รายการอ้างอิง

ภาษาไทย

สมบัติ กุลวุฒิ. วิธีการประมาณความน่าจะเป็นที่จะเสียชีวิตสำหรับข้อมูลประกันชีวิตที่ไม่สมบูรณ์. วิทยานิพนธ์ปริญญามหาบัณฑิต ภาควิชาสถิติ บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย ,2538.

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ภาคผนวก

ภาคผนวก ก.

ตาราง ก. แสดงค่า P_x และค่าพารามิเตอร์ k และ n สำหรับการแจกแจงแบบไวบูลล์ B และ c สำหรับการแจกแจงแบบกอมเพิรตซ์ ซึ่งนำค่าพารามิเตอร์นี้ไปจำลองข้อมูลเกี่ยวกับระยะเวลาที่จะมีชีวิตอยู่ต่อไปในอนาคต

x	P_x	กำหนด $n = 1.0$ และค่า k เป็นดังนี้	กำหนด $c = 1.08$ และค่า B เป็นดังนี้
25	0.9987670	0.0024675	0.0011869
26	0.9987265	0.0025486	0.0012259
27	0.9986712	0.0026594	0.0012792
28	0.9986106	0.0027807	0.0013376
29	0.9985440	0.0029141	0.0014017
30	0.9984711	0.0030601	0.0014719
31	0.9983912	0.0032202	0.0015489
32	0.9983035	0.0033959	0.0016334
33	0.9982073	0.0035886	0.0017261
34	0.9981020	0.0037996	0.0018276
35	0.9979864	0.0040313	0.0019391
36	0.9978598	0.0042850	0.0020611
37	0.9977210	0.0045632	0.0021949
38	0.9975687	0.0048685	0.0023418
39	0.9974018	0.0052032	0.0025028
40	0.9972188	0.0055701	0.0026793
41	0.9970182	0.0059725	0.0028728
42	0.9967983	0.0064137	0.0030850
43	0.9965573	0.0068973	0.0033176
44	0.9962930	0.0074278	0.0035728
45	0.9960034	0.0080092	0.0038525

ตาราง ก. (ต่อ) แสดงค่า p_x และค่าพารามิเตอร์ k และ n สำหรับการแจกแจงแบบไวบูลล์ B และ c สำหรับการแจกแจงแบบกอมเพิรตซ์ ซึ่งนำค่าพารามิเตอร์นี้ไปจำลองข้อมูลเกี่ยวกับระยะเวลาที่จะมีชีวิตอยู่ต่อไปในอนาคต

x	p_x	กำหนด $n = 1.0$ และค่า k เป็นดังนี้	กำหนด $c = 1.08$ และค่า B เป็นดังนี้
46	0.9956859	0.0086469	0.0041592
47	0.9953379	0.0093460	0.0044955
48	0.9949564	0.0101127	0.0048643
49	0.9945383	0.0109533	0.0052686
50	0.9940801	0.0118750	0.0057119
51	0.9935779	0.0128856	0.0061981
52	0.9930276	0.0139936	0.0067310
53	0.9924245	0.0152087	0.0073155
54	0.9917636	0.0165410	0.0079563
55	0.9910395	0.0180018	0.0086590
56	0.9902462	0.0196034	0.0094293
57	0.9893770	0.0213597	0.0102741
58	0.9884248	0.0232854	0.0112004
59	0.9873819	0.0253968	0.0122160
60	0.9862396	0.0277119	0.0133296
61	0.9849886	0.0302504	0.0145507
62	0.9836187	0.0330339	0.0158895
63	0.9821188	0.0360860	0.0173576
64	0.9804769	0.0394324	0.0189672
65	0.9786797	0.0431017	0.0207322

หมายเหตุ ค่า p_xที่ใช้ในการจำลองข้อมูลนี้มาจากภาคผนวก 2A ในหน้า 560-561 ของหนังสือ Actuarial Mathematics

