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ภาคผนวก

ภาคผนวก ก

ตารางที่ 1 *Percent points of the normal probability plot correlation coefficient r*

	Level													
n	.000	.005	.01	.025	.05	.10	.25	.50	.75	.90	.95	.975	.99	.995
3	.366	.867	.869	.872	.879	.891	.924	.966	.991	.999	1.000	1.000	1.000	1.000
4	.784	.813	.822	.845	.868	.894	.931	.958	.979	.992	.996	.998	.999	1.000
5	.726	.803	.822	.855	.879	.902	.935	.960	.977	.988	.992	.995	.997	.998
6	.683	.818	.835	.868	.890	.911	.940	.962	.977	.986	.990	.993	.996	.997
7	.648	.828	.847	.876	.899	.916	.944	.965	.978	.986	.990	.992	.995	.996
8	.619	.841	.859	.886	.905	.924	.948	.967	.979	.986	.990	.992	.995	.996
9	.595	.851	.868	.893	.912	.929	.951	.968	.980	.987	.990	.992	.994	.995
10	.574	.860	.876	.900	.917	.934	.954	.970	.981	.987	.990	.992	.994	.995
11	.556	.868	.883	.906	.922	.938	.957	.972	.982	.988	.990	.992	.994	.995
12	.539	.875	.889	.912	.926	.941	.959	.973	.982	.988	.990	.992	.994	.995
13	.525	.882	.895	.917	.931	.944	.962	.975	.983	.988	.991	.993	.994	.995
14	.512	.888	.901	.921	.934	.947	.964	.976	.984	.989	.991	.993	.994	.995
15	.500	.894	.907	.925	.937	.950	.965	.977	.984	.989	.991	.993	.994	.995
16	.489	.899	.912	.928	.940	.952	.967	.978	.985	.989	.991	.993	.994	.995
17	.478	.903	.916	.931	.942	.954	.968	.979	.986	.990	.992	.993	.994	.995
18	.469	.907	.919	.934	.945	.956	.969	.979	.986	.990	.992	.993	.995	.995
19	.460	.909	.923	.937	.947	.958	.971	.980	.987	.990	.992	.993	.995	.995
20	.452	.912	.925	.939	.950	.960	.972	.981	.987	.991	.992	.994	.995	.995
21	.445	.914	.928	.942	.952	.961	.973	.981	.987	.991	.993	.994	.995	.996
22	.437	.918	.930	.944	.954	.962	.974	.982	.988	.991	.993	.994	.995	.996
23	.431	.922	.933	.947	.955	.964	.975	.983	.988	.991	.993	.994	.995	.996
24	.424	.926	.936	.949	.957	.965	.975	.983	.988	.992	.993	.994	.995	.996
25	.418	.928	.937	.950	.958	.966	.976	.984	.989	.992	.993	.994	.995	.996
26	.412	.930	.939	.952	.959	.967	.977	.984	.989	.992	.993	.994	.995	.996
27	.407	.932	.941	.953	.960	.968	.977	.984	.989	.992	.994	.995	.995	.996
28	.402	.934	.943	.955	.962	.969	.978	.985	.990	.992	.994	.995	.995	.996
29	.397	.937	.945	.956	.962	.969	.979	.985	.990	.992	.994	.995	.995	.996
30	.392	.938	.947	.957	.964	.970	.979	.986	.990	.993	.994	.995	.996	.996
31	.388	.939	.948	.958	.965	.971	.980	.986	.990	.993	.994	.995	.996	.996
32	.383	.939	.949	.959	.966	.972	.980	.986	.990	.993	.994	.995	.996	.996
33	.379	.940	.950	.960	.967	.973	.981	.987	.991	.993	.994	.995	.996	.996
34	.375	.941	.951	.960	.967	.973	.981	.987	.991	.993	.994	.995	.996	.996
