*)'                                LOG     M(I,J,K)=U+U2(J)+U3(K)'
      WRITE(5,71)
      GO TO   398
405   CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)           OPEN(MOOD,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'                                      LOG     M(I,J,K)=U+U2(J)+U3(K)+U23(J,K)'
      WRITE(5,71)
      GO TO   398
401         CALL      ESTI7(I1,J1,K1,SUM13,EST7)
      CALL            CALG(X1,EST7,I1,J1,K1,G)
      ID7=ID1+(J1-1)
      CALL        TESTING(ID7,GTAB)
      IF(G. GE. GTAB)  GO    TO     406
      CALL              REPLACE(I1,J1,K1,EST7,G1,EST,G)
      CALL            ESTI8(I1,J1,K1,SUM1,EST8)
      CALL            CALG(X1,EST8,I1,J1,K1,G)
      ID8=ID7+(K1-1)
      CALL        TESTING(ID8,GTAB)
      IF(G. GE. GTAB)  GO    TO     407
      CALL              REPLACE(I1,J1,K1,EST8,G1,EST,G)
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)           OPEN(MOOD,FILE='PRN')
      WRITE(5,71)
```

```
      WRITE(MOOD,*)'THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'                                LOG     M(I,J,K)=U+U1(I)'
      WRITE(5,71)
      GO TO   398
407    CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)          OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*) THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'                                  LOG     M(I,J,K)=U+U1(I)+U3(K)'
      WRITE(5,71)
      GO TO   398
406             CALL     EST19(I1,J1,K1,SUM1,SUM2,SUM12,SUM,EST9)
      CALL           CALG(X1,EST9,I1,J1,K1,G)
      ID9=ID1+(K1-1)
      CALL       TESTING(ID9,GTAB)
      IF(G. GE. GTAB) GO    TO     408
      CALL             REPLACE(I1,J1,K1,EST9,G1,EST,G)
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)          OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'                                  LOG .  M(I,J,K)=U+U1(I)+U2(J)'
      WRITE(5,71)
      GO TO   398
408           CALL      EST110(I1,J1,K1,SUM1,SUM23,SUM,EST10)
      CALL           CALG(X1,EST10,I1,J1,K1,G)
      ID10=ID1+(I1-1)*(K1-1)
      CALL       TESTING(ID10,GTAB)
      IF(G. GE. GTAB) GO    TO     409
      CALL             REPLACE(I1,J1,K1,EST10,G1,EST,G)
      CALL              EST111(I1,J1,K1,SUM1,SUM2,SUM3,SUM,EST11)
      CALL           CALG(X1,EST11,I1,J1,K1,G)
      ID11=ID10+(J1-1)*(K1-1)
      CALL       TESTING(ID11,GTAB)
      IF(G. GE. GTAB) GO    TO     410
      CALL             REPLACE(I1,J1,K1,EST11,G1,EST,G)
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)          OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE     MODEL      IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'                                    LOG    M(I,J,K)=U+U1(I)+U2(J)+U3(K)'
      WRITE(5,71)
```