ภาคผนวก ข.

```
C*************************************************************************C
C                          MAIN PROGRAM                                   C
C                                FOR                                      C
C                  ESTIMATION OF PROBABILITY OF SURVIVAL                  C
C*************************************************************************C
      COMMON/SEED/IX
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      NN = 700
      NW = 280
      IX = 50327
      WRITE(6,25) NN
   25 FORMAT(5X,'SAMPLE SIZE = ',I4,5X,'PERCENT OF WITHDRAW IS 40%')
      DO 99 IA = 25,65
      CALL REALQX
      TQX = QX(IA)
      TPX = 1.0-TQX
      AK = -2.0*ALOG(1.0-TQX)
      AN = 1.0
      C  = 1.08
      UC = ALOG(C)
```

```
B  = -ALOG(1.0-TQX)*UC/0.08
ALP1 = 5.0
A1 = 1.0/SQRT(2.0*ALP1-1.0)
ALP2 = 1.5
A2 = 1.0/SQRT(2.0*ALP2-1.0)
SUM1 = 0.0
SUM2 = 0.0
SUM3 = 0.0
SUM4 = 0.0
SUM5 = 0.0
SUM6 = 0.0
SUM7 = 0.0
SUM8 = 0.0
SUM9 = 0.0
SUM10 = 0.0
SUM11 = 0.0
SUM12 = 0.0
SUM13 = 0.0
SUM14 = 0.0
SUM15 = 0.0
SUM16 = 0.0
DO 40 I = 1,2000
    NWWU = 0
    NWGU = 0
    NWWB = 0
    NWGB = 0
    NSWU = 0
    NSGU = 0
    NSWB = 0
    NSGB = 0
```

```
      NDWU = 0
      NDGU = 0
      NDWB = 0
      NDGB = 0
      NDWUG = 0
      NDWUW = 0
      NDWBG = 0
      NDWBW = 0
      SMDWUG = 0.0
      SMDWUW = 0.0
      SMDWBG = 0.0
      SMDWBW = 0.0
      SUMWWU = 0.0
      SUMWGU = 0.0
      SUMWWB = 0.0
      SUMWGB = 0.0
      SUMDWU = 0.0
      SUMDGU = 0.0
      SUMDWB = 0.0
      SUMDGB = 0.0
      SUWU  = 0.0
      SUWB  = 0.0
      SUGU  = 0.0
      SUGB  = 0.0
      IS    = IX
    DO 60 J = 1,NN
10    U1 = RAND(IS)
      IF (U1 .LE. 0.0) GOTO 10
        CALL GENWEI
        CALL GENGOM
```

```
      IF (NWWB .GE. NW) THEN
        IF (NWGB .GE. NW) THEN
          WB = 1.0
        ELSE
          CALL GENBET
        ENDIF
      ELSE
        CALL GENBET
      ENDIF
      IF (NWWU .GE. NW) THEN
        IF (NWGU .GE. NW) THEN
          WU = 1.0
        ELSE
          CALL GENUNI
        ENDIF
      ELSE
        CALL GENUNI
      ENDIF
      CALL FINDMI
60    CONTINUE
      SMDWU = SUMDWU+SMDWUW
      SMDWB = SUMDWB+SMDWBW
      SMDGU = SUMDGU+SMDWUG
      SMDGB = SUMDGB+SMDWBG
      NDDWU  = NDWU+NDWUW
      NDDWB  = NDWB+NDWBW
      NDDGU  = NDGU+NDWUG
      NDDGB  = NDGB+NDWBG
      SUMWWU  = SUMWWU-SUWU
      SUMWWB  = SUMWWB-SUWB
```

```
SUMWGU =SUMWGU-SUGU
SUMWGB =SUMWGB-SUGB
NWWU   =NWWU-NDWUW
NWWB   =NWWB-NDWBW
NWGU   =NWGU-NDWUG
NWGB   =NWGB-NDWBG
IF (SMDWU .EQ. 0.) THEN
  IF (SMDGU .EQ. 0.) THEN
    IF (SMDWB .EQ. 0.) THEN
      IF (SMDGB .EQ. 0.) THEN
        APWU = 1.0
        APGU = 1.0
        APWB = 1.0
        APGB = 1.0
        BPWU = 1.0
        BPGU = 1.0
        BPWB = 1.0
        BPGB = 1.0
        CPWU = 1.0
        CPGU = 1.0
        CPWB = 1.0
        CPGB = 1.0
        ACPWU = 1.0
        ACPGU = 1.0
        ACPWB = 1.0