35	.371	.943	.952	.961	.968	.974	.982	.987	.991	.993	.995	.995	.996	.997
36	.367	.945	.953	.962	.968	.974	.982	.987	.991	.994	.995	.996	.996	.997
37	.364	.947	.955	.962	.969	.975	.982	.988	.991	.994	.995	.996	.996	.997
38	.360	.948	.956	.964	.970	.975	.983	.988	.992	.994	.995	.996	.996	.997
39	.357	.949	.957	.965	.971	.976	.983	.988	.992	.994	.995	.996	.996	.997
40	.354	.949	.958	.966	.972	.977	.983	.988	.992	.994	.995	.996	.996	.997
41	.351	.950	.958	.967	.972	.977	.984	.989	.992	.994	.995	.996	.996	.997
42	.348	.951	.959	.967	.973	.978	.984	.989	.992	.994	.995	.996	.997	.997
43	.345	.953	.959	.967	.973	.978	.984	.989	.992	.994	.995	.996	.997	.997
44	.342	.954	.960	.968	.973	.978	.984	.989	.992	.994	.995	.996	.997	.997
45	.339	.955	.961	.969	.974	.978	.985	.989	.993	.994	.995	.996	.997	.997
46	.336	.956	.962	.969	.974	.979	.985	.990	.993	.995	.995	.996	.997	.997
47	.334	.956	.963	.970	.974	.979	.985	.990	.993	.995	.995	.996	.997	.997
48	.331	.957	.963	.970	.975	.980	.985	.990	.993	.995	.996	.996	.997	.997
49	.329	.957	.964	.971	.975	.980	.986	.990	.993	.995	.996	.996	.997	.997
50	.326	.959	.965	.972	.977	.981	.986	.990	.993	.995	.996	.996	.997	.997
55	.315	.962	.967	.974	.978	.982	.987	.991	.994	.995	.996	.997	.997	.997
60	.305	.965	.970	.976	.980	.983	.988	.991	.994	.995	.996	.997	.997	.998
65	.296	.967	.972	.977	.981	.984	.989	.992	.994	.996	.996	.997	.997	.998
70	.288	.969	.974	.978	.982	.985	.989	.993	.995	.996	.997	.997	.998	.998
75	.281	.971	.975	.979	.983	.986	.990	.993	.995	.996	.997	.997	.998	.998
80	.274	.973	.976	.980	.984	.987	.991	.993	.995	.996	.997	.997	.998	.998
85	.268	.974	.977	.981	.985	.987	.991	.994	.995	.997	.997	.997	.998	.998
90	.263	.976	.978	.982	.985	.988	.991	.994	.996	.997	.997	.998	.998	.998
95	.257	.977	.979	.983	.986	.989	.992	.994	.996	.997	.997	.998	.998	.998
100	.252	.979	.981	.984	.987	.989	.992	.994	.996	.997	.998	.998	.998	.998

ตารางที่ 2 *Percentage points of* $10Z_A - 32$ *for testing normality*

n	0.001	0.01	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.99	0.999
5	−0.351	−0.303	−0.186	−0.080	0.093	0.262	0.435	0.613	0.817	1.083	1.457	2.093	2.720	4.188	5.568
6	−0.133	−0.063	0.066	0.170	0.344	0.503	0.660	0.832	1.038	1.299	1.658	2.278	2.923	4.431	6.231
7	0.032	0.111	0.242	0.344	0.510	0.658	0.809	0.976	1.173	1.420	1.765	2.374	2.994	4.503	6.472
8	0.158	0.241	0.369	0.468	0.625	0.766	0.912	1.073	1.261	1.499	1.831	2.414	3.020	4.484	6.540
9	0.258	0.339	0.465	0.561	0.710	0.845	0.985	1.139	1.319	1.545	1.864	2.419	2.993	4.409	[illegible]
10	0.335	0.416	0.538	0.632	0.774	0.904	1.038	1.184	1.356	1.575	1.879	2.414	2.970	4.318	6.265