```
      GO TO   398
410    CALL   SEP(MOOD)
       IF(MOOD.EQ.6)          OPEN(6,FILE='PRN')
       WRITE(5,71)
       WRITE(MOOD,*)'THE    MODEL     IS-'
       WRITE(5,61)
       WRITE(MOOD,*)'                                    LOG    M(I,J,K)=U+U1(I)+U2(J)+U3(K)+U23(
     *,K)
       WRITE(5,71)
       GO TO   398
409            CALL    ESTI12(I1,J1,K1,SUM2,SUM13,SUM,EST12)
       CALL          CALC(X1,EST12,I1,J1,K1,G)
       ID12=ID1+(J1-1)*(K1-1)
       CALL       TESTING(ID12,GTAB)
       IF(G.GE.GTAB)   GO   TO   411
       CALL            REPLACE(I1,J1,K1,EST12,G1,EST,G)
       CALL    SEP(MOOD)
       IF(MOOD.EQ.6)          OPEN(6,FILE='PRN')
       WRITE(5,71)
       WRITE(MOOD,*)'THE    MODEL     IS-'
       WRITE(5,61)
       WRITE(MOOD,*)'                                    LOG    M(I,J,K)=U+U1(I)+U2(J)+U3(K)+U13
     *,K)'
       WRITE(5,71)
       GO TO   398
411    CALL    SEP(MOOD)
       IF(MOOD.EQ.6)          OPEN(6,FILE='PRN')
       WRITE(5,71)
       WRITE(MOOD,*) THE    MODEL     IS-'
       WRITE(5,61)
       WRITE(MOOD,*)'                                    LOG    M(I,J,K)=U+U1(I)+U2(J)+U3(K)+U13
     *,K)+U23(J,K)'
       WRITE(5,71)
       GO TO   398
400          CALL    ESTI13(I1,J1,K1,SUM12,EST13)
       CALL          CALC(X1,EST13,I1,J1,K1,G)
       ID13=ID+(K1-1)
       CALL       TESTING(ID13,GTAB)
       IF(G.GE.GTAB)   GO   TO   412
       CALL            REPLACE(I1,J1,K1,EST13,G1,EST,G)
       CALL    SEP(MOOD)
       IF(MOOD.EQ.6)          OPEN(6,FILE='PRN')
       WRITE(5,71)
       WRITE(MOOD,*)'THE    MODEL     IS-'
       WRITE(5,61)
       WRITE(MOOD,*)'                                    LOG    M(I,J,K)=U+U1(I)+U2(J)+U12(I,J)'
```

```
      WRITE(5,71)
      GO TO   398
412             CALL      ESTI14(I1,J1,K1,SUM12,SUM23,SUM2,EST14)
      CALL            CALG(X1,EST14,I1,J1,K1,G)
      ID14=ID+(I1-1)*(K1-1)
      CALL        TESTING(ID14,GTAB)
      IF(G. GE. GTAB)   GO   TO   413
      CALL              REPLACE(I1,J1,K1,EST14,G1,EST,G)
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)         OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*) THE     MODEL     IS-'
      WRITE(5,61)
      WRITE(MOOD,*)                                       LOG   M(I,J,K)=U+U1(I)+U2(J)+U3(K)+U12
     *,J)
      WRITE(5,71)
      GO TO   398
413              CALL     ESTI15(I1,J1,K1,SUM12,SUM13,SUM1,EST15)
      CALL            CALG(X1,EST15,I1,J1,K1,G)
      ID15=ID+(J1-1)*(K1-1)
      CALL        TESTING(ID15,GTAB)
      IF(G. GE. GTAB)   GO   TO   414
      CALL              REPLACE(I1,J1,K1,EST15,G1,EST,G)
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)         OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE     MODEL     IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'                                      LOG   M(I,J,K)=U+U1(I)+U2(J)+U3(K)+U12
     *,J)+U13(I,K)'
      WRITE(5,71)
      GO TO   398
414     CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)         OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE     MODEL     IS-'
      WRITE(5,61)
      WRITE(MOOD,*)'LOG                           M(I,J,K)=U+U1(I)+U2(J)+U3(K)+U12(I,J)+U13(I,K)
     *U23(J,K)'
      WRITE(5,71)
      GO TO   398
399     DO   81    I=1,I1
      DO   81    J=1,J1
      DO   81    K=1,K1
      EST(I,J,K)=X1(I,J,K)
81      CONTINUE
```