        ACPGB = 1.0
      ELSE
        CALL FINDBP
        CALL FINDAP
        CALL FINDCP
```

```
            CALL FINDAC
          ENDIF
        ELSE
          CALL FINDBP
          CALL FINDAP
          CALL FINDCP
          CALL FINDAC
        ENDIF
      ELSE
        CALL FINDBP
        CALL FINDAP
        CALL FINDCP
        CALL FINDAC
      ENDIF
    ELSE
      CALL FINDBP
      CALL FINDAP
      CALL FINDCP
      CALL FINDAC
    ENDIF
    SUM1 = SUM1+BPWU
    SUM2 = SUM2+BPGU
    SUM3 = SUM3+BPWB
    SUM4 = SUM4+BPGB
    SUM5 = SUM5+APWU
    SUM6 = SUM6+APGU
    SUM7 = SUM7+APWB
    SUM8 = SUM8+APGB
    SUM9 = SUM9+ACPWU
    SUM10 = SUM10+ACPGU
```

```
      SUM11 = SUM11+ACPWB
      SUM12 = SUM12+ACPGB
      SUM13 = SUM13+CPWU
      SUM14 = SUM14+CPGU
      SUM15 = SUM15+CPWB
      SUM16 = SUM16+CPGB
   40 CONTINUE
      PBWU  = SUM1/2000.0
      RBWU  = ABS(PBWU-TPX)*100.0/PBWU
      PBGU  = SUM2/2000.0
      RBGU  = ABS(PBGU-TPX)*100.0/PBGU
      PBWB  = SUM3/2000.0
      RBWB  = ABS(PBWB-TPX)*100.0/PBWB
      PBGB  = SUM4/2000.0
      RBGB  = ABS(PBGB-TPX)*100.0/PBGB
      PAWU  = SUM5/2000.0
      RAWU  = ABS(PAWU-TPX)*100.0/PAWU
      PAGU  = SUM6/2000.0
      RAGU  = ABS(PAGU-TPX)*100.0/PAGU
      PAWB  = SUM7/2000.0
      RAWB  = ABS(PAWB-TPX)*100.0/PAWB
      PAGB  = SUM8/2000.0
      RAGB  = ABS(PAGB-TPX)*100.0/PAGB
      PACWU = SUM9/2000.0
      RACWU = ABS(PACWU-TPX)*100.0/PACWU
      PACGU = SUM10/2000.0
      RACGU = ABS(PACGU-TPX)*100.0/PACGU
      PACWB = SUM11/2000.0
      RACWB = ABS(PACWB-TPX)*100.0/PACWB
      PACGB = SUM12/2000.0
```

```
      RACGB = ABS(PACGB-TPX)*100.0/PACGB
      PCWU  = SUM13/2000.0
      RCWU  = ABS(PCWU-TPX)*100.0/PCWU
      PCGU  = SUM14/2000.0
      RCGU  = ABS(PCGU-TPX)*100.0/PCGU
      PCWB  = SUM15/2000.0
      RCWB  = ABS(PCWB-TPX)*100.0/PCWB
      PCGB  = SUM16/2000.0
      RCGB  = ABS(PCGB-TPX)*100.0/PCGB
      WRITE(6,20) IA,IX,TQX,TPX
   20 FORMAT(' AGE =',I3,'  SEED =',I6,'  QX =',F10.7,'  PX =',F10.7)
      WRITE(6,2)
    2 FORMAT (28X,'WEIB+UNIF   GOMP+UNIF   WEIB+BETA   GOMP+BETA')
      WRITE(6,4)  PBWU, PBGU,PBWB, PBGB
    4 FORMAT (' P THE ESTIMATOR C   ',4(5X,F9.7))
      WRITE(6,6) PAWU,PAGU,PAWB,PAGB
    6 FORMAT (' P THE ESTIMATOR A   ',4(5X,F9.7))
      WRITE(6,7) PCWU,PCGU,PCWB,PCGB
    7 FORMAT (' P THE ESTIMATOR B   ',4(5X,F9.7))
      WRITE(6,8) PACWU,PACGU,PACWB,PACGB
    8 FORMAT (' P THE ACTUARIAL METHOD',4(5X,F9.7)
     *     /80('-'))
      WRITE(6,32) RBWU,RBGU,RBWB,RBGB
   32  FORMAT (' R THE EATIMATOR C   ',4(5X,F9.6))
      WRITE(6,34) RAWU,RAGU,RAWB,RAGB
   34 FORMAT (' R THE ESTIMATOR A   ',4(5X,F9.6))
      WRITE(6,35) RCWU,RCGU,RCWB,RCGB
   35 FORMAT (' R THE ESTIMATOR B   ',4(5X,F9.6))
      WRITE(6,36)RACWU,RACGU,RACWB,RACGB
   36 FORMAT (' R THE ACTUARIAL METHOD',4(5X,F9.6)
```

```
     *     /80('-'))
  99 CONTINUE
     STOP
     END
