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APPENDIX A

Calculation Programs

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย


```

{ ***** CALCU7.PAS ***** }

unit calcu7;
interface
uses crt,data12x;
const R = 0.00205;
      Kintr : real = 0;
      exitcal : boolean = false;
type state = (v,l);
      stateArray = array[state] of real;
      coeArray = array[1..4] of real;
      phiArray = array[state] of compArray;

procedure Cubic(mx :byte; coe : coeArray; var zz : stateArray);
procedure ABBB(mode :byte; t,p :real; tc,pc,w,m,n,del :compArray;
              var AS,BS,CS,alpha,AB,BB,CB :compArray);
procedure AmBm(Kij :real; frac,AB,BB,CB,BS,CS :compArray;
              var Am,Bm,Cm,BSm,CSm :real);
procedure CoeForCubic(mode :byte; Am,Bm,Cm :real; var coe :coeArray);
procedure PhiMix(mode :byte; t,p,Kij :real; x,y,tc,pc,w,m,n,del :compArray;
              var phi :phiArray);
procedure BPP(mode :byte; t,p,Kij :real; x,y,tc,pc,w,m,n,del
              :compArray; var Pcal :real; var Ycal :compArray);
PROCEDURE FIBO(left,right :real; mode, meth,kl,ked,numT :byte; pt :ptArray;
              tc,pc,w,m,n,del :compArray; var min :real);

implementation
var i : byte;
    stt : state;

procedure Cubic(mx :byte; coe :coeArray; var zz :stateArray);
var z : real;
    loop : byte;

    function h(coe :coeArray; z :real) : real;
    begin
      h := (coe[1]*sqr(z)*z + coe[2]*sqr(z) + coe[3]*z + coe[4])/
            (3*coe[1]*sqr(z) + 2*coe[2]*z + coe[3]);
    end;

begin {cubic}
  zz[l] := 0; zz[v] := 1;
  for stt := 1 downto v do
    begin
      z := zz[stt];
      loop := 0;
      repeat
        if exitcal then exit;
        z := z-h(coe,z);
        loop := loop+1;
      until (abs(h(coe,z)/z) < 0.0001) or (loop > 27);
      zz[stt] := z;
      if mx = 0 then exit; {mx = 0 for only finding PT parameter}
    end;
  end;
end;

```

```

procedure ABBB(mode :byte; t,p :real; tc,pc,w,m,n,del :compArray;
              var AS,BS,CS,alpha,AB,BB,CB :compArray);
var  mm,ptp,omeA,omeB,omeC : compArray;
    ob : stateArray;
    coef : coeArray;

    function FMM(a,b,c,w :real) :real;
    begin
        FMM := a + b*w + c*sqr(w);
    end;

begin
    for i := 1 to 2 do
        begin
            (FMM(0.40,1.574,-0.176,w[i]) )
            case mode of
                {SRK}      1 : mm[i] := FMM(0.48508,1.55171,-0.15613,w[i]);
                {PR,MPR}  2,5 : mm[i] := FMM(0.37464,1.54226,-0.26992,w[i]);
                {PT}      3 : begin
                    mm[i] := FMM(0.452413,1.30982,-0.295937,w[i]);
                    ptp[i] := FMM(0.329032,-0.076799,0.0211947,w[i]);
                end;
            end;

            case mode of
                {All EOS} 1,2,3,5 : alpha[i] := sqr(1+mm[i]*(1-sqrt(t/tc[i])));
                {MSRK}    4 : alpha[i] := 1+(1-t/tc[i])*(m[i]+n[i]/(t/tc[i]));
            end;

            case mode of
                {SRK,MSRK} 1,4 : begin
                    omeB[i] := 0.08664;
                    omeA[i] := 0.42747;
                end;
                {PR,MPR}  2,5 : begin
                    omeB[i] := 0.0778;
                    omeA[i] := 0.45724;
                end;
                {PT}      3 : begin
                    coef[1] := 1;          coef[3] := 3*sqr(ptp[i]);
                    coef[2] := 2-3*ptp[i]; coef[4] := -1*ptp[i]*sqr(ptp[i]);
                    cubic(0,coef,ob);
                    omeC[i] := 1-3*ptp[i];
                    omeB[i] := ob[1]; {0.32429*ptp[i]-0.022005;}
                    omeA[i] := 3*sqr(ptp[i])+3*(1-2*ptp[i])*omeB[i]
                               +sqr(omeB[i])+(1-3*ptp[i]);
                end;
            end;

            AS[i] := omeA[i]*sqr(R*tc[i])/pc[i];

            case mode of
                {All EOS} 1,2,3,4 : BS[i] := omeB[i]*R*tc[i]/pc[i];
                {MPR}    5 : BS[i] := omeB[i]*R*tc[i]/pc[i]*(1+del[i]*(1-t/tc[i]))
            end;
        end;
    end;
end;

```

```

    AB[i] := AS[i]*alpha[i]*p/sqr(R*t);
    BB[i] := BS[i]*p/(R*t);
    case mode of
  (All EOS) 1,2,4,5 : begin
        CS[i] := 0;
        CB[i] := 0;
      end;
  (PT)      3 : begin
        CS[i] := omeC[i]*R*tc[i]/pc[i];
        CB[i] := CS[i]*p/(R*t);
      end;
    end;
  end; {for}
end; {ABBB}

procedure AmBm(Kij :real; frac,AB,BB,CB,BS,CS :compArray;
               var Am,Bm,Cm,BSm,CSm :real);
var A12 : real;

begin
  A12 := (1-Kij)*sqrt(AB[1]*AB[2]);
  Am := AB[1]*sqrt(frac[1]) + AB[2]*sqrt(frac[2]) + 2*frac[1]*frac[2]*A12;
  Bm := BB[1]*frac[1] + BB[2]*frac[2];
  Cm := CB[1]*frac[1] + CB[2]*frac[2];
  BSm := BS[1]*frac[1] + BS[2]*frac[2];
  CSm := CS[1]*frac[1] + CS[2]*frac[2];
end; {AmBm}

procedure CoeForCubic(mode :byte; Am,Bm,Cm :real; var coe :coeArray);
begin
  {aZ^3 + bZ^2 + cZ + d = 0}
  coe[1] := 1;
  case mode of
    1,4 : begin
        coe[2] := -1;
        coe[3] := Am-Bm-sqr(Bm);
        coe[4] := -1*Am*Bm;
      end;
    2,5 : begin
        coe[2] := Bm-1;
        coe[3] := Am-2*Bm-3*sqr(Bm);
        coe[4] := -1*(Am*Bm-sqr(Bm)-sqr(Bm)*Bm);
      end;
    3 : begin
        coe[2] := Cm-1;
        coe[3] := Am-2*Bm*Cm-Bm-Cm-sqr(Bm);
        coe[4] := Bm*Cm+sqr(Bm)*Cm-Am*Bm;
      end;
  end; {case}
end;

procedure PhiMix(mode :byte; t,p,Kij :real; x,y,tc,pc,w,m,n,del :compArray;
                 var phi :phiArray);
var j : state;