```
      CALL    SEP(MOOD)
      IF(MOOD. EQ. 6)          OPEN(6,FILE='PRN')
      WRITE(5,71)
      WRITE(MOOD,*)'THE    MODEL      IS--'
      WRITE(5,61)
      WRITE(MOOD,*) LOG                                    M(I,J,K)=U+U1(I)+U2(J)+U3(K)+U12(I,J)+U13(I,K)
     *U23(J,K)+U123(I,J,K)'
      WRITE(5,71)
398     WRITE(5,*) THE   RESULTS   ARE   READY'
      GO TO   108
 505              CALL       RESPRT(X1,I1,J1,K1,SUM1,SUM2,SUM3,SUM12,SUM13,SUM23,EST,G1)
      GO TO   108
 506   RETURN
      END
*************************************************************************
      SUBROUTINE  MENU
      WRITE(*,99)
99          FORMAT(/////'38X,'LOG-LINEAR-MODELS'/)
      WRITE(*,98)
98            FORMAT(34X,'CHOICE',19X,'TYPE'/)
      WRITE(*,100)
100         FORMAT(20X,2H1. ,2X,'enter          Cell          frequencies',12X,'C'/)
      WRITE(*,101)
101             FORMAT(20X,2H2. ,12X,'Edit',22X,'E'/)
      WRITE(*,102)
102              FORMAT(20X,2H3. ,9X,'Processing',19X,'P'/)
      WRITE(*,103)
103              FORMAT(20X,2H4. ,10X,'PRinting',20X,'PR'/)
      WRITE(*,104)
104             FORMAT(20X,2H5. ,12X,'List',22X,'L'/)
      WRITE(*,105)
105           FORMAT(20X,2H6. ,12X,'OVer'22X,'OV'/)
      WRITE(*,106)
106             FORMAT(20X,2H7. ,12X,'MENU',21X,'ME'/)
      RETURN
      END
*************************************************************************
      SUBROUTINE              INTIAL(X1,EST,EST1,EST2,EST3,EST4,EST5,EST6,ESTO12
     *                  ,EST113,EST223,ESTO,EST312,SUM1,SUM2,SUM3,SUM12,SUM13,SUM23,
     *EST7,EST8,EST9,EST10,EST11,EST12,EST13,EST14,EST15)
      DIMENSION                        X1(7,7,7),EST(7,7,7),EST1(7,7,7),EST2(7,7,7)
     *                           ,ESTO(7,7,7),ESTO12(7,7),EST113(7,7),EST223(7,7),EST312(7,7)
     *                         ,SUM12(7,7),SUM13(7,7),SUM23(7,7),SUM1(7),SUM2(7),SUM3(7)
     *                          ,EST3(7,7,7),EST4(7,7,7),EST5(7,7,7),EST6(7,7,7),
     *EST7(7,7,7),EST8(7,7,7),EST9(7,7,7),EST10(7,7,7),
     *EST11(7,7,7),EST12(7,7,7),EST13(7,7,7),EST14(7,7,7),EST15(7,7,7)
```

```
      DO    231     I=1,7
      DO    231     J=1,7
      DO    231     K=1,7
      EST(I,J,K)=0
      EST1(I,J,K)=0
      EST0(I,J,K)=0
      EST2(I,J,K)=0
      EST3(I,J,K)=0
      EST4(I,J,K)=0
      EST5(I,J,K)=0
      EST6(I,J,K)=0
      EST7(I,J,K)=0
      EST8(I,J,K)=0
      EST9(I,J,K)=0
      EST10(I,J,K)=0
      EST11(I,J,K)=0
      EST12(I,J,K)=0
      EST13(I,J,K)=0
      EST14(I,J,K)=0
      EST15(I,J,K)=0
231    CONTINUE
      DO    232     I=1,7
      DO    232     J=1,7
      SUM12(I,J)=0
      SUM13(I,J)=0
      SUM23(I,J)=0
      EST012(I,J)=0
      EST113(I,J)=0
      EST223(I,J)=0
      EST312(I,J)=0
232    CONTINUE
      DO    233     I=1,7
      SUM1(I)=0
      SUM2(I)=0
      SUM3(I)=0
233    CONTINUE
      RETURN
      END
C*************************************************************************
      SUBROUTINE      EDEET(X1,I1,J1,K1)
      DIMENSION       X1(7,7,7)
      CHARACTER   DECI*1
123    WRITE(*,*) WHICH   OBSERVATION   YOU   WANT   TO   CHANGE?'
      WRITE(5,66)
66        FORMAT(2(/))
      WRITE(*,*) ENTER   LEVEL   OF   VAR-1,OF   VAR-2,OF   VAR-3.  IN    ORDER'
```