C*************************************************************************C
C    FIND THE FUTURE LIFETIME OF DEATH UNDER GOMPERZT DISTRIBUTION   C
C*************************************************************************C
     SUBROUTINE GENGOM
     COMMON/SEED/IX
     COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
     COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
     COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
     COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
     COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
     COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
     COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
     COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
     COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
     U2 = U1
     UU1 = ALOG(U2)
     UU2 = UC*UU1/B
     UU3 = 1.0-UU2
     UU4 = ALOG(UU3)
     T1  = UU4/UC
     IF (T1 .GE. 1.0) THEN
       T1 = 1.0
     ENDIF
     DG = T1
     RETURN
     END
```

```
C*************************************************************************C
C     FIND THE FUTURE LIFRTIME OF DEATH UNDER WEIBULL DISTRIBUTION     C
C*************************************************************************C
      SUBROUTINE GENWEI
      COMMON/SEED/IX
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      U3 = U1
      UU5 = ALOG(U3)
      ANK = (AN+1.0)/AK
      AN1 = 1.0/(AN+1.0)
      T2  = (-ANK*UU5)**AN1
      IF (T2 .GE. 1.0) THEN
        T2 = 1.0
      ENDIF
      DW = T2
      RETURN
      END
C*************************************************************************C
C FIND THE FUTURE LIFE TIME OF WITHDRAW UNDER UNIFORM DISTRIBUTION C
C*************************************************************************C
      SUBROUTINE GENUNI
      COMMON/SEED/IX
```

```
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      T3 = U1
      IF (T3 .GE. 1.0) THEN
        T3 = 1.0
      ENDIF
      WU = T3
      RETURN
      END
C*************************************************************************C
C   FIND THE FUTURE LIFE TIME OF WITHDRAW UNDER BETA DISTRIBUTION   C
C*************************************************************************C
      SUBROUTINE GENBET
      COMMON/SEED/IX
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
```

```
      U4 = U1
      U5 = U1
      V1 = A1*ALOG(U4/(1.0-U4))
      Y1 = EXP(V1)*ALP1
      V2 = A2*ALOG(U5/(1.0-U5))
      Y2 = EXP(V2)*ALP2
      T4 = Y1/(Y1+Y2)
      IF (T4 .GE. 1.0) THEN
        T4 = 1.0
      ENDIF
      WB = T4
      RETURN
      END
C*************************************************************************C
C   FIND MINIMUM THE FUTURE LIFE TIME BETWEEN DEATH AND WITHDRAW  C
C*************************************************************************C
      SUBROUTINE FINDMI
      COMMON/SEED/IX
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      WUW = WU
      WUG = WU
      WBW = WB
```

```
WBG = WB