12	0.453	0.530	0.645	0.730	0.862	0.983	1.106	1.242	1.401	1.602	1.885	2.375	2.882	4.117	5.978
14	0.533	0.607	0.716	0.795	0.918	1.029	1.144	1.272	1.420	1.607	1.866	2.316	2.783	3.939	5.641
16	0.592	0.663	0.766	0.840	0.954	1.059	1.166	1.285	1.423	1.596	1.838	2.256	2.689	3.740	5.287
18	0.639	0.707	0.803	0.873	0.981	1.079	1.180	1.291	1.419	1.582	1.810	2.199	2.601	3.568	5.031
20	0.674	0.739	0.831	0.897	0.999	1.092	1.187	1.291	1.414	1.567	1.780	2.146	2.521	3.427	4.780
25	0.737	0.796	0.876	0.935	1.025	1.106	1.190	1.282	1.389	1.524	1.710	2.029	2.353	3.126	4.246
30	0.776	0.829	0.902	0.955	1.036	1.109	1.184	1.266	1.362	1.482	1.648	1.931	2.217	2.902	3.914
40	0.823	0.868	0.929	0.973	1.041	1.102	1.165	1.233	1.313	1.413	1.550	1.783	2.015	2.564	3.380
50	0.847	0.887	0.941	0.979	1.038	1.091	1.145	1.204	1.273	1.358	1.475	1.674	1.873	2.342	3.028
70	0.874	0.906	0.949	0.979	1.026	1.068	1.111	1.157	1.212	1.279	1.371	1.526	1.682	2.046	2.567
100	0.890	0.915	0.949	0.973	1.009	1.042	1.075	1.111	1.152	1.204	1.275	1.394	1.514	1.791	2.193
150	0.900	0.919	0.944	0.962	0.989	1.013	1.038	1.064	1.095	1.133	1.184	1.271	1.359	1.562	1.856
200	0.904	0.919	0.939	0.954	0.976	0.995	1.014	1.036	1.060	1.090	1.132	1.202	1.272	1.435	1.670
300	0.906	0.918	0.932	0.943	0.959	0.973	0.987	1.002	1.020	1.042	1.072	1.122	1.172	1.289	1.465
500	0.906	0.914	0.924	0.931	0.942	0.951	0.960	0.970	0.982	0.996	1.016	1.048	1.081	1.159	1.275
1000	0.905	0.909	0.915	0.919	0.925	0.930	0.935	0.941	0.947	[illegible]	0.966	0.984	1.002	1.046	1.111

ตารางที่ 3 *Percentage points of Z_C for testing normality*

n	0.001	0.01	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95	0.99	0.999
5	0.664	0.724	0.874	1.007	1.252	1.501	1.749	2.002	2.261	2.577	3.002	3.639	4.213	5.460	6.757
6	0.704	0.808	1.003	1.176	1.475	1.756	2.028	2.298	2.602	2.967	3.433	4.158	4.849	6.382	8.280
7	0.745	0.881	1.120	1.322	1.662	1.966	2.255	2.555	2.891	3.288	3.797	4.610	5.385	7.196	9.635
8	0.781	0.945	1.218	1.446	1.819	2.144	2.453	2.778	3.141	3.567	4.123	5.007	5.864	7.908	10.954
9	0.813	0.997	1.306	1.556	1.955	2.299	2.631	2.979	3.362	3.810	4.404	5.350	6.267	8.545	12.102
10	0.842	1.049	1.388	1.658	2.079	2.438	2.789	3.155	3.559	4.035	4.659	5.663	6.650	9.138	13.115
12	0.895	1.138	1.526	1.831	2.290	2.682	3.065	3.463	3.902	4.424	5.105	6.209	7.304	10.156	15.147
14	0.935	1.212	1.645	1.972	2.464	2.888	3.298	3.723	4.195	4.755	5.486	6.669	7.862	11.103	16.969
16	0.976	1.277	1.746	2.096	2.616	3.064	3.495	3.944	4.443	5.036	5.808	7.065	8.352	11.838	18.474
18	1.014	1.334	1.838	2.207	2.754	3.222	3.675	4.147	4.669	5.287	6.099	7.422	8.767	12.493	19.899
20	1.046	1.396	1.924	2.309	2.875	3.361	3.835	4.328	4.869	5.511	6.362	7.752	9.157	13.150	21.149