```
      WRITE(5,66)
      READ(*,* I,J,K
      WRITE(*,121)I,J,K,X1(I,J,K)
121                FORMAT('OLD       OBS(',I1,1X,I1,1X,I1,')=',F10.4)
      WRITE(5,66)
      WRITE(*,122)I,J,K
122               FORMAT( CORRECTED       OBS( ,I1,1X,I1,1X,I1,')')
      WRITE(5,66)
      READ(*,*)        , X1(I,J,K)
      WRITE(5,66)
      WRITE(*,*) DO  YOU   WANT   TO   CHANGE   ANY   MORE   OBSERVATION(Y/N)?'
      WRITE(5,66)
      READ(*,124)DECI
124     FORMAT(A1)
      WRITE(5,67)
67          FORMAT(29(/))
      IF((DECI.EQ.'Y').OR.(DECI.EQ.'y'))    GO      TO      123
      RETURN
      END
*****************************************************************************
      SUBROUTINE          LEEST(X1,I1,J1,K1)
      DIMENSION        X1(7,7,7)
      DO   11     I=1,I1
      DO   11     J=1,J1
      DO   11    K=1,K1
      WRITE(*,119)I,J,K,X1(I,J,K)
119                       FORMAT('OBS(',I1,1X,I1,1X,I1,)=',F10.4)
11     CONTINUE
      RETURN
      END
*****************************************************************************
      SUBROUTINE            SUMM(X1,SUM,SUM1,SUM2,SUM3,SUM12,SUM13,SUM23
     *      ,I1,J1,K1)
      DIMENSION                 X1(7,7,7),SUM1(7),SUM2(7),SUM3(7)
     *              ,SUM12(7,7),SUM13(7,7),SUM23(7,7)
      SUM=0
      DO   20     I2=1,I1
      SUM1(I2)=0
      DO   25     J2=1,J1
      SUM12(I2,J2)=0
      DO   30     K2=1,K1
      SUM12(I2,J2)=SUM12(I2,J2)+X1(I2,J2,K2)
30     CONTINUE
      SUM1(I2)=SUM1(I2)+SUM12(I2,J2)
25     CONTINUE
      SUM=SUM+SUM1(I2)
```

```
20          CONTINUE
            DO    35     J2=1,J1
            SUM2(J2)=0
            DO    40     K2=1,K1
            SUM23(J2,K2)=0
            DO    45     I2=1,I1
            SUM23(J2,K2)=SUM23(J2,K2)+X1(I2,J2,K2)
45          CONTINUE
            SUM2(J2)=SUM2(J2)+SUM23(J2,K2)
40          CONTINUE
35          CONTINUE
            DO    50     K2=1,K1
            SUM3(K2)=0
            DO    55     I2=1,I1
            SUM13(I2,K2)=0
            DO    60     J2=1,J1
            SUM13(I2,K2)=SUM13(I2,K2)+X1(I2,J2,K2)
60          CONTINUE
            SUM3(K2)=SUM3(K2)+SUM13(I2,K2)
55          CONTINUE
50          CONTINUE
            RETURN
            END
*********************************************************************
      SUBROUTINE                    ESTI(X1,I1,J1,K1,EST,SUM12,SUM13,SUM23)
      DIMENSION                              X1(7,7,7),EST(7,7,7),EST1(7,7,7),ESTO(7,7,7)
     *                            ,EST2(7,7,7),EST3(7,7,7),ESTO12(7,7),EST113(7,7),
     *                          EST223(7,7),EST312(7,7),SUM12(7,7),SUM13(7,7),
     *      SUM23(7,7)
        DEL=0.001
        DO    1     I=1,I1
        DO    1     J=1,J1
        ESTO12(I,J)=0
        DO  1       K=1,K1
        ESTO(I,J,K)=1
        ESTO12(I,J)=ESTO12(I,J)+ESTO(I,J,K)
1        CONTINUE
7       DO    2     I=1,I1
        DO  2       K=1,K1
        EST113(I,K)=0
        DO    2     J=1,J1
        EST1(I,J,K)=ESTO(I,J,K)*SUM12(I,J)/ESTO12(I,J)
        EST113(I,K)=EST113(I,K)+EST1(I,J,K)
2        CONTINUE
        DO    3     J=1,J1
        DO  3       K=1,K1
```

```
      EST223(J,K)=0
      DO   3    I=1,I1
      EST2(I,J,K)=EST1(I,J,k)*SUM13(I,K)/EST113(I,K)
      EST223(J,K)=EST223(J,K)+EST2(I,J,K)
3      CONTINUE
      DO   4    I=1,I1
      DO   4    J=1,J1
      EST312(I,J)=0
      DO  4     K=1,K1
      EST3(I,J,K)=EST2(I,J,K)*SUM23(J,K)/EST223(J,K)
      EST312(I,J)=EST312(I,J)+EST3(I,J,K)
4      CONTINUE
      DO   6    I=1,I1
      DO   6    J=1,J1
      DO  6     K=1,K1
      IF(ABS(EST3(I,J,K)-ESTO(I,J,K)). GE. DEL)GOTO                19
6      CONTINUE
      GO TO   31
19     DO   8    I=1,I1
      DO   8    J=1,J1
      DO  8     K=1,K1
      ESTO12(I,J)=EST312(I,J)
      ESTO(I,J,K)=EST3(I,J,K)
8      CONTINUE
      GOTO  7
31     DO   32   I=1,I1
      DO   32   J=1,J1
      DO   32   K=1,K1
      EST(I,J,K)=EST3(I,J,K)
32     CONTINUE
      RETURN
      END
*************************************************************************
      SUBROUTINE       TESTING(IDQ,GTAB)
      WRITE(4,*) ENTER   LEVEL    OF      SIGNIFICANCE'
      READ *,*)ALPHA
      WRITE(3,69)
69         FORMAT(2(/))
      WRITE(*,301)ALPHA,IDQ
301          FORMAT('ENTER     TABLE       CHI-SQUARE(',F4. 3,',',I3')')
      READ(*,*)GTAB
      WRITE(5,70)
70         FORMAT(23(/))
      RETURN
      END
*************************************************************************
```

```
      SUBROUTINE ESTI1(I1,J1,K1,SUM13,SUM23,SUM3,EST1)
      DIMENSION EST1(7,7,7),SUM13(7,7),SUM23(7,7),SUM3(7)
       DO  65  I=1,I1
       DO  65  J=1,J1
       DO  65  K=1,K1
       EST1(I,J,K)=SUM13(I,K)*SUM23(J,K)/SUM3(K)
65      CONTINUE
       RETURN
       END
*****************************************************************
      SUBROUTINE ESTI14(I1,J1,K1,SUM12,SUM23,SUM2,EST14)
      DIMENSION EST14(7,7,7),SUM12(7,7),SUM23(7,7),SUM2(7)
      DO  165  I=1,I1
      DO  165  J=1,J1
      DO  165  K=1,K1
      EST14(I,J,K)=SUM12(I,J)*SUM23(J,K)/SUM2(J)
165     CONTINUE
      RETURN
      END
*****************************************************************
      SUBROUTINE ESTI15(I1,J1,K1,SUM12,SUM13,SUM1,EST15)
      DIMENSION EST15(7,7,7),SUM12(7,7),SUM13(7,7),SUM1(7)
      DO  265  I=1,I1
      DO  265  J=1,J1
      DO  265  K=1,K1
      EST15(I,J,K)=SUM12(I,J)*SUM13(I,K)/SUM1(I)
265     CONTINUE
      RETURN
      END
*****************************************************************
      SUBROUTINE ESTI2(I1,J1,K1,SUM23,EST2)
      DIMENSION SUM23(7,7),EST2(7,7,7)
      DO  415  I=1,I1
      DO  415  J=1,J1
      DO  415  K=1,K1
      EST2(I,J,K)=SUM23(J,K)/FLOAT(I1)
415     CONTINUE
      RETURN
      END
*****************************************************************
      SUBROUTINE ESTI3(I1,J1,K1,SUM3,EST3)
      DIMENSION SUM3(7),EST3(7,7,7)
      DO  415  I=1,I1
      DO  415  J=1,J1
      DO  415  K=1,K1
      EST3(I,J,K)=SUM3(K)/(FLOAT(I1)*FLOAT(J1))
```

```
416       CONTINUE
          RETURN
          END
*************************************************************************
          SUBROUTINE          ESTI4(I1,J1,K1,SUM,EST4)
          DIMENSION        EST4(7,7,7)
          DO   417     I=1,I1
          DO   417     J=1,J1
          DO   417     K=1,K1
          EST4(I,J,K)=SUM  (FLOAT(I1)*FLOAT(J1)*FLOAT(K1))
417       CONTINUE
          RETURN
          END
*************************************************************************
          SUBROUTINE          ESTI5(I1,J1,K1,SUM2,EST5)
          DIMENSION          SUM2(7),EST5(7,7,7)
          DO   418     I=1,I1
          DO   418     J=1,J1
          DO   418     K=1,K1
          EST5(I,J,K)=SUM2(J)/(FLOAT(I1)*FLOAT(K1))
418       CONTINUE
          RETURN
          END
*************************************************************************
          SUBROUTINE          ESTI6(I1,J1,K1,SUM2,SUM3,SUM,EST6)
          DIMENSION          SUM2(7),SUM3(7),EST6(7,7,7)
          DO   419     I=1,I1
          DO   419     J=1,J1
          DO   419     K=1,K1
          EST6(I,J,K)=SUM2(J)*SUM3(K)/(SUM*FLOAT(I1))
419       CONTINUE
          RETURN
          END
*************************************************************************
          SUBROUTINE          ESTI7(I1,J1,K1,SUM13,EST7)
          DIMENSION          SUM13(7,7),EST7(7,7,7)
          DO   420     I=1,I1
          DO   420     J=1,J1
          DO   420     K=1,K1
          EST7(I,J,K)=SUM13(I,K)/FLOAT(J1)
420       CONTINUE
          RETURN
          END
*************************************************************************
          SUBROUTINE          ESTI8(I1,J1,K1,SUM1,EST8)
          DIMENSION          SUM1(7),EST8(7,7,7)
```

```
      DO    421     I=1,I1
      DO    421     J=1,J1
      DO    421    K=1,K1
      EST8(I,J,K)=SUM1(I)*(FLOAT(J1)*FLOAT(K1))
421    CONTINUE
      RETURN
      END
*****************************************************************************
      SUBROUTINE              EST9(I1,J1,K1,SUM1,SUM2,SUM12,SUM,EST9)
      DIMENSION                 SUM1(7),SUM2(7),SUM12(7,7),EST9(7,7,7)
      DO    422     I=1,I1
      DO    422     J=1,J1
      DO    422    K=1,K1
      EST9(I,J,K)=SUM1(I)*SUM2(J)/(SUM*FLOAT(K1))
422    CONTINUE
      RETURN
      END
*****************************************************************************
      SUBROUTINE              EST10(I1,J1,K1,SUM1,SUM23,SUM,EST10)
      DIMENSION               SUM1(7),SUM23(7,7),EST10(7,7,7)
      DO    423     I=1,I1
      DO    423     J=1,J1
      DO    423    K=1,K1
      EST10(I,J,K)=SUM1(I)*SUM23(J,K)/SUM
423    CONTINUE
      RETURN
      END
*****************************************************************************
      SUBROUTINE              EST11(I1,J1,K1,SUM1,SUM2,SUM3,SUM,EST11)
      DIMENSION               SUM1(7),SUM2(7),SUM3(7),EST11(7,7,7)
      DO    424     I=1,I1
      DO    424     J=1,J1
      DO    424    K=1,K1
      EST11(I,J,K)=SUM1(I)*SUM2(J)*SUM3(K)/SUM**2
424    CONTINUE
      RETURN
      END
*****************************************************************************
      SUBROUTINE              EST12(I1,J1,K1,SUM2,SUM13,SUM,EST12)
      DIMENSION               SUM2(7),SUM13(7,7),EST12(7,7,7)
      DO    425     I=1,I1
      DO    425     J=1,J1
      DO    425    K=1,K1
      EST12(I,J,K)=SUM2(J)*SUM13(I,K)/SUM
425    CONTINUE
      RETURN
```

```
      END
*************************************************************************
      SUBROUTINE          ESTI13(I1,J1,K1,SUM12,EST13)
      DIMENSION           SUM12(7,7),EST13(7,7,7)
      DO   426    I=1,I1
      DO   426    J=1,J1
      DO   426    K=1,K1
      EST13(I,J,K)=SUM12(I,J)/FLOAT(K1)
426    CONTINUE
      RETURN
      END
*************************************************************************
      SUBROUTINE          REPLACE(I1,J1,K1,ESTO,G1,EST,G)
      DIMENSION           ESTO(7,7,7),EST(7,7,7)
      G1=G
      DO   427    I=1,I1
      DO   427    J=1,J1
      DO   427    K=1,K1
427            EST(I,J,K)=ESTO(I,J,K)
      RETURN
      END
*************************************************************************
      SUBROUTINE    SEP(MOOD)
      CHARACTER     DECI*1
      INTEGER   MOOD
      WRITE(*,*) DO   YOU   WANT   MODEL   ON     PRINTER(Y/N)?'
      READ      (*,428)DECI
428     FORMAT(A)
      WRITE(5,68)
68        FORMAT(22(/))
72          IF((DECI. EQ.  Y ). OR. (DECI. EQ. 'y')   )      THEN
          MOOD=6
           ELSE       IF((DECI. EQ. 'N'). OR. (DECI. EQ. 'n'))       THEN
             MOOD=5
              ELSE
                WRITE(5,*)'ENTER   Y   OR     N'
                  GO TO   72
       END  IF
      RETURN
      END
*************************************************************************
      SUBROUTINE          RESPRT(X1,I1,J1,K1,SUM1,SUM2,SUM3,SUM12,SUM13
     *     ,SUM23,EST,G1)
      DIMENSION                X1(7,7,7),SUM1(7),SUM2(7),SUM3(7),SUM12(7,7),
     *          SUM13(7,7),SUM23(7,7),EST(7,7,7)
      CHARACTER   RESULT*3
```