IF (WUW .EQ. 1.0) THEN
   IF (DW .EQ. 1.0) THEN
      NSWU = NSWU+1
   ELSE
      SUMDWU = SUMDWU+DW
      NDWU  = NDWU+1
   ENDIF
ELSE
   IF (DW .EQ. 1.0) THEN
      SUMWWU = SUMWWU+WUW
      NWWU  = NWWU+1
   ELSE
      IF (DW .LE. WUW) THEN
         SUMDWU = SUMDWU+DW
         NDWU  = NDWU+1
      ELSE
         SUMWWU = SUMWWU+WUW
         NWWU  = NWWU+1
         SMDWUW = SMDWUW+DW
         NDWUW = NDWUW+1
      ENDIF
   ENDIF
ENDIF
IF (WUG .EQ. 1.0) THEN
   IF (DG .EQ. 1.0) THEN
      NSGU = NSGU+1
   ELSE
      SUMDGU = SUMDGU+DG
      NDGU  = NDGU+1
```

```
      ENDIF
   ELSE
      IF (DG .EQ. 1.0) THEN
         SUMWGU = SUMWGU+WUG
         NWGU  = NWGU+1
      ELSE
         IF (DG .LE. WUG) THEN
            SUMDGU = SUMDGU+DG
            NDGU  = NDGU+1
         ELSE
            SUMWGU = SUMWGU+WUG
            NWGU  = NWGU+1
            SMDWUG = SMDWUG+DG
            NDWUG = NDWUG+1
         ENDIF
      ENDIF
   ENDIF
   IF (WBW .EQ. 1.0) THEN
      IF (DW .EQ. 1.0) THEN
         NSWB = NSWB+1
      ELSE
         SUMDWB = SUMDWB+DW
         NDWB  = NDWB+1
      ENDIF
   ELSE
      IF (DW .EQ. 1.0) THEN
         SUMWWB = SUMWWB+WBW
         NWWB  = NWWB+1
      ELSE
         IF (DW .LE. WB) THEN
```

```
          SUMDWB = SUMDWB+DW
          NDWB   = NDWB+1
        ELSE
          SUMWWB = SUMWWB+WBW
          NWWB   = NWWB+1
          SMDWBW = SMDWBW+DW
          NDWBW = NDWBW+1
        ENDIF
      ENDIF
    ENDIF
    IF (WBG .EQ. 1.0) THEN
      IF (DG .EQ. 1.0) THEN
        NSGB = NSGB+1
      ELSE
        SUMDGB = SUMDGB+DG
        NDGB   = NDGB+1
      ENDIF
    ELSE
      IF (DG .EQ. 1.0) THEN
        SUMWGB = SUMWGB+WBG
        NWGB   = NWGB+1
      ELSE
        IF (DG .LE. WBG) THEN
          SUMDGB = SUMDGB+DG
          NDGB   = NDGB+1
        ELSE
          SUMWGB = SUMWGB+WBG
          NWGB   = NWGB+1
          SMDWBG = SMDWBG+DG
          NDWBG = NDWBG+1
```

```
        ENDIF
      ENDIF
    ENDIF
    RETURN
    END
C*************************************************************************C
C          FIND ESTIMATE MORTALITY PROBABILITY BY ESTIMATOR C          C
C*************************************************************************C
     SUBROUTINE FINDBP
    COMMON/SEED/IX
    COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
    COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
    COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
    COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
    COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
    COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
    COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
    COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
    COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
    TWU  = SMDWU+SUMWWU+NSWU
    UWU  = -NDDWU/TWU
    BPWU = EXP(UWU)
    TGU  = SMDGU+SUMWGU+NSGU
    UGU  = -NDDGU/TGU
    BPGU = EXP(UGU)