25	1.120	1.519	2.103	2.519	3.137	3.664	4.176	4.707	5.298	5.994	6.918	8.438	9.984	14.432	23.753
30	1.170	1.618	2.246	2.693	3.349	3.910	4.456	5.023	5.649	6.391	7.375	8.998	10.662	15.580	26.091
40	1.285	1.783	2.483	2.972	3.693	4.307	4.901	5.521	6.209	7.031	8.109	9.888	11.733	17.223	29.333
50	1.366	1.912	2.674	3.193	3.957	4.612	5.248	5.913	6.648	7.522	8.683	10.594	12.583	18.480	31.707
70	1.512	2.131	2.963	3.535	4.367	5.079	5.771	6.499	7.302	8.262	9.540	11.640	13.835	20.399	35.532
100	1.693	2.369	3.279	3.902	4.810	5.590	6.344	7.132	8.011	9.059	10.452	12.758	15.171	22.242	39.126
150	1.891	2.653	3.655	4.339	5.327	6.175	6.999	7.862	8.818	9.970	11.488	14.027	16.628	24.405	42.354
200	2.043	2.867	3.923	4.649	5.696	6.593	7.464	8.376	9.391	10.613	12.244	14.934	17.714	25.839	44.611
300	2.298	3.196	4.338	5.118	6.245	7.209	8.149	9.123	10.220	11.530	13.276	16.179	19.139	27.523	46.663
500	2.609	3.596	4.861	5.702	6.932	7.977	8.990	10.055	11.246	12.674	14.567	17.717	20.927	29.760	49.888
1000	3.072	4.191	5.588	6.526	7.885	9.045	10.169	11.346	12.654	14.224	16.322	19.796	23.301	32.811	53.458

ภาคผนวก ข

โปรแกรมสำหรับการคำนวณค่าความน่าจะเป็นของความคลาดเคลื่อนประเภทที่ 1 และค่ากำลังของการทดสอบของตัวสถิติทดสอบทั้ง 3 ตัว

```
      PROGRAM MAIN
      COMMON/SEED/IX
      REAL X(100),XX(100),EX,STD,VAR,MEAN,MEAN2,
     *ALPHA,LAMBDA,
     *ALPHA1,ALPHA2,
     *ALPHA1,ALPHA2,GAMMA,BETA,
     *KKW,
     *Z(100),FX(100),A(50),
     *XN,XXN,XM(100),XMM(100),
     *PR01,PR05,PR10,
     *PZA01,PZA05,PZA10,PZC01,PZC05,PZC10
      INTEGER N,KR,K,NR,AI,NNW,NW,
     *DF,ND,KK,
     *R01,R05,R10,
     *ZA01,ZA05,ZA10,ZC01,ZC05,ZC10

      OPEN (1,FILE='D:\power.xls')

C     **********SET INITIAL VALUE**********
      N = 80
      IX = 65539
      EX = 0.0
      STD = 1.0
      VAR = STD**2

C     **********CHECK VALUE OF T DIST**********
      DF = 50
      ND = DF/2.0
      DIFF = DF-(ND*2.0)
      IF (DIFF.EQ.0.0) THEN
            KK = DF/2.0
      ELSE
            KK = (DF-1)/2.0
      END IF

C     **********SET INITIAL VALUE OF GAMMA DIST**********
C       ALPHA = 6.20
C       LAMBDA = 1.0

C     **********SET INITIAL VALUE OF BETA DIST**********
C       ALPHA1 = 3.0
C       ALPHA2 = 4.50

C     **********SET INITIAL VALUE OF JOHNSON DIST**********
C       ALPHA1 = 2.0
C       ALPHA2 = 1.0
C       GAMMA = -3.0
C       BETA = 1.0

C     **********SET INITIAL VALUE**********
      R01 = 0.0
      R05 = 0.0
      R10 = 0.0
      ZA01 = 0.0
      ZA05 = 0.0
```

```
      ZA10 = 0.0
      ZC01 = 0.0
      ZC05 = 0.0
      ZC10 = 0.0

C     **********GENERATE X**********
      DO 1005 KR=1,1000
            DO 21 I=1,N
                  CALL T(EX,STD,DF,KK,DIFF,ZNORM,X_CHI,X_T)
                  X(I) = X_T
21          CONTINUE

C     **********COMPUTE MEAN AND SD OF X(I)**********
      SM = 0.0
      V1 = 0.0
      DO 51 I=1,N
51          SM = SM+X(I)
      MEAN = SM/N
      DO 48 I=1,N
            QQ = (X(I)-MEAN)**2
48          V1 = V1+QQ
      VX = V1/(N-1)
      SD = SQRT(VX)

C     **********TRANSFORM X(I)**********
      DO 52 I=1,N
            XX(I) = (X(I)-MEAN)/SD
52    CONTINUE

C     **********SORT XX(I)**********
      L = N-1
      DO 30 J=1,L
            G = N-J
            DO 30 K=1,G
                  IF (XX(K).LE.XX(K+1)) GOTO 30
                        SAVE = XX(K)
                        XX(K) = XX(K+1)
                        XX(K+1) = SAVE
30    CONTINUE

C     **********COMPUTE MEAN AND SD OF XX(I)**********
      SM2 = 0.0
      V12 = 0.0
      DO 39 I=1,N
39          SM2 = SM2+XX(I)
      MEAN2 = SM2/N
      DO 43 I=1,N
            QQ2 = (XX(I)-MEAN2)**2
43          V12 = V12+QQ2
      VX2 = V12/(N-1)
      SD2 = SQRT(VX2)

C     **********COMPUTE Z(I) AND FX(I)**********
      DO 49 I=1,N
49          Z(I) = (XX(I)-MEAN2)/SD2
      CALL CDFZ(Z,N,FX)

C     **********ZA STATISTIC**********
      SUMZA = 0.0
      DO 1 I = 1,N
```

```
                A1 = (ALOG(FX(I)))/(N-I+0.5)
                B1 = (ALOG(1-FX(I)))/(I-0.5)
                SUMZA = SUMZA+A1+B1
1       CONTINUE
        SZA = (-1)*SUMZA
        ZA = (10*SZA)-32
        IF (ZA.GT.1.961) ZA01 = ZA01+1.0
        IF (ZA.GT.1.626) ZA05 = ZA05+1.0
        IF (ZA.GT.1.482) ZA10 = ZA10+1.0
        CONTINUE

C   **********************ZC STATISTIC**************************
        SUMZC = 0.0
        DO 2 I = 1,N
                A2 = ((FX(I))**(-1))-1.0
                B2 = ((N-0.5)/(I-0.75))-1.0
                C2 = (ALOG(A2/B2))**2
                SUMZC = SUMZC+C2
2       CONTINUE
        ZC = SUMZC
        IF (ZC.GT.21.013) ZC01 = ZC01+1.0
        IF (ZC.GT.14.280) ZC05 = ZC05+1.0
        IF (ZC.GT.12.013) ZC10 = ZC10+1.0
        CONTINUE

C   ****************CONSTANT VALUE OF R STATISTIC****************
        XN = N
        XXN = 1.0/XN
        XM(N) = (0.5)**XXN
        XM(1) = 1.0-XM(N)
        KRR = N-1
        DO 64 I=2,KRR
                AI = I
64              XM(I) = (AI-0.3175)/(XN+0.365)
        DO 75 J=1,N
                IF (XM(J).GT.0.5) GOTO 72
                        XM(J) = 1.0-XM(J)
                        YXM = XM(J)
                        CALL STUD(YXM,ZI)
                                XMM(J) = (-1)*ZI
                        GOTO 75
72              YXM = XM(J)
                CALL STUD(YXM,ZI)
                XMM(J) = ZI
75      CONTINUE

C   **********************R STATISTIC (R)************************
        SUMMX = 0.0
        SUMM2 = 0.0
                DO 84 J = 1,N
                SUMMX = SUMMX+(XMM(J)*XX(J))
84              SUMM2 = SUMM2+(XMM(J)**2)
        AAA = SUMM2*V12
        R = SUMMX/SQRT(AAA)
        IF (R.LT.0.976) R01 = R01+1.0
        IF (R.LT.0.984) R05 = R05+1.0
        IF (R.LT.0.987) R10 = R10+1.0
        CONTINUE

1005    CONTINUE
```

```
C   ************CALCULATE PROBABILITY OF REJECTION**************
        PR01 = R01/1000.0
        PR05 = R05/1000.0
        PR10 = R10/1000.0
        PZA01 = ZA01/1000.0
        PZA05 = ZA05/1000.0
        PZA10 = ZA10/1000.0
        PZC01 = ZC01/1000.0
        PZC05 = ZC05/1000.0
        PZC10 = ZC10/1000.0
        WRITE (1,*) PR01,PR05,PR10,PZA01,PZA05,PZA10,PZC01,PZC05,PZC10
C       *PW01,PW05,PW10
        STOP
        END

C   ***************************************************************
C   ***************************************************************

        SUBROUTINE RANDOM(IX,IY,RN)
        DOUBLE PRECISION IY
        REAL RN
        IY = 16807*IX
        IF (IY.LT.0.0) IY = (IY+2147483647)+1
        RN = IY
        RN = RN/2147483647
        IX = IY
        RETURN
        END

C       ********************NORMAL DISTRIBUTION*******************
        SUBROUTINE NORMAL(EX,STD,X_NORMAL)
        COMMON/SEED/IX
        INTEGER IX
        REAL VV1,VV2,ZNORM
        DOUBLE PRECISION IY
181             CALL RANDOM(IX,IY,RN)
                    R1 = RN
                CALL RANDOM(IX,IY,RN)
                    R2 = RN
                VV1 = (2*R1)-1
                VV2 = (2*R2)-1
                S = (VV1*VV1)+(VV2*VV2)
                IF (S.GT.1.0) GOTO 181
                ZNORM = VV1*SQRT(-2*ALOG(S)/S)
                X_NORMAL = EX+(ZNORM*STD)
45      RETURN
        END

C       ******************LOGNORMAL DISTRIBUTION*****************
        SUBROUTINE LOGNORMAL(EX,STD,X_LOGNORMAL)
        COMMON/SEED/IX
        INTEGER IX
        CALL NORMAL(EX,STD,X_NORMAL)
                X_LOGNORMAL = EXP(X_NORMAL)
        RETURN
        END

C       ******************CHISQUARE DISTRIBUTION*****************
        SUBROUTINE CHISQUARE(KK,DIFF,X_CHI)
        COMMON/SEED/IX
```

```
      INTEGER IX
      REAL PP,ZNORM,X_CHI
      DOUBLE PRECISION IY
      PP = 1.0
      DO 386 I = 1,KK
            CALL RANDOM(IX,IY,RN)
                  R = RN
                  PP = R*PP
386   CONTINUE
      PP = -2.0*ALOG(PP)
      IF (DIFF.GT.0.0) THEN
            CALL NORMAL(EX,STD,X_NORMAL)
                  ZNORM = (X_NORMAL-EX)/STD
                  Z = ZNORM
            X_CHI = (Z*Z)+PP
      ELSE
            X_CHI = PP
      END IF
      RETURN
      END

C     **********T DISTRIBUTION**********
      SUBROUTINE T(EX,STD,DF,KK,DIFF,ZNORM,X_CHI,X_T)
      COMMON/SEED/IX
      INTEGER IX,DF
      REAL XX,X_T
      CALL NORMAL(EX,STD,X_NORMAL)
            ZNORM = (X_NORMAL-EX)/STD
      CALL CHISQUARE(KK,DIFF,X_CHI)
            XX = X_CHI
      X_T = ZNORM/SQRT(XX/DF)
      RETURN
      END

C     **********GAMMA DISTRIBUTION (LT 1)**********
      SUBROUTINE GAMMA1(ALPHA,LAMBDA,X_GAMMA)
      COMMON/SEED/IX
      REAL BG1,PG1,YG1,YG2,ZG1,ZG2,LAMBDA
      DOUBLE PRECISION IY
      BG1 = (EXP(1.0)+ALPHA)/EXP(1.0)
311   CALL RANDOM(IX,IY,RN)
            R1 = RN
      PG1 = BG1*R1
      CALL RANDOM(IX,IY,RN)
            R2 = RN
      IF (PG1.GT.1.0) GOTO 411
      YG1 = PG1**(1.0/ALPHA)
      ZG1 = EXP(-YG1)
      IF (R2.LE.ZG1) THEN
            X_GAMMA = (1/LAMBDA)*YG1
      ELSE
            GOTO 311
      END IF
      RETURN
411   YG2 = -ALOG((BG1-PG1)/ALPHA)
      ZG2 = YG2**(ALPHA-1.0)
      IF (R2.LE.ZG2) THEN
            X_GAMMA = (1/LAMBDA)*YG2
      ELSE
            GOTO 311
```

```
      END IF
      RETURN
      END

C     ***************GAMMA DISTRIBUTION (EQ 1)*****************
      SUBROUTINE GAMMA2(LAMBDA,X_GAMMA)
      COMMON/SEED/IX
      REAL VG2,LAMBDA
      DOUBLE PRECISION IY
      CALL RANDOM(IX,IY,RN)
      VG2 = -ALOG(RN)
      X_GAMMA = (1/LAMBDA)*VG2
      RETURN
      END

C     ***************GAMMA DISTRIBUTION (GT 1)*****************
      SUBROUTINE GAMMA3(ALPHA,LAMBDA,X_GAMMA)
      COMMON/SEED/IX
      REAL A,B,Q,D,V,Y,Z,W,T1,T2,LAMBDA
      DOUBLE PRECISION IY
      A = 1/SQRT((2*ALPHA)-1)
      B = ALPHA-ALOG(4.0)
      Q = ALPHA+(1/A)
      D = 1+ALOG(4.5)
313   CALL RANDOM(IX,IY,RN)
            R1 = RN
      CALL RANDOM(IX,IY,RN)
            R2 = RN
      V = A*ALOG(R1/(1-R1))
      Y = ALPHA*EXP(V)
      Z = (R1**2)*R2
      W = B+(Q*V)-Y
      T1 = W+D-(4.5*Z)
      IF (T1.GE.0.0) THEN
            X_GAMMA = (1/LAMBDA)*Y
      END IF
            T2 = ALOG(Z)
      IF (W.GE.T2) THEN
            X_GAMMA = (1/LAMBDA)*Y
      ELSE
            GOTO 313
      END IF
      RETURN
      END

C     ******************BETA DISTRIBUTION*********************
      SUBROUTINE BETA(ALPHA1,ALPHA2,X_BETA)
      COMMON/SEED/IX
      REAL Y1,Y2,LAMBDA
C     DOUBLE PRECISION IY
      LAMBDA = 1.0
      ALPHA = ALPHA1
      IF (ALPHA1.EQ.1.0) THEN
            CALL GAMMA2(LAMBDA,X_GAMMA)
            Y1 = X_GAMMA
            ELSE IF (ALPHA1.GT.1.0) THEN
                  CALL GAMMA3(ALPHA,LAMBDA,X_GAMMA)
                  Y1 = X_GAMMA
                  ELSE
                        CALL GAMMA1(ALPHA,LAMBDA,X_GAMMA)
```

```
                        Y1 = X_GAMMA
      END IF
      ALPHA = ALPHA2
      IF (ALPHA2.EQ.1.0) THEN
            CALL GAMMA2(LAMBDA,X_GAMMA)
            Y2 = X_GAMMA
            ELSE IF (ALPHA2.GT.1.0) THEN
                  CALL GAMMA3(ALPHA,LAMBDA,X_GAMMA)
                  Y2 = X_GAMMA
                  ELSE
                        CALL GAMMA1(ALPHA,LAMBDA,X_GAMMA)
                        Y2 = X_GAMMA
      END IF
      X_BETA = Y1/(Y1+Y2)
      RETURN
      END

C     ******************JOHNSON DISTRIBUTION**********************
      SUBROUTINE JOHNSON(ALPHA1,ALPHA2,GAMMA,BETA,X_JOHNSON)
      COMMON/SEED/IX
      INTEGER IX
      REAL ALPHA1,ALPHA2,GAMMA,BETA
      CALL NORMAL(EX,STD,X_NORMAL)
            ZNORM = (X_NORMAL-EX)/STD
      AJ = (ZNORM-ALPHA1)/ALPHA2
      YJ = EXP(AJ)
      BJ = YJ-(1.0/YJ)
      CJ = (BETA/2.0)*BJ
      X_JOHNSON = GAMMA+CJ
      RETURN
      END

      SUBROUTINE CDFZ(Z,N,FX)
      REAL BB,A(6),Z(100),F(100),FX(100)
      A(1) = 0.070523078
      A(2) = 0.042282012
      A(3) = 0.009270527
      A(4) = 0.000152014
      A(5) = 0.000276567
      A(6) = 0.000043064
      DO 4 I = 1,N
            BB = 1.0
            DO 3 J = 1,6
3                 BB = BB+(A(J)*(ABS(Z(I))/SQRT(2.0))**J)
                  F(I) = BB**(-16)
                  IF (Z(I).GT.0.0) THEN
                        FX(I) = 1.0-F(I)/2.0
                        ELSE
                              FX(I) = F(I)/2.0
                  END IF
4     CONTINUE
      RETURN
      END

      SUBROUTINE STUD(YXM,ZI)
      REAL YXM,ZI,P,IA,IB
      ZI = 0.0
234   T1 = 1.0/(1.0+(0.2316419*ZI))
      DZ = 0.3989423*EXP(-ZI*ZI/2.0)
      IA = (1.330274*T1-1.821256)
```

```
      IB = (((IA*T1+1.781478)*T1-0.3565688)*T1+0.3198815)
      P = 1.0-DZ*T1*IB
      IF (P.GE.YXM) GOTO 456
            ZI = ZI+0.001
            GOTO 234
456   CONTINUE
      RETURN
      END
```

ประวัติผู้เขียนวิทยานิพนธ์

นางสาวกนกพร แซ่อึ้ง เกิดเมื่อวันที่ 27 กุมภาพันธ์ พ.ศ.2522 ที่เขตดุสิต กรุงเทพมหานคร จบการศึกษาชั้นมัธยมศึกษาตอนปลายจากโรงเรียนฤทธิณรงค์รอน กรุงเทพมหานคร สำเร็จการศึกษาปริญญาวิทยาศาสตรบัณฑิต สาขาวิชาสถิติ คณะวิทยาศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ เมื่อปีการศึกษา 2544 และเข้าศึกษาต่อในหลักสูตรสถิติศาสตรมหาบัณฑิต สาขาวิชาสถิติ คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย เมื่อปีการศึกษา 2545