```
      WRITE(*,*)' DO YOU WANT THE RESULTS ON SCREEN(S) OR ON PRINTER(PR
     *)'
41      WRITE(*,*)'ENTER S OR PRI'
      READ(*,43)RESULT
43      FORMAT(2A)
      IF((RESULT.EQ.'PRI').OR.(RESULT.EQ.'pri'))          THEN
        MYMOOD=6
          ELSE      IF((RESULT.EQ.'S').OR.(RESULT.EQ.'s'))      THEN
            MYMOOD=5
          ELSE
            GO TO 41
       END IF
        IF(MYMOOD.EQ.6)          OPEN(6,FILE='PRN')
        WRITE(MYMOOD,*)'-------------------------------------------------
     *----------------------------------'
        WRITE(MYMOOD,114)
114                                          FORMAT('I','I',1X,'J',1X,'K','I','SUM1(I)','I','SUM2(J)','I',
     *'SUM3(K)','I','SUM12(I,J)','I','SUM13(I,K)','I','SUM23(J,K)','I')
        WRITE(MYMOOD,*)'-------------------------------------------------
     *----------------------------------'
        DO  51   I=1,I1
        DO  51   J=1,J1
        DO  51   k=1,K1
        WRITE(MYMOOD,115)I,J,K,SUM1(I),SUM2(J),SUM3(K),SUM12(I,J),
     *       SUM13(I,K),SUM23(J,K)
115                                  FORMAT('I',I1,1X,I1,1X,I1,3('I',F7.2),3('I',F10.4),'I')
51       CONTINUE
        WRITE(MYMOOD,*)'-------------------------------------------------
     *----------------------------'
        WRITE(*,*)
        WRITE(*,*)
        WRITE(MYMOOD,*)'-------------------------------------------------
     *----------------------------'
        WRITE(MYMOOD,17)
17        FORMAT(17X,'ESTIMATES  UNDER  PROPER  MODEL')
        WRITE     (MYMOOD,18)
18                                  FORMAT(1X,'I',1X,'J',1X,'K',2X,'X(I,J,K)',10X,'M(I,J,K)')
        WRITE(MYMOOD,*)'-------------------------------------------------
     *----------------------------'
        DO  29   I=1,I1
        DO  29   J=1,J1
        DO  29   k=1,K1
        WRITE(MYMOOD,21)I,J,K,X1(I,J,K),EST(I,J,K)
21                FORMAT(3(1X,I1),2X,F8.2,9X,F10.4)
29       CONTINUE
        WRITE(MYMOOD,*)'-------------------------------------------------
```

```
*-----------------------------'
      WRITE(MYMOOD,706)
706        FORMAT('CALCULATED      G-SQUARE ',12X,'G')
      WRITE(MYMOOD,707)G1
707        FORMAT(27X,F10.4)
      WRITE(MYMOOD,*)'-------------------------------------------------------
*-----------------------------'
      RETURN
      END
C*************************************************************************
       SUBROUTINE            CALG(X1,EST,I1,J1,K1,G)
      DIMENSION             X1(7,7,7),EST(7,7,7)
      G=0
      DO   89    I=1,I1
      DO   89    J=1,J1
      DO   89   K=1,K1
      IF((X1(I,J,K).EQ.0).OR.EST(I,J,K).EQ.0)      GO      TO      89
      G=G+X1(I,J,K)*ALOG(X1(I,J,K)/EST(I,J,K))
89     CONTINUE
      G=2*G
      RETURN
      END
C*************************************************************************
      SUBROUTINE          DIMEN(I1,J1,K1)
      WRITE(*,*)'ENTER   TOTAL   NO   OF   OBSERVATIONS   (LEVELS)   OF   VARIABLE-
      READ(*,*)I1
      WRITE(5,64)
64         FORMAT(22(/))
      WRITE(*,*)'ENTER   TOTAL   NO   OF   OBSERVATIONS   (LEVELS)   OF   VARIABLE-
      READ(*,*)J1
      WRITE(5,64)
      WRITE(*,*)'ENTER   TOTAL   NO   OF   OBSERVATIONS   (LEVELS)   OF   VARIABLE-
      READ(*,*)K1
      WRITE(5,64)
      RETURN
      END
C*************************************************************************
      SUBROUTINE          GETDAT(OBS,I1,J1,K1)
      DIMENSION       OBS(7,7,7)
      DO 9 I   =   1,I1
      DO 9 J   =   1,J1
      DO 9 K   =   1,K1
      WRITE(*,111)I,J,K
111                FORMAT('OBS(',I1,1X,I1,1X,I1,')')
      READ(*,*)          OBS(I,J,K)
      WRITE(5,65)
```

```
C5          FORMAT(22(/))
C           CONTINUE
            RETURN
            END
C*************************************************************************
```

Various facilities like 'listing', 'editing', 'data entry' and 'printing results' are available in both the packages. By making some minor changes these softwares are useful to fit 'quasi likelihood models' as well as models for 'over' dispersed and 'under' dispersed binomial and Poisson data.