    TWB  = SMDWB+SUMWWB+NSWB
    UWB  = -NDDWB/TWB
    BPWB = EXP(UWB)
    TGB  = SMDGB+SUMWGB+NSGB
    UGB  = -NDDGB/TGB
```

```
      BPGB = EXP(UGB)
      RETURN
      END
C*************************************************************************C
C          FIND ESTIMATE MORTALITY PROBABILITY BY ESTIMATOR A          C
C*************************************************************************C
      SUBROUTINE FINDAP
      COMMON/SEED/IX
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      ERRWU  = 1.0
      ERRGU  = 1.0
      ERRWB  = 1.0
      ERRGB  = 1.0
      APWU = 0.9
      APGU = 0.9
      APWB = 0.9
      APGB = 0.9
    9 IF (ERRWU .GE. 0.0000001) THEN
        FWU1  = 1.0-APWU
        FWU2  = FWU1+ALOG(APWU)
        FWU3  = NSWU/APWU-(NDWU+NWWU)/FWU1
        FWU4  = -(NWWU+NDWUW)/(APWU*ALOG(APWU))+NDWUW*FWU1/
```

```
            (FWU2*APWU)
      DWU1  = NSWU/(APWU**2)+(NDWU+NWWU)/(FWU1*2)
      DWU2  = (NWWU+NDWUW)*(1.0+ALOG(APWU))/(APWU*ALOG(APWU))**2
      DWU3  = ((FWU2*APWU)+(FWU1*(FWU2+FWU1)))/(FWU2*APWU)**2
      PWU   = APWU-((FWU3+FWU4)/(-(DWU1+DWU2+DWU3)))
      ERRWU = ABS(APWU-PWU)
      APWU  = PWU
      GOTO 9
    ENDIF
2   IF (ERRGU .GE. 0.0000001) THEN
      FGU1  = 1-APGU
      FGU2  = FGU1+ALOG(APGU)
      FGU3  = NSGU/APGU-(NDGU+NWGU)/FGU1
      FGU4  = -(NWGU+NDWUG)/(APGU*ALOG(APGU))+NDWUG*FGU1/
            (FGU2*APGU)
      DGU1  = NSGU/(APGU**2)+(NDGU+NWGU)/(FGU1*2)
      DGU2  = (NWGU+NDWUG)*(1+ALOG(APGU))/(APGU*ALOG(APGU))**2
      DGU3  = ((FGU2*APGU)+(FGU1*(FGU2+FGU1)))/(FGU2*APGU)**2
      PGU   = APGU-((FGU3+FGU4)/(-(DGU1+DGU2+DGU3)))
      ERRGU = ABS(APGU-PGU)
      APGU  = PGU
      GOTO 12
    ENDIF
14  IF (ERRWB .GE. 0.0000001) THEN
      FWB1  = 1-APWB
      FWB2  = FWB1+ALOG(APWB)
      FWB3  = NSWB/APWB-(NDWB+NWWB)/FWB1
      FWB4  = -(NWWB+NDWBW)/(APWB*ALOG(APWB))+NDWBW*FWB1/
            (FWB2*APWB)
      DWB1  = NSWB/(APWB**2)+(NDWB+NWWB)/(FWB1*2)
```

```
      DWB2 = (NWWB+NDWBW)*(1+ALOG(APWB))/(APWB*ALOG(APWB))**2
      DWB3 = ((FWB2*APWB)+(FWB1*(FWB2+FWB1)))/(FWB2*APWB)**2
      PWB  = APWB-((FWB3+FWB4)/(-(DWB1+DWB2+DWB3)))
      ERRWB = ABS(APWB-PWB)
      APWB = PWB
      GOTO 14
    ENDIF
 16 IF (ERRGB .GE. 0.0000001) THEN
      FGB1 = 1-APGB
      FGB2 = FGB1+ALOG(APGB)
      FGB3 = NSGB/APGB-(NDGB+NWGB)/FGB1
      FGB4 = -(NWGB+NDWBG)/(APGB*ALOG(APGB))+NDWBG*FGB1/
             (FGB2*APGB)
      DGB1 = NSGB/(APGB**2)+(NDGB+NWGB)/(FGB1*2)
      DGB2 = (NWGB+NDWBG)*(1+ALOG(APGB))/(APGB*ALOG(APGB))**2
      DGB3 = ((FGB2*APGB)+(FGB1*(FGB2+FGB1)))/(FGB2*APGB)**2
      PGB  = APGB-((FGB3+FGB4)/(-(DGB1+DGB2+DGB3)))
      ERRGB = ABS(APGB-PGB)
      APGB = PGB
      GOTO 16
    ENDIF
    RETURN
    END
C*************************************************************************C
C   FIND ESTIMATE MORTALITY PROBABILITY BY THE ACTUARIAL METHOD   C
C*************************************************************************C