```

```

    apha12,xx1,xx2,xx3           : real;
    AS,BS,CS,alpha,AB,BB,CB     : compArray;
    apha,Am,Bm,Cm,BSm,CSm,      : stateArray;
    zz,zzz,vb,qb,db             : phiArray;
    xy,Zigma                     : coeArray;
    coe

begin
    kintr := Kij;
    ABBB(mode,t,p,tc,pc,w,m,n,del,AS,BS,CS,alpha,AB,BB,CB);
    for i := 1 to 2 do
        begin
            xy[v,i] := y[i];
            xy[l,i] := x[i];
        end;
    apha12 := (1-Kij)*sqrt(AS[1]*alpha[1]*AS[2]*alpha[2]);

    for j := v to l do
        begin
            apha[j] := AS[1]*alpha[1]*sqrt(xy[j,1]) + AS[2]*alpha[2]*
                sqrt(xy[j,2]) + 2*xy[j,1]*xy[j,2]*apha12;
            AmBm(Kij,xy[j],AB,BB,CB,BS,CS,Am[j],Bm[j],Cm[j],BSm[j],CSm[j]);
            CoeForCubic(mode,Am[j],Bm[j],Cm[j],coe);
            Cubic(l,coe,zz);
            if exitcal then exit;
            zzz[j] := zz[j];
        end;

    case mode of
    1,4 : for j := v to l do
        begin
            xx1 := zzz[j]-Bm[j];
            xx2 := 1+Bm[j]/zzz[j];

            for i := 1 to 2 do
                begin
                    Zigma[j,i] := xy[j,i]*AS[i]*alpha[i] + (1-xy[j,i])*apha12;
                    if (xx1 > 0) and (xx2 > 0) then
                        begin
                            xx3 := BB[i]*(zzz[j]-1)/Bm[j] - ln(xx1) +
                                ln(xx2)*Am[j]/Bm[j]*(BB[i]/Bm[j]-2*Zigma[j,i]/apha[j]);
                            if xx3 > 88 then xx3 := 0
                                else if xx3 < -88 then xx3 := -88;
                            phi[j,i] := exp(xx3);
                        end else
                            if j = v then phi[j,i] := 1 else phi[j,i] := 0.2;
                    end; {for i}
                end; {for j}
        end;
    2,5 : for j := v to l do
        begin
            xx1 := zzz[j]-Bm[j];
            xx2 := (zzz[j]+2.414*Bm[j])/(zzz[j]-0.414*Bm[j]);

            for i := 1 to 2 do

```

```

begin
  Zigma[j,i] := xy[j,i]*AS[i]*alpha[i] + (1-xy[j,i])*apha12;
  if (xx1 > 0) and (xx2 > 0) then
    begin
      xx3 := BB[i]*(zzz[j]-1)/Bmm[j] - ln(xx1) +
            ln(xx2)*Amm[j]/(Bmm[j]*2*sqrt(2))*
            (BB[i]/Bmm[j]-2*Zigma[j,i]/apha[j]);

      if xx3 > 88 then xx3 := 0
      else if xx3 < -88 then xx3 := -88;
      phi[j,i] := exp(xx3);
    end else
      if j = v then phi[j,i] := 1 else phi[j,i] := 0.2;
    end; {for i}
  end; {for j}
3 : for j := v to 1 do
  begin
    vb[j] := zzz[j]*R#t/p;
    qb[j] := vb[j]+(BSmm[j]+CSmm[j])/2;
    db[j] := sqrt(BSmm[j]*CSmm[j]+sqr(BSmm[j]+CSmm[j])/4);
    xx1 := zzz[j]-Bmm[j];
    xx2 := (qb[j]+db[j])/(qb[j]-db[j]);

    for i := 1 to 2 do
      begin
        Zigma[j,i] := xy[j,i]*AS[i]*alpha[i] + (1-xy[j,i])*apha12;
        if (xx1 > 0) and (xx2 > 0) then
          begin
            xx3 := R#t*BS[i]/(vb[j]-BSmm[j]) - R#t*ln(xx1) - Zigma[j,i]/
                  db[j]*ln(xx2) + apha[j]*(BS[i]+CS[i])/(2*(sqr(qb[j])-sqr(db[j])))
                  + apha[j]/(8*sqr(db[j])*db[j]) * (CS[i]*(3*BSmm[j]+CSmm[j]) +
                  BS[i]*(3*CSmm[j]+BSmm[j])) * (ln(xx2) -
                  2*qb[j]*db[j]/(sqr(qb[j])-sqr(db[j]))));

            xx3 := xx3/(R#t);
            if xx3 > 88 then xx3 := 0
            else if xx3 < -88 then xx3 := -88;
            phi[j,i] := exp(xx3);
          end else
            if j = v then phi[j,i] := 1 else phi[j,i] := 0.2;
          end; {for i}
        end; {for j}
      end; {case}
    end; {phimix}

  procedure BPP(mode :byte; t,p,Kij :real; x,y,tc,pc,w,m,n,del
                :compArray; var Pcal :real; var Ycal :compArray);
  var nlap      : byte;
      phif      : phiArray;
      y12       : real;

  begin
    phimix(mode,t,p,Kij,x,y,tc,pc,w,m,n,del,phif);
    if exitcal then exit;
    phif[v,1] := 1; phif[v,2] := 1;
  end;

```

```

Pcal := p;
nlap := 0;
Ycal[1] := x[1]*phif[1,1]/phif[v,1];
Ycal[2] := x[2]*phif[1,2]/phif[v,2];
y12 := Ycal[1]+Ycal[2];
while (nlap <> 36) and (abs(y12-1) > 0.0001) do
begin
  Pcal := Pcal*y12;
  Ycal[1] := Ycal[1]/y12;
  Ycal[2] := Ycal[2]/y12;
  phimix(mode,t,Pcal,Kij,x,Ycal,tc,pc,w,m,n,del,phif);
  if exitcal then exit;
  Ycal[1] := x[1]*phif[1,1]/phif[v,1];
  Ycal[2] := x[2]*phif[1,2]/phif[v,2];
  y12 := Ycal[1]+Ycal[2];
  nlap := nlap+1;
end;
end;

PROCEDURE FIBO(left,right :real; mode, meth, k1, ked, numT : byte; pt : ptArray;
  tc, pc, w, m, n, del : compArray; var min : real);
var
  x, d, a, b, ll : array[1..20] of real;
  RemainPoint, alpha, less : real;
  FibNum : array[0..20] of word;
  k, nn : byte;
  c, e : array[1..3] of real;
  i : byte; {No delete}
  ch : char;

{ ---- FUNCTION ---- }
function F(Kij : real) : real;
var
  Ff, f1, f2, f3, f4 : real;
  phi : phiArray;
  pcalc : pxyArray;
  ycalc : xy20Array;
  i, j, numTx : byte;
  searchPntr : PntrT;
begin
  case meth of
  1 : begin
    Ff := 0; if k1 = numT+2 then numTx := numT else numTx := 1;
    for j := 1 to numTx do
      begin
        if k1 = 1 then searchPntr := pt[ked]
        else if k1 = numT+2 then searchPntr := pt[j]
        else searchPntr := pt[k1-1];
        with searchPntr^.expRe do
          for i := 1 to rw do
            begin
              Phimix(mode,t,p[i],Kij,x[i],y[i],tc,pc,w,m,n,del,phi);
              if exitcal then exit;
              f1 := phi[1,1]*x[i,1]*p[i];
              f2 := phi[v,1]*y[i,1]*p[i];
              f3 := phi[1,2]*x[i,2]*p[i];

```

```

        f4 := phi[v,2]*y[i,2]*p[i];
        Ff := Ff+ abs(f1-f2)/f2 + abs(f3-f4)/f4;
    end; {for i}
end; {for j}
F := Ff;
end;
2 : begin
Ff := 0; if kl = numT+2 then numTx := numT else numTx := 1;
for j := 1 to numTx do
begin
if kl = 1 then searchPntr := pt[ked]
else if kl = numT+2 then searchPntr := pt[j]
else searchPntr := pt[kl-1];
with searchPntr^.expRe do
for i := 1 to rw do
begin
BPP(mode,t,p[i],Kij,x[i],y[i],tc,pc,w,m,n,del,
Pcalc[i],Ycalc[i]);
if exitcal then exit;
Ff := sqr((p[i]-Pcalc[i])/p[i]) + Ff;
end; {for i}
end; {for j}
F := Ff;
end;
end; {case}
end;
{ ----- }

begin {main}
a[1] := left;
b[1] := right;
{ if 1/alpha <= 2 then }
alpha := 0.01;
LL[1] := b[1]-a[1];

(* FIBONACCI NUMBER *)
FiboNum[0] := 1;
FiboNum[1] := 1;
nn := 2;
FiboNum[nn] := FiboNum[nn-1] + FiboNum[nn-2];
while FiboNum[nn] < 1/alpha do
begin
nn := nn + 1 ;
FiboNum[nn] := FiboNum[nn-1] + FiboNum[nn-2];
end;

(* START SEARCH *)
d[1] := FiboNum[nn-2]*LL[1]/FiboNum[nn];
x[1] := a[1] + d[1];
x[2] := b[1] - d[1];

(* ----- *)
if F(x[2]) > F(x[1]) then
begin
if exitcal then exit;

```

```

    a[2] := a[1];
    b[2] := x[2];
    RemainPoint := x[1];
end
else
begin
    if exitcal then exit;
    a[2] := x[1];
    b[2] := b[1];
    RemainPoint := x[2];
end;
LL[2] := LL[1] - d[1];
(* ----- *)
for k := 2 to nn-1 do
begin
    d[k] := FibNum[nn-(k+1)]*LL[k]/FibNum[nn-(k-1)];

    if RemainPoint > (a[k]+b[k])/2 then      { IF 1 : to define new x }
        x[k+1] := a[k] + d[k]
    else
        x[k+1] := b[k] - d[k];

    if F(x[k+1]) > F(RemainPoint) then      { IF 2 : to compare 2 F(x) }
    begin
        if exitcal then exit;
        if x[k+1] < (a[k]+b[k])/2 then
        begin
            a[k+1] := x[k+1];
            b[k+1] := b[k]
            { RemainPoint := RemainPoint }
        end
        else
        begin
            a[k+1] := a[k];
            b[k+1] := x[k+1];
            { RemainPoint := RemainPoint }
        end;
    end
    else
    begin
        if exitcal then exit;
        if RemainPoint < (a[k]+b[k])/2 then
        begin
            a[k+1] := RemainPoint;
            b[k+1] := b[k];
            RemainPoint := x[k+1]
        end
        else
        begin
            a[k+1] := a[k];
            b[k+1] := RemainPoint;
            RemainPoint := x[k+1]
        end;
    end;
end;
end;

```



```
    LL[k+1] := LL[k] - d[k];  
end; { FOR }  
  
(* ----- *)  
e[1] := x[nn];  
e[2] := a[nn-1];  
e[3] := b[nn-1];  
for i := 1 to 3 do begin c[i] := F(e[i]); if exitcal then exit; end;  
  
less := c[1]; min := e[1];  
for i := 2 to 3 do  
    if c[i] < less then begin less := c[i]; min := e[i] end;  
end;  
end; { fibot }  
  
end.
```



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```

{ ***** KIJ.PAS ***** }

program Kij;
uses crt,skw,data12x,tablex,select;
const maxMain = 5;
      maxChoice = 3;
type  string80 = string[80];
      structureMenu = record
          win      : array[1..4] of byte;
          col      : array[0..maxChoice] of byte;
          row      : array[0..maxChoice] of byte;
          msg      : array[0..maxChoice] of string80;
          numChoice : byte;
      end;
      strucMenu = array[1..maxMain] of structureMenu;

const menu : strucMenu = (
    (win      : (1,2,2,3);
      col      : (1,0,0,0);
      row      : (1,0,0,0);
      msg      : (' CALCULATION ',
                  ' ',' ');
      numChoice : 0),

    (win      : (21,2,22,3);
      col      : (21,0,0,0);
      row      : ( 1,0,0,0);
      msg      : (' DISPLAY ',
                  ' ',' ');
      numChoice : 0),

    (win      : (37,2,55,5);
      col      : (37,2,2,0);
      row      : ( 1,1,2,0);
      msg      : (' ADD ',
                  ' Add Component ',
                  ' Add VLE ');
      numChoice : 2),

    (win      : (49,2,77,6);
      col      : (49,2,2,2);
      row      : ( 1,1,2,3);
      msg      : (' CUT/MODIFY ',
                  ' Cut/Modify Component ',
                  ' Cut/Modify VLE P ',
                  ' Cut/Modify VLE T,Compnt ');
      numChoice : 3),

    (win      : (68,2,69,3);
      col      : (68,0,0,0);
      row      : ( 1,0,0,0);
      msg      : (' QUIT ',

```

```

        '','');
    numChoice := 0)
    );

const choiceMenu : array[1..maxMain] of 1..maxChoice = (1,1,1,1,1);
    statusMenu : 1..maxMain = 1;
    finish      : boolean = false;
var   key      : char;

procedure displayBottom;
begin
    if crtType=7 then
        mem[$b000:$0f9f] := $30 else mem[$b800:$0f9f] := $30;
    gotoxy(1,25);
    textAttr := 3+7#16;
    write(' <-- --> ');
    textAttr := 15+3#16;
    write(' Choose choice ');
    textAttr := 3+7#16;
    write(' F1 ');
    textAttr := 15+3#16;
    write(' Information ');
    textAttr := 3+7#16;
    write(' Alt-X ');
    textAttr := 15+3#16;
    write(' Quit ');

end;

procedure displayMain;
var i : byte;
begin
    window(1,1,80,25);
    textbackground(3);
    for i := 1 to 80 do write(' ');
    textAttr := 7+3#16;
    for i := 1 to maxMain do
        with menu[i] do
            begin
                gotoxy(col[0],row[0]);
                write(msg[0]);
            end;
        displaybottom;
        norvideo;
    end;

procedure choiceActive(old,new : byte);
begin
    with menu[statusMenu] do
        begin
            textAttr := 15+0#16;
            gotoxy(col[old],row[old]);
            write(msg[old]);
            textAttr := 0+7#16;
            gotoxy(col[new],row[new]);

```

```

        write(msg[new]);
        normvideo;
    end;
end;

procedure menuActive(new : byte);
var i : byte;
begin
    displayMain;
    textAttr := 15+7*16;
    with menu[new] do
        begin
            gotoxy(col[0],row[0]);
            write(msg[0]);
            setInitWin(1,15,6,'',15,3,0,15,0);
            windowopen(win[1],win[2],win[3],win[4]);
            for i := 1 to numChoice do
                begin
                    gotoxy(col[i],row[i]);
                    write(msg[i]);
                end;
            end;
            choiceActive(1,choiceMenu[new]);
            normvideo;
        end;
end;

procedure up;
var oldChoice : byte;
begin
    if not(statusMenu in [1,2,5]) then
        begin
            oldChoice := choiceMenu[statusMenu];
            if oldChoice = 1 then
                choiceMenu[statusMenu] := menu[statusMenu].numChoice
            else choiceMenu[statusMenu] := oldChoice - 1;
            choiceActive(oldChoice,choiceMenu[statusMenu]);
        end;
end;

procedure down;
var oldChoice : byte;
begin
    if not(statusMenu in [1,2,5]) then
        begin
            oldChoice := choiceMenu[statusMenu];
            if oldChoice = menu[statusMenu].numChoice then
                choiceMenu[statusMenu] := 1
            else choiceMenu[statusMenu] := oldChoice + 1;
            choiceActive(oldChoice,choiceMenu[statusMenu]);
        end;
end;

procedure right;
begin
    windowclose;
end;

```

```

    if statusMenu+1 > maxMain then statusMenu := 1
        else statusMenu := statusMenu+1;
    menuActive(statusMenu);
end;

procedure left;
begin
    windowclose;
    if statusMenu = 1 then statusMenu := maxMain
        else statusMenu := statusMenu-1;
    menuActive(statusMenu);
end;

procedure quit;
var ch: char;
begin
    setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
    windowopen(20,19,60,22);
    gotoxy(5,2); write('QUIT THE PROGRAM ? [Y/N] ');
    repeat ch := upcase(readkey) until ch in ['Y','N'];
    windowClose;
    if ch = 'N' then exit;
    windowClose;
    cursoron;
    clrscr;
    finish := true;
end;

procedure domenu3;
begin
    case choicemenu[statusmenu] of
        1 : AddCompnt;
        2 : AddVLE;
    end;
end;

procedure domenu4;
begin
    case choicemenu[statusmenu] of
        1 : CutModCompnt;
        2 : CutModP;
        3 : CutModT;
    end;
end;

procedure doMenu;
begin
    windowclose;
    case statusMenu of
        1 : FindKij;           {kbp5}
        2 : DspCompntVLE;     {display}
        3 : domenu3;          {add}
        4 : domenu4;          {cut/modify}
        5 : quit;             {exit}
    end;
end;

```

```
    if statusmenu (<) 5 then menuActive(statusmenu)
end;

procedure testKey(key : char);
begin
    if key = #0 then
        begin
            key := readkey;
            case key of
                #72 : up;
                #80 : down;
                #75 : left;
                #77 : right;
                #45 : quit;
            end; {case}
        end
    else if key = #13 then doMenu;
end;

begin {Kij}
    textbackground(6);
    clrscr; title;
    menuActive(1);
    repeat
        key := readkey;
        testKey(key);
    until finish;
end.
```



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```

{ ***** SELECT.PAS ***** }

unit Select;
interface
uses crt,dos,skw,tablex,data12x,calcu7;

PROCEDURE FindKij;
PROCEDURE DspCompntVLE;
PROCEDURE AddCompnt;
PROCEDURE AddVLE;
PROCEDURE CutModP;
PROCEDURE CutModT;
PROCEDURE CutModCompnt;
implementation
const space = ' '; {40}
var k,numT,Neos,
    Npage,lfi,lastX,lastY : byte;
    sw : char;
    quit : boolean;
    strTem : strChoice;
    pt : ptArray;
    pofi : pofiArray;
    comp,ncomp : comptype;
    head : PntrT;
    fi : compntfi;
    fiExp : fiExpType;
    page : pageType;

procedure exitCalProc;
var ch : char;
    d : integer;
begin
if keypressed then
begin
ch := readkey;
if ch = #27 then
begin
d := 500;
repeat
sound(d); dec(d,100); delay(100);
until d = 100;
nosound; exitcal := true;
end;
end;
end;

{$f+} procedure writeKijInt; {$f-} interrupt;
var h,m,s,fr : word;
begin
gettime(h,m,s,fr);
writeKijTime(kintr,h,m,s);
exitCalProc
end;

PROCEDURE FindKij;

```

```

var   mode,meth           : byte;
      q,back,back1       : boolean;
      ocomp,ncomp        : compType;

procedure calKBPP(mode,meth :byte; var q,back :boolean);
var   ch,chout            : char;
      i,row,r,startT     : byte;
      tc,pc,w,m,n,del    : compArray;
      left,right         : real;
      h,mm,s,fr          : word;
      irow               : maxTrow;
      iKij,iAAD          : maxTt;
      iPcal,iDP,iDY1     : maxTP;
      iYcal               : maxTXY;
      Kij,AAD            : real;
      Pcal,DP,DY1        : pxyArray;
      Ycal                : xy2DArray;
      vec                : pointer;

procedure findResult(k,ked :byte; Kij :real; var row :byte; var Pcal,
                    DP,DY1 :pxyArray; var Ycal :xy2DArray; var aad :real);
var   r                  : byte;
      searchPntr         : PntrT;
begin
  if exitcal then exit;
  if k in [1,numT+2] then searchPntr := pt[ked] else searchPntr := pt[k-1];
  aad := 0;
  with searchPntr^.expre do
  begin
    for r := 1 to rw do
    begin
      BPP(mode,t,p[r],Kij,x[r],y[r],tc,pc,w,m,n,del,Pcal[r],Ycal[r]);
      exitCalProc; if exitcal then exit;
      DP[r] := abs(Pcal[r]-p[r]);
      DY1[r] := abs(Ycal[r,1]-y[r,1]);
      aad := aad+abs(1-Pcal[r]/p[r]);
      if k in [2..numT+1] then
      begin
        gotoxy(2,4+r); textAttr := 7+0*16;
        write(Pcal[r]:8:4,DP[r]:9:4,Ycal[r,1]:9:4,DY1[r]:9:4);
      end;
    end; {for r}
    row := rw;
  end; {with}
end; {findResult}

procedure dspResult(k :byte; Kij :real);
var   r :byte;
begin
  if exitcal then exit;
  gotoxy(39,25); write(space);
  gettime(h,mm,s,fr);
  writeKijTime(Kij,h,mm,s);
  write(#7);
  gotoxy(2,4); textAttr := 0+7*16;

```



```

write(' Pcal    DP    Yical    DY1 ');
window(1,5,40,23); textAttr := 7+0*16; clrscr; window(1,1,80,25);
findResult(k,0,Kij,row,Pcal,DP,DY1,Ycal,AAD);
if exitcal then exit;
gotoxy(10,1); textAttr := 15+0*16;
write('AAD = ',(aad*100/row):7:4,' %');
write(#7);
gettime(h,mm,s,fr);
writeKijTime(Kij,h,mm,s);
textAttr := 15+7*16;
gotoxy(46,1); write('F5 :Print');
gotoxy(50,25); write('...Press any key...');
ch := readkey; textAttr := 7+0*16;
end;

procedure dspAllT;
var r,u : byte;
begin
  if exitcal then exit;
  gettime(h,mm,s,fr);
  write(#7);
  gotoxy(2,4); textAttr := 0+7*16;
  write(' Pcal    DP    Yical    DY1 ');
  u := 1;
  repeat
    window(1,5,40,23); textAttr := 7+0*16; clrscr; window(1,1,80,25);
    gotoxy(39,25); write(space);
    textAttr := 15+7*16;
    gotoxy(44,25); write('Esc :Cont. ');
    gotoxy(56,25); write('Up/Dn :Change T ');
    gotoxy(73,25); write(u:2,'/',numT);
    writeModeMeth(mode, meth);
    gotoxy(27,24); write(strTem[u+1]); gotoxy(24,24); write('T(K) : ');
    writeKijTime(iKij[u],h,mm,s);
    gotoxy(2,4); textAttr := 0+7*16;
    write(' Pcal    DP    Yical    DY1 ');
    for r := 1 to irow[u] do
      begin
        gotoxy(2,4+r); textAttr := 7+0*16;
        write(ipcal[u,r]:8:4,idp[u,r]:9:4,iycal[u,r,1]:9:4,idy1[u,r]:9:4);
      end;

    textAttr := 15+0*16; gotoxy(2,1);
    write('AAD(%),N : ',(iaad[u]*100/irow[u]):6:4,' ',irow[u], ' ');
    if k = numT+2 then
      begin gotoxy(26,1); write('< ',(aad*100/row):6:4,' ',row, ' >') end;
    ch := readkey;
    if ch = #0 then
      begin
        ch := readkey;
        case ch of
          #00 : begin
            u := u+1;
            if u > numT then begin u := numT; write(#7) end;
          end;
        end;
      end;
  until false;
end;

```

```

#72 : begin
    u := u-1;
    if u < 1 then begin u := 1; write(#7) end;
    end;
#73 : u := 1;
#81 : u := numT;
end;
end;
until ch = #27;
end;

procedure KijZero(k :byte);
var a,b,c : word;
    i : byte;
begin
    gotoxy(39,25); write(space);
    writeModeMeth(mode,3);
    gotoxy(27,24); write(strTem[k]); gotoxy(24,24); write('T(K) : ');
    setTime(0,0,0,0);
    if k in [2..numT+1] then dspResult(k,0) else
    begin
        writeKijTime(0,0,0,0);
        write(#7); textAttr := 15+2*16+128;
        gotoxy(52,25); write('...THINKING... ');
        i := 1; row := 0; aad := 0;
        repeat
            iKij[i] := 0;
            FindResult(k,i,iKij[i],irow[i],iPcal[i],iDP[i],iDY1[i],
                iYcal[i],iaad[i]);
            if k = numT+2 then begin row := row+irow[i]; aad := aad+iaad[i] end;
            inc(i);
        until (i > numT) or (exitcal);
        dspAllT;
    end;
end;

begin {calKBPP}
    clrscr;
    for i := 1 to 2 do
    begin
        tc[i] := ncomp[i].tc;
        pc[i] := ncomp[i].pc;
        w[i] := ncomp[i].w;
        m[i] := ncomp[i].m;
        n[i] := ncomp[i].n;
        del[i] := ncomp[i].del;
    end;

    startT := 1; back := false;
    REPEAT
    REPEAT
    repeat
        exitcal := false;
        writeModeMeth(mode,meth);
        gotoxy(39,25); write(space);

```



```
textAttr := 15+7*16;
gotoxy(47,25); write('F10 :Main Menu');
gotoxy(66,25); write('Esc :EOS');
normVideo; gotoxy(35,1); write(space);
textAttr := 15+7*16; gotoxy(46,1); write('F4 :Kij=0');
normVideo; q := false;
chooseT(ncomp,pt,numT,startT,k,sw,strTem);
startT := k;
case sw of
  #27 : begin back := true; exit end;
  #68 : begin q := true; exit end;
  #62 : KijZero(k);
end; {case}
until sw = #13;

gotoxy(1,1); write(space);
gotoxy(1,25); write(space);
gotoxy(39,25); write(space);
textAttr := 15+7*16;
gotoxy(47,25); write('F2 :Continue');
gotoxy(61,25); write('Esc :ChooseT');
textAttr := 7+0*16;
gotoxy(46,1); write('ENTER RANGE : ');
InputRange(chout,left,right);
UNTIL chout <> #27;
cursoroff;
gotoxy(39,25); write(space);
textAttr := 15+2*16+128;
gotoxy(52,25); write('...THINKING... '); textAttr := 7+0*16;
gotoxy(27,24); write(strTem[k]); gotoxy(24,24); write('T(K) : ');
setTime(0,0,0,0);
getintvec(%lc,vec);
setintvec(%lc,@writeKijInt);
i := 1;
if k = 1 then
begin
repeat
Fibo(left,right,mode,meth,k,i,numT,pt,tc,pc,w,m,n,del,iKij[i]);
FindResult(k,i,iKij[i],irow[i],iPcal[i],iDP[i],
idYl[i],iYcal[i],iaad[i]);
inc(i);
until (i > numT) or (exitcal);
setintvec(%lc,vec);
dspAllT;
end else
if k = numT+2 then
begin
row := 0; aad := 0;
fibo(left,right,mode,meth,k,0,numT,pt,tc,pc,w,m,n,del,Kij);
repeat
iKij[i] := Kij;
FindResult(k,i,iKij[i],irow[i],iPcal[i],iDP[i],
idYl[i],iYcal[i],iaad[i]);
row := row+irow[i];
aad := aad+iaad[i];
```

```

    inc(i);
    until (i > numT) or (exitcal);
    setintvec($lc,vec);
    dspAllT;
end else
begin
    Fibo(left,right,mode,meth,k,0,numT,pt,tc,pc,w,m,n,del,Kij);
    setintvec($lc,vec);
    dspResult(k,Kij);
end;
UNTIL false;
end;

```

```

procedure Continue;
begin
    q := false;
    repeat
        chooseModeMeth(Neos,mode,meth,quit,back1);
        if back1 then exit;
        if quit then begin q := true; exit end;
        ncomp := ocomp;
        if mode = 5 then
            begin
                ncomp[1].w := ncomp[1].wnew;
                ncomp[2].w := ncomp[2].wnew;
            end;
        calKBPP(mode,meth,q,back);
    until not back;
end;

```

```

begin {FindKij}
    REPEAT
        repeat
            display(2,npage,lfi,lastX,lastY,page,comp,quit,ip,co,ro);
            if quit then exit;
            InitDispExp(head,comp,ocomp,numT,Neos,pt,pofi);
        until numT <> 0;
        Continue;
    UNTIL q;
end;

```

```

PROCEDURE DspCompntVLE;
var q : boolean;
begin
    repeat
        repeat
            display(2,npage,lfi,lastX,lastY,page,comp,quit,ip,co,ro);
            if quit then exit;
            InitdispExp(head,comp,ncomp,numT,Neos,pt,pofi);
        until numT <> 0;

```

```

        clrscr; k := 1; q := false;
        while q = false do
            begin
                gotoxy(5,25); textAttr := 15+7*16;

```

```

write('Esc :Choose Components'); textAttr := 7+0#16;
chooseT(ncomp,pt,numT,k,k,sw,strTem);
if (sw in [#27]) then q := true
end;
until sw = #68;
end;

```

```

PROCEDURE AddCompnt;
var changed :boolean;
begin
AddData(changed);
if changed then loadCompnt(fi,npage,lfi,lastX,lastY,page);
end;

```

```

PROCEDURE AddVLE;
begin
AddExp(head);
end;

```

```

PROCEDURE CutModCompnt;
var dum      : byte;
    ch,exitOut : char;
    choice    : strChoice;
    poNeed    : LongInt;
    oldrec    : compntRec;

```

```

begin {CutModCompnt}
choice[1] := ' Delete ' ;
choice[2] := ' Modify ' ;
repeat
repeat
display(1,npage,lfi,lastX,lastY,page,comp,quit,ip,co,ro);
if quit then exit;
setInitwin(2,15,6,'',15,3,0,7,0);
windowOpen(20,19,60,22);
chooseChoice(2,1,2,1,choice,[#13,#27],dum,exitout);
if exitOut = #27 then windowClose;
until exitOut = #13;
ch := 'n';
poNeed := (ip-1)#16 + (ro-1)#4 + co - 1;
oldrec := page[ip,co,ro];
if dum = 2 then
begin
ModCompnt(poNeed,oldrec,fi);
loadCompnt(fi,npage,lfi,lastX,lastY,page);
end
else
begin
clrscr;
gotoxy(10,1); write('DELETE !!!');
gotoxy(3,2); write('Are you sure ? [Y/n] ');
repeat ch := readkey until ch in ['Y','n'];
write(ch);
if ch = 'Y' then
begin

```

```

        CutCompnt(poneed,co,ro,fi);
        loadCompnt(fi,npage,lfi,lastX,lastY,page);
    end;
    windowClose;
end;
until false;
end;

PROCEDURE CutModP;
var q : boolean;
begin
    repeat
        repeat
            display(2,npage,lfi,lastX,lastY,page,comp,quit,ip,co,ro);
            if quit then exit;
            InitdispExp(head,comp,ncomp,numT,Neos,pt,pofi);
        until numT <> 0;

        clrscr; k := 1; q := false;
        while q = false do
            begin
                gotoxy(39,25); write(space);
                gotoxy(5,25); textAttr := 15+7*16;
                write('Esc :Choose Components'); textAttr := 7+0*16;
                chooseT(ncomp,pt,numT,k,k,sw,strTem);
                if (sw in [#27]) then q := true;
                if (sw = #13) and (k in [2..numT+1]) then cutP(pt[k-1],pofi[k-1],fiExp);
            end;
        until sw = #68;
    end;

    procedure CutModT;
    var q : boolean;
        ch : char;
    begin
        repeat
            repeat
                display(2,npage,lfi,lastX,lastY,page,comp,quit,ip,co,ro);
                if quit then exit;
                InitdispExp(head,comp,ncomp,numT,Neos,pt,pofi);
            until numT <> 0;

            clrscr; k := 1; q := false;
            while (q = false) and (numT <> 0) do
                begin
                    gotoxy(5,25); textAttr := 15+7*16;
                    write('Esc :Choose Components'); textAttr := 7+0*16;
                    chooseT(ncomp,pt,numT,k,k,sw,strTem);
                    if (sw in [#27]) then q := true;
                    if sw = #13 then
                        begin
                            setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
                            windowOpen(20,19,60,22);
                            gotoxy(5,1); write('Delete or Modify');
                            gotoxy(5,2); write('[D/M/Esc] ');
                        end;
                end;
            end;
        until false;
    end;
end;

```

```

repeat ch := upcase(readkey) until ch in ['D','M',#27];
if ch in ['M'] then begin windowClose; {modT} end
else if ch in ['D'] then
begin
  clrscr;
  gotoxy(3,1); write('DELETE T(K) : ',strTem[k]);
  gotoxy(3,2); write('Are you sure ? [Y/n] ');
  repeat ch := readkey until ch in ['Y','n'];
  if ch = 'Y' then
  begin
    cutT(k,numT,head,pt,pofi,fiExp);
    InitdispExp(head,comp,ncomp,numT,Neos,pt,pofi);
  end;
  windowClose;
end
else windowClose;
end; {if}
end;
until sw = #68;
end;

begin
  textbackground(6); clrscr;
  Cursoroff; title;
  gotoxy(33,24); textAttr := 15+3#16+128;
  write('... LOADING ...');
  loadCompnt(fi,npage,lfi,lastX,lastY,page);
  LoadfiExp(fiExp,head);
end.

```

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```

{ ***** SKW.PAS ***** }

unit Skw;
interface
uses crt,dos;
type str20 = string[20];
const colorseg = $b000;
      monoseg   = $b000;
      winGround : byte = black;
      frameText : byte = white;
      frameGround : byte = black;
      charText   : byte = lightgray;
      charGround : byte = black;
      headText   : byte = white;
      headGround : byte = black;
      frameStyle : byte = 1;
      winHead    : string = '';

var videoseg : word;
    crttype  : byte absolute $0040:$0049;
    cursorMode : word absolute $0040:$0060;
    vport     : word absolute $0040:$0063;

procedure windowbox(x1,y1,x2,y2 : byte);
procedure windowopen(x1,y1,x2,y2 : byte);
procedure windowclose;
procedure setInitWin(sty:byte; FT,FG:byte; strH:str20; HT,HG,WG,CT,CG:byte);
procedure setcursor(start,stop : byte);
procedure bigcursor;
procedure normcursor;
procedure cursoron;
procedure cursoroff;

implementation

type screenline = array[1..80] of integer;
    screenArray = array[1..25] of screenline;
    screenBlock = array[1..2000] of integer;
    windowLink = ^windowControlBlock;
    windowControlBlock = record
        x1,y1,x2,y2 : integer;
        x,y         : integer;
        id          : byte;
        screenContents : screenBlock;
        backLink    : windowLink;
    end;

var ActiveWindow : windowLink;
    screenPtr     : ^screenArray;
    fixedsize     : integer;
    windowCount   : byte;
    regs          : Registers;

procedure textGround(attText,attGround : byte);

```




```

begin
  textcolor(attText);
  textBackground(attGround);
end;

procedure windowBox(x1,y1,x2,y2 : byte);
const  frame  : array[1..4,1..6] of char =
        ((#218,#191,#192,#217,#196,#179),
         (#201,#187,#200,#188,#205,#186),
         (#213,#184,#212,#190,#205,#179),
         (#214,#183,#211,#189,#196,#186));
var    x,y    : byte;
begin
  window(x1,y1,x2,y2);
  textBackground(winGround);
  clrscr;
  window(1,1,80,25);
  textGround(frameText,frameGround);
  gotoxy(x1,y1);
  write(frame[frameStyle,1]);
  for x := x1+1 to x2-1 do write(frame[frameStyle,5]);
  write(frame[frameStyle,2]);
  for y := y1+1 to y2-1 do
    begin
      gotoxy(x1,y); write(frame[frameStyle,6]);
      gotoxy(x2,y); write(frame[frameStyle,6]);
    end;
  gotoxy(x1,y2);
  write(frame[frameStyle,3]);
  for x := x1+1 to x2-1 do write(frame[frameStyle,5]);
  write(frame[frameStyle,4]);
  textGround(headText,headGround);
  gotoxy((x1+x2-length(winHead)) div 2 + 1,y1);
  write(winHead);
  window(x1+1,y1+1,x2-1,y2-1);
  textGround(charText,charGround);
end;

procedure windowopen(x1,y1,x2,y2 : byte);
var  block      : windowLink;
     lineLength,windowSize,i : integer;
     y          : byte;
begin
  lineLength := x2-x1+1;
  windowSize := lineLength*(y2-y1+1)*2+fixedSize;
  if (x2<81) and (y2<26) and (x2-x1>1) and (y2-y1>1)
     and (abs(memavail) >= windowSize) then
    begin
      getmem(block,windowSize);
      block^.x1 := x1;
      block^.x2 := x2;
      block^.y1 := y1;
      block^.y2 := y2;
      block^.x  := wherex;
      block^.y  := wherey;
    end;
end;

```

```

    block^.backlink := activeWindow;
    activeWindow := block;
    windowCount := windowCount+1;
    block^.id := windowCount;
    i := 1;
    for y := y1 to y2 do
    begin
        move(screenPtr^[y,x1],Block^.screenContents[i],lineLength*2);
        i := i+lineLength;
    end;
    windowbox(x1,y1,x2,y2);
end;
end;

procedure windowClose;
var block : windowlink;
    linelength,windowSize,i : integer;
    y : byte;
begin
    if activewindow <> nil then
    begin
        block := activeWindow;
        lineLength := block^.x2-block^.x1+1;
        windowSize := linelength*(block^.y2-block^.y1+1)*2+fixedSize;
        windowCount := windowCount-1;
        i := 1;
        for y := block^.y1 to block^.y2 do
        begin
            move(block^.screenContents[i],screenPtr^[y,block^.x1],linelength*2);
            i := i + linelength;
        end;
        activeWindow := block^.backlink;
        if activewindow = nil then window(1,1,80,25)
        else with activewindow^ do window(x1+1,y1+1,x2-1,y2-1);
        gotoxy(block^.x,block^.y);
        freeMem(block,windowSize);
    end;
end;

procedure setInitWin(sty:byte; FT,FG:byte; strH:str20; HT,HG,WG,CT,CG:byte);
begin
    frameStyle := sty;
    frameText := FT;
    frameGround := FG;
    winhead := strH;
    headText := HT;
    headGround := HG;
    winGround := WG;
    charText := CT;
    charGround := CG;
end;

procedure identifyCRT;
begin
    case crttype of

```

```

        0..3 : videoseg := colorseg;
        7 : videoseg := monoseg;
    end;
end;

procedure cursoron;
begin
    port[vport] := 10;
    port[vport+1] := hi(cursormode) and $df;
    port[vport] := 11;
    port[vport+1] := lo(cursormode)
end;

procedure cursoroff;
begin
    port[vport] := 10;
    port[vport+1] := hi(cursormode) or $20;
    port[vport] := 11;
    port[vport+1] := lo(cursormode)
end;

procedure setcursor(start,stop : byte);
begin
    with regs do
        begin
            ah := 1;
            ch := start;
            cl := stop;
            intr($10,regs)
        end;
    end;
end;

procedure bigCursor;
begin
    if crttype = 7 then setcursor(8,12) else setcursor(8,14);
end;

procedure normCursor;
begin
    if crttype = 7 then setcursor(11,12) else setcursor(13,14);
end;

procedure initwin;
begin
    activewindow := nil;
    fixedsize := sizeof(windowControlBlock)-sizeof(screenBlock);
    screenPtr := Ptr(videoseg,0);
    window(1,1,80,25);
    windowcount := 0;
end;

begin {main}
    identifyCRT;
    initwin;
end.

```

```

{ ***** TABLEX.PAS ***** }

unit tablex;
interface
uses crt;
type str1 = string[1];
     str3 = string[3];

procedure TableAdd(ystart : byte);
procedure TableSel;
procedure frame;
procedure tableExp1(tx : byte);
procedure tableExp2(px : byte);
procedure title1;

implementation

var i : byte;

procedure TableAdd(ystart : byte);
type tableArray = array[0..13] of string[50];
const tableLine : tableArray =
(


| PROPERTY                   | DATA | (-99.9 for None) |
|----------------------------|------|------------------|
| ▪ NAME OF COMPONENT        |      |                  |
| ▪ CRITICAL TEMPERATURE (K) |      |                  |
| ▪ CRITICAL PRESSURE (atm)  |      |                  |
| ▪ ACENTRIC FACTOR          |      |                  |
| ▪ m (for MSRK)             |      |                  |
| ▪ n (for MSRK)             |      |                  |
| ▪ δ (for MPR)              |      |                  |
| ▪ w (for MPR)              |      |                  |
|                            |      |                  |


);
begin
  for i := 0 to 13 do
  begin
    gotoxy(15,i+ystart); write(tableLine[i]);
  end;
  gotoxy(18,ystart+12); textattr := black+lightgray#16; write('F2');
  textattr := lightgray+black#16; write(' ',#26,' Save. ');
  textattr := black+lightgray#16; write('F10');
  textattr := lightgray+black#16; write(' ',#26,' Main. ');
end;

procedure TableSel;
procedure table;
begin {TABLE}
  (gotoxy(8,4); write(' '); for i:= 1 to 29 do write('='); write(' ');
   for i:= 1 to 16 do write('='); write(' '); for i:= 1 to 16 do write('=');
   writeln(' ');
  (gotoxy(8,5); write(' '); gotoxy(38,5); write(' '); gotoxy(55,5);

```

```

write(' '); gotoxy(72,5); writeln(' ');
{ }gotoxy(8,6); write(' '); for i:= 1 to 29 do write('='); write(' ');
for i:= 1 to 16 do write('='); write(' '); for i:= 1 to 16 do write('=');
write(' ');
{ }for i:= 1 to 8 do begin gotoxy(8,6+i); writeln(' '); end;
for i:= 1 to 8 do begin gotoxy(38,6+i); writeln(' '); end;
for i:= 1 to 8 do begin gotoxy(55,6+i); writeln(' '); end;
for i:= 1 to 8 do begin gotoxy(72,6+i); writeln(' '); end;
{ }gotoxy(8,15); write(' '); for i := 1 to 29 do write('='); write(' ');
for i:= 1 to 16 do write('='); write(' '); for i := 1 to 16 do write('=');
write(' ');
end; { TABLE }

begin {tableSel}
gotoxy(28,2); textattr := white+black#16;
writeln('SELECT YOUR COMPONENTS, PLEASE');
textattr := lightgray+black#16; table;
gotoxy(17,5); write('CONSTANTS'); gotoxy(41,5);
write('COMPONENT: 1'); gotoxy(58,5); write('COMPONENT: 2');
gotoxy(11,7); write(' * NAME OF COMPONENT');
gotoxy(11,8); write(' * CRITICAL TEMPERATURE (K)');
gotoxy(11,9); write(' * CRITICAL PRESSURE (atm)');
gotoxy(11,10); write(' * ACENTRIC FACTURE');
gotoxy(11,11); write(' * m (for MSRK)');
gotoxy(11,12); write(' * n (for MSRK)');
gotoxy(11,13); write(' * δ (for MPR) ');
gotoxy(11,14); write(' * w (for MPR) ');
end; {TableSel}

procedure frame;
begin
gotoxy(3,16);
for i := 1 to 75 do write(' ');
for i := 1 to 5 do
begin gotoxy(3,16+i); write(' '); gotoxy(76,16+i); write(' ') end;
gotoxy(3,22); for i:= 1 to 75 do write(' ');
gotoxy(3,23); for i:= 1 to 75 do write(' ');
gotoxy(29,24); textAttr := 15+0#16; write(#3, ' F10 : Main Menu ',#3);
end; {FRAME}

procedure tableExpl(tx :byte);

procedure tableCompnt_T(stngT:str1);
begin
gotoxy(4,2); textattr := white+black#16;
write('VLE EXPERIMENTAL DATA'); textattr := lightgray+black#16;
gotoxy(3,4); write(' ');
gotoxy(3,5); write(' COMPONENT 1 : ');
gotoxy(3,6); write(' COMPONENT 2 : ');
gotoxy(3,7); write(' TEMPERATURE (K) : ');
gotoxy(3,8); write(' ');
gotoxy(18,7); write(stngT);
gotoxy(4,10); textattr := 15+0#16; write('F2');
textattr := 7+0#16; write(' ',#26, ' Continue ');
textattr := 15+0#16; write('F10');

```

```

      textAttr := 7+0#16;   write(' ',#26,' Main');
end;

begin {tableExp1}
  case tx of
    1 : tableCompnt_I('K');
    2 : tableCompnt_I('C');
    3 : tableCompnt_I('F');
  end;
end;

procedure tableExp2(px :byte);

procedure TablePXY(stngP:str3);
begin
  gotoxy(43,2);   write(' ');
  gotoxy(43,3);   write(' P (atm)   X1   Y1 ');
  gotoxy(43,4);   write(' |         |         | ');
  for i := 1 to 18 do
  begin
    gotoxy(43,4+i); write(' |         |         | ');
  end;
  gotoxy(43,23);  write(' |         |         | ');
  gotoxy(49,3);   write(stngP);
  textAttr := 15+0#16;
  for i := 1 to 18 do
    begin gotoxy(77,4+i); write(i) end;
  textAttr := 7+0#16;
end;

begin {TableExp2}
  case px of
    1 : tablePXY('atm');
    2 : tablePXY('psi');
    3 : tablePXY('MPa');
  end
end;

procedure title;
begin
  textAttr := 15+3#16;
  gotoxy(18,7); write(' ');
  gotoxy(18,8); write(' ');
  gotoxy(18,9); write(' ');
  gotoxy(18,10); write(' ');
  gotoxy(18,11); write(' ');
  gotoxy(18,12); write(' ');
  gotoxy(18,13); write(' ');
  gotoxy(18,14); write(' ');
  gotoxy(18,15); write(' ');
  gotoxy(18,16); write(' ');
  gotoxy(18,17); write(' ');
  gotoxy(18,18); write(' ');
  gotoxy(18,19); write(' ');
  gotoxy(18,20); write(' ');

```

COMPUTER PROGRAM FOR
CALCULATION INTERACTION PARAMETERS
OF HYDROCARBON SYSTEMS
BY
PONGPHISANU MUANGCHAREON
PETROCHEMICAL AND POLYMER
CHULALONGKORN UNIVERSITY
2536

```
gotoxy(18,21); write('████████████████████');  
end;  
  
end.
```



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```

{ ***** DATA12X.PAS ***** }

unit Data12x;
interface
uses crt,skw,tablex,dos;
const maxLineEditor = 8;
      maxPage       = 5;
      maxTemp       = 15;
      maxChoice     = 17; {maxTemp+ALL T+EXIT}
      maxRowExp     = 18;
      ip : byte = 1;
      co : byte = 1;
      ro : byte = 1;

type  str15 = string[15];
      str30 = string[30];
      compntrec = record
        name      : str15;
        tc,pc,W,M,
        n,del,wnew : real;
      end;
      compntfi = file of compntrec;
      xytype   = array[1..4,1..4] of compntrec;
      pagetype = array[1..maxPage] of xytype;
      comptype = array[1..2] of compntrec;
      strArray = array[1..maxLineEditor] of str15;
      valArray = array[1..maxLineEditor] of real;
      intArray = array[1..maxLineEditor] of integer;

type  strChoice = array[1..maxChoice] of str30;
      exitSet   = set of char;
      nameArray = array[1..2] of str15;
      PXYArray  = array[1..maxRowExp] of real;
      compArray = array[1..2] of real;
      XY20Array = array[1..maxRowExp] of compArray;
      expRec    = record
        name : nameArray;
        t    : real;
        p    : PXYArray;
        x    : XY20Array;
        y    : XY20Array;
        rw   : byte;
      end;
      fiExpType = file of expRec;
      strColArray = array[1..3] of str15;
      strRowArray = array[1..maxRowExp] of strColArray;
      valColArray = array[1..3] of real;
      valRowArray = array[1..maxRowExp] of valColArray;
      ptArray     = array[1..maxTemp] of pointer;
      pofiArray   = array[1..maxTemp] of word;
      maxTrow     = array[1..maxTemp] of byte;
      maxTt       = array[1..maxTemp] of real;
      maxTP       = array[1..maxTemp] of PXYarray;
      maxTXY      = array[1..maxTemp] of xy20Array;

```



```

type   PntrT = ^mixT;
       mixT = record
       expRe : expRec;
       next  : PntrT;
       end;

PROCEDURE Openfile(var fi : compntfi);
PROCEDURE Editor(x1,y1,x2,y2,startX,startY : byte; var strx : strArray;
               var ch : char );
PROCEDURE AddData(var changed :boolean);
PROCEDURE LoadCompnt(var fi :compntfi; var n,l,lastX,lastY : byte;
               var page :pageType);
PROCEDURE Display(numwin,n,l,lastX,lastY : byte; page : pageType;
               var comp:compType; var quit :boolean; var ip,co,ro :byte);
PROCEDURE ChooseChoice(startx,starty,numChoice,startChoice :byte;
               choice :strChoice; exitIn :Exitset; var dum : byte; var exitOut :char);
PROCEDURE AddExp(head :PntrT);
PROCEDURE LoadfiExp(var fiExp :fiExpType; var head :PntrT);
PROCEDURE InitDispExp(head :PntrT; comp :compType; var ncomp: compType;
               var numT,Neos :byte; var pomem :ptArray; var pofi :pofiArray);
PROCEDURE ChooseT(ncomp : compType; pomem :ptArray; numT,startT :byte;
               var kT:byte; var exitOut :char; var strTem : strChoice);
PROCEDURE ChooseModeMeth(Neos :byte; var mode,meth :byte;
               var quit,backl :boolean);
PROCEDURE WriteModeMeth(mode,meth :byte);
PROCEDURE WriteKijTime(kij :real; h,m,s :word);
PROCEDURE InputRange(var chout :char; var left,right :real);
PROCEDURE CutP(ptmem :pointer; ptfi :word; var fiexp :fiExpType);
PROCEDURE CