APPENDIX

Simulation From $P_3(\theta,\lambda,\phi)$ And Obtaining M.L.E.'s

1. Simulation From $P_3(\theta,\lambda,\phi)$:

Result-1 : If r.v. T_1 follows Pareto type- II distribution with parameters λ,ϕ, (that is $T_1 \to P_2(\lambda,\phi)$), its survival function given by

$$\bar{F}_{T_1}(t) = (1+t/\phi)^{-\lambda} \qquad \ldots(1),$$

and, r.v.T_2 follows exponential distribution with parameter θ , its survival function is given by

$$\bar{F}_{T_2}(t) = \exp\{-t\theta\} \qquad \ldots(2),$$

then $T = \min\{T_1, T_2\}$ follows Pareto type-III distribution with parameters θ,λ,ϕ (that is $T \to P_3(\theta,\lambda,\phi)$)and its survival function is given by

$$\bar{F}_T(t) = \exp\{-t\theta\}.(1+t/\phi)^{-\lambda} \qquad \ldots(3).$$

For random sampling from $P_3(\theta,\lambda,\phi)$, generate one $P_2(\lambda,\phi)$ r.v. T_1 and one exponential r.v. T_2 with parameter θ using following respective formulae

$T_1 = \phi.[\exp\{-1/\lambda.\log(U1)\}-1]$ and $T_2 = -(1/\theta)\log(U2)$; where U1 and U2 are uniform random variables over (0,1).