    SUBROUTINE FINDAC
    COMMON/SEED/IX
    COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
    COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
```

```
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      AWU  = NWWU/2.
      BWU  = NN - AWU
      QWU  = NDDWU/BWU
      ACPWU = 1 - QWU
      AGU  = NWGU/2.
      BGU  = NN - AGU
      QGU  = NDDGU/BGU
      ACPGU = 1 - QGU
      AWB  = NWWB/2.
      BWB  = NN - AWB
      QWB  = NDDWB/BWB
      ACPWB = 1-QWB
      AGB  = NWGB/2.
      BGB  = NN - AGB
      QGB  = NDDGB/BGB
      ACPGB = 1 - QGB
      RETURN
      END
C*************************************************************************C
C          FIND ESTIMATE MORTALITY PROBABILITY BY ESTIMATOR B           C
C*************************************************************************C
      SUBROUTINE FINDCP
      COMMON/SEED/IX
```

```
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      AWU = NN-(NWWU+NDWUW)/2
      BWU = NSWU+NWWU/2
      CWU = SQRT((NDWUW**2)/4+4*AWU*BWU)
      CPWU = ((-(NDWUW/2)+CWU)/(2*AWU))**2
      AGU = NN-(NWGU+NDWUG)/2
      BGU = NSGU+NWGU/2
      CGU = SQRT((NDWUG**2)/4+4*AGU*BGU)
      CPGU = ((-(NDWUG/2)+CGU)/(2*AGU))**2
      AWB = NN-(NWWB+NDWBW)/2
      BWB = NSWB+NWWB/2
      CWB = SQRT((NDWBW**2)/4+4*AWB*BWB)
      CPWB = ((-(NDWBW/2)+CWB)/(2*AWB))**2
      AGB = NN-(NWGB+NDWBG)/2
      BGB = NSGB+NWGB/2
      CGB = SQRT((NDWBG**2)/4+4*AGB*BGB)
      CPGB = ((-(NDWBG/2)+CGB)/(2*AGB))**2
      RETURN
      END
C*************************************************************************C
C                          FUNCTION RANDOM (0,1)                          C
C*************************************************************************C
```

```
      FUNCTION RAND(IX)
      IX = IX*16807
      IF (IX .LT. 0)THEN
         IX = IX+2147483647
      ENDIF
      RAND = FLOAT(IX)
      RAND = RAND/2147483647
      RETURN
      END
C*************************************************************************C
C                          DETERMINATION QX                               C
C*************************************************************************C
      SUBROUTINE REALQX
      COMMON/SEED/IX
      COMMON/PARA/B,UC,AK,AN,ALP1,A1,ALP2,A2,U1
      COMMON/DTA1/NN,NWWU,NWGU,NWWB,NWGB,NDWU,NDGU,NDWB,NDGB
      COMMON/DTA2/NSWU,NSGU,NSWB,NSGB,DW,DG,WU,WB,SUMDGB,SUMDWB
      COMMON/DTA3/SUMWWU,SUMWGU,SUMWWB,SUMWGB,SUMDWU, SUMDGU
      COMMON/DTA4/SMDWUG,SMDWUW,SMDWBG,SMDWBW,SMDWU,SMDGU
      COMMON/DTA5/NDWUG,NDWUW,NDWBG,NDWBW,NDDWU, NDDGU,NDDWB
      COMMON/DTA6/SUWU,SUGU,SUWB,SUGB, SMDWB,SMDGB,NDDGB
      COMMON/MORT1/QX(100),BPWU,BPGU,BPWB,BPGB,APWU,APGU,APWB,APGB
      COMMON/MORT2/ACPWU,ACPGU,ACPWB,ACPGB,CPWU,CPGU,CPWB,CPGB
      QX(25) = 0.0012330
      QX(26) = 0.0012735
      QX(27) = 0.0013288
      QX(28) = 0.0013895
      QX(29) = 0.0014560
      QX(30) = 0.0015289
      QX(31) = 0.0016089
```

QX(32) = 0.0016965

QX(33) = 0.0017927

QX(34) = 0.0018980

QX(35) = 0.0020136

QX(36) = 0.0021402

QX(37) = 0.0022791

QX(38) = 0.0024313

QX(39) = 0.0025982

QX(40) = 0.0027812

QX(41) = 0.0029818

QX(42) = 0.0032017

QX(43) = 0.0034427

QX(44) = 0.0037070

QX(45) = 0.0039966

QX(46) = 0.0043141

QX(47) = 0.0046621

QX(48) = 0.0050436

QX(49) = 0.0054617

QX(50) = 0.0059199

QX(51) = 0.0064221

QX(52) = 0.0069724

QX(53) = 0.0075755

QX(54) = 0.0082364

QX(55) = 0.0089605

QX(56) = 0.0097538

QX(57) = 0.0106230

QX(58) = 0.0115752

QX(59) = 0.0126181

QX(60) = 0.0137604

QX(61) = 0.0150114

QX(62) = 0.0163813

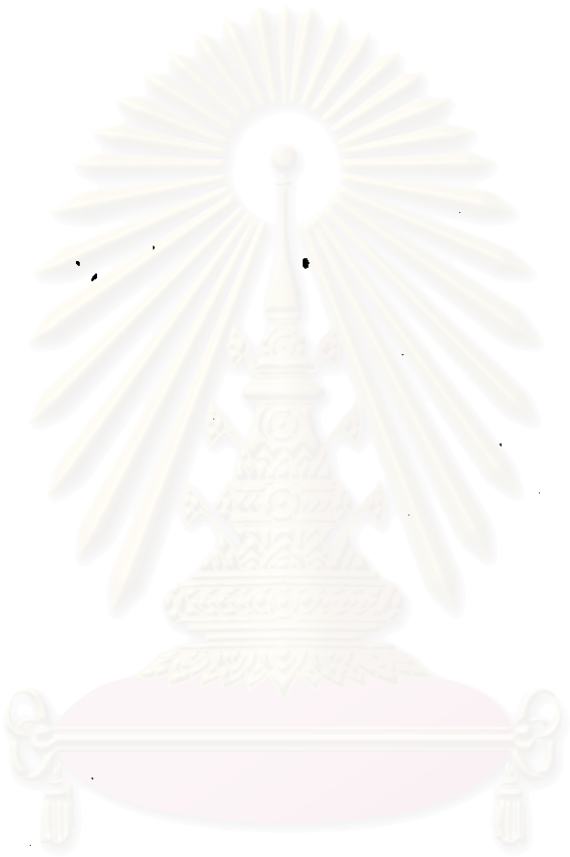
QX(63) = 0.0178812

QX(64) = 0.0195231

QX(65) = 0.0213203

RETURN

END



ประวัติผู้เขียน

นางสาวศานิต ควงสวัสดิ์ เกิดเมื่อวันที่ 21 พฤษภาคม 2514 สำเร็จการศึกษาปริญญาสถิติศาสตรบัณฑิต (สถ.บ.) ภาควิชาสถิติ คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย ในปีการศึกษา 2535 และเข้าศึกษาต่อในหลักสูตรวิทยาศาสตรมหาบัณฑิต ภาควิชาสถิติ คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย ในปีการศึกษา 2536 ปัจจุบันทำงานอยู่ที่ บริษัท ประกันชีวิตศรีอยุธยา จำกัด (มหาชน) ฝ่ายคณิตศาสตร์