Therefore by above result $T = \min\{T_2, T_2\}$. Repeat this procedure for appropriate sample size.

```
program py(input,output);
  VAR
        X :ARRAY [1..1000] of real;
        Y :ARRAY [1..1000] of real;
        GM:ARRAY[1..100] of real;
        BT:ARRAY[1..100] OF REAL;
        AL  :ARRAY[1..100] OF REAL;
        A:ARRAY[1..100]  of real;
        B:ARRAY[1..100] OF REAL;

        EP,EP1,EP2,R,R1 : REAL ;
        I,J,K,K1,K2,INDEX ,KIRAN:INTEGER;
        L4 ,L3,L2 :INTEGER ;
        ISEED,U,SUM :REAL ;
        ALL,ALL1,BLL,BLL1,C5,C6 : REAL;
        N , COUNTER : INTEGER;
        C1,C2,C3,C4 : REAL;
        P,P1,P2,P3,P4,P5 : REAL;
        SUM2,SUMB,SB,CON,SUM2B : REAL;
PROCEDURE RAND( ISEED : REAL; VAR U:REAL);
   CONST
      A = 93.0;
      M = 8192.0;
      C = 1.0;
   BEGIN
      ISEED := A * ISEED + C;
      ISEED := ROUND(((ISEED/M) - TRUNC (ISEED/M)) * M);
      U := ISEED/M
   END;
```

```
PROCEDURE AGAMMA(KIRAN :INTEGER);
     VAR
         F , FD :REAL ;
         A,B :  REAL;
     BEGIN
          F:=0.0;
          FD:=0.0;
      REPEAT
        A:= AL[L4];
        B:= BT[L3];

         FOR K := 1 TO I DO
             BEGIN

                   F := F+((1+X[K]*B)/(1+GM[L2]*(1+X[K]*B)))/I-A*B*SUM/I ;
                   FD := FD+((-((1+X[K]*B)*(1+X[K]*B)))/((1+GM[L2]*(1+X[K]*B
             END ;

         R :=F/FD;
         L2 :=L2+1;
         GM[L2] := GM[L2-1] - R;

         WRITELN (L2,GM[L2]);

         UNTIL (GM[L2] < 0.0)  ;

         WRITELN(' L2 = ',L2 ,' GAMMA = ',GM[L2] )
  END;
PROCEDURE ABETA(KIRAN : INTEGER);
     VAR
```

```
   SK1 , SK2, SK3 ,SK4:REAL;
   SN1,SN2,SN3 :REAL;
   S1,S2,S3,S4,S51,S61,S52,S62 : REAL;
   BN,CN,HN,DN :REAL;
   F,FD : REAL ;
 BEGIN
     AGAMMA(KIRAN);
REPEAT

     SK1 :=0;
     SK2 :=0;
     SK3 :=0;

     FOR K:= 1 TO I DO
      BEGIN
         SK1 := SK1 + LN (1+X[K]*BT[L3])+GM[L2]*BT[L3]
                 *X[K] ;
         SK2 := SK2 + (1+GM[L2]*(1+X[K]*BT[L3]))/
                 (1+X[K]*BT[L3]) ;
         SK3 := SK3 +1-(X[K]*BT[L3])/(1+GM[L2]*(1+X[K]*
                 BT[L3]))
      END ;

     SN1 :=0 ;
     SN2 :=0 ;

     FOR K:= 1 TO J DO
        BEGIN
              SN1 := SN1 + LN(1+Y[K]*BT[L3])+GM[L2]*
                     BT[L3]*Y[K];
         SN2 := SN2 + (1+GM[L2]*(1+Y[K]*BT[L3]))/
                  (1+Y[K]*BT[L3])
   END ;

S1 :=0  ;
S2 :=0  ;
S3 :=0  ;
S51 :=0 ;
S61 :=0 ;
FOR K:= 1 TO I DO
  BEGIN
    S1 :=S1+(SQR(X[K]))*GM[L2]*BT[L3]/(SQR(1+GM[L2]*
          (1+X[K]*BT[L3])));
    S2 :=S2+X[K]/(1+GM[L2]*(1+X[K]*BT[L3]));
    S3 :=S3+X[K]/(1+X[K]*BT[L3])+GM[L2]*X[K];
    S51 :=GM[L2]*X[K]/(1+X[K]*BT[L3]) ;
    S61 :=S61+((1+GM[L2]*(1+X[K]*BT[L3]))*X[K])/
           SQR(1+X[K]+BT[L3])
  END ;

SK4 := S1-S2;
S52 :=0  ;
S62 :=0  ;
S4 :=0   ;

FOR K:= 1 TO J DO
   BEGIN
        S52 :=S52+GM[L2]*Y[K]/(1+Y[K]*BT[L3]) ;
        S62 :=S62+((1+GM[L2]*(1+Y[K]*BT[L3]))*Y[K])/
               SQR(1+Y[K]+BT[L3])
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```
                 S4  :=S4+Y[K]/(1+Y[K]*BT[L3])+GM[L2]*Y[K]
           END;

         F  :=SK1+SN1-(BT[L3]/I)*(SK2+SN2)*SK3;
         BN  :=S3+S4  ;
         CN  :=SK2+SN2  ;
         DN  :=S51-S61+S52-S62  ;
         HN  :=SK2+SN2  ;
         FD  :=BN-(BT[L3]/I)*CN*SK4-SK3*((BT[L3]/I)*DN+
              (1/I)*HN);
         R1  :=F/FD  ;
         L3  :=L3+1  ;
         BT[L3]  :=  BT[L3-1]  -  R1;

  UNTIL(BT[L3]  <  0.0  );

         WRITELN  ('L3  =  ',L3,'BETA',BT[L3]);

END;

PROCEDURE  ALPHA(KIRAN:INTEGER);
   VAR
       SK,SN  :  REAL;

   BEGIN

    REPEAT
       AGAMMA(KIRAN);
       ABETA(KIRAN);
       SK  :=  0  ;
       FOR K:= 1 TO I DO
         BEGIN
                SK := SK+ LN(1+X[K])+GM[L2]*BT[L3]*X[K]
         END;
       SN :=0 ;

       FOR K:= 1 TO J DO
         BEGIN
           SN:= SN +LN(1+Y[K])+GM[L2]*BT[L3]*Y[K]
         END;
       L4 := L4 +1;
       AL[L4]:=I/(SK+SN)
 UNTIL((ABS(R) < EP) AND ( ABS(R1) < EP1 ) );
       WRITELN('ESTIMATED ALPHA,  BETA  AND  GAMMA  IS  GIVEN  BY
               :');.
       WRITELN('ALPHA =',AL[L4],'BETA =',BT[L3],'GAMMA =',GM[L2])
END;
BEGIN
   WRITELN('ENTER L2,L3,L4');
   READLN(L2);
   READLN(L3);
   READLN(L4);
   WRITELN('INITIAL VALUES OF ALPHA & BETA ');
   READLN(AL[L4]);
   READLN(BT[L3]);
   WRITELN('ENTER PRECISION VALULS EP, EP1,EP2 ');
   READLN(EP);
   READLN(EP1);
   READLN(EP2);
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```
        WRITELN ('ENTER ALL,ALL1,BLL,BLL1,C5,C6,N,ISEED  ' );
        READLN (ALL)  ;
        READLN(ALL1)  ;
        READLN(BLL)   ;
        READLN(BLL1)  ;
        READLN(C5)   ;
        READLN(C6)   ;
        READLN(N)    ;
        READLN(ISEED) ;
        I:=0;
        J:=0;
        K:=0;
        K1:=0;
        K2:=0;

REPEAT
   RAND( ISEED ,U);
   IF(U < 0.9) THEN
       BEGIN
            I:=I+1;
            RAND(ISEED+I,U);
            C1:=-(1/(ALL*BLL*C5))*LN(U);
            RAND(ISEED+I+7,U);
            C2:=(1/BLL)*(EXP (-1/ALL * LN(U)) - 1);
            IF (C1 < C2) THEN
                BEGIN X[I] := C1 END
            ELSE
                BEGIN X[I] := C2 END
       END
   ELSE
       BEGIN
               J:=J+1;
               RAND(ISEED+J,U);
               C3:=-(1/(ALL1*BLL1*C6))*LN(U);
               RAND(ISEED+J+7,U);
               C4:=(1/BLL1)*(EXP(-1/ALL1 * LN (U)) - 1);
               IF (C3 < C4) THEN
                   BEGIN    Y[J]:=C3  END
               ELSE
                   BEGIN    Y[J]:=C4  END
        END
UNTIL ((I+J) >= N);
FOR K:= 1 TO I DO
   BEGIN
       WRITELN ('X',K,'  ',X[K]) ;
  END ;

FOR K:= 1 TO J DO
   BEGIN
       WRITELN ('Y',K,'  ',Y[K]);
  END  ;

       P:=0  ;
       P1:=0  ;
       P2:=0  ;
       P3:=0  ;

       FOR K:= 1 TO I DO
         BEGIN
```

```
           P  :=P+X[K];
           P3  :=P3+X[K]*X[K]
        END;
      FOR K:= 1 TO J DO
        BEGIN
           P1  :=P1 + Y[K];
           P2  :=P2+Y[K]*Y[K]
        END;
      SUM  := P+P1;
      SUM2  :=P2+P3;
      SB  := P/I  ;
      SUMB  := SUM/N  ;
      SUM2B  :=SUM2/N;
      CON  :=SUM2B/(2*SUMB);
      WRITELN('    I    ,     J     ,      SB         ,     CON'
              );
       WRITELN('  ', I,'  ',J,  '     ',SB,'     ',CON );

      IF (SB < CON) THEN
         BEGIN
           WRITELN('CONDITION IS SATISFIED');
           ALPHA(KIRAN)
         END
     ELSE
         BEGIN
             WRITELN('CONDITION NOT SATISFIED ')
         END
END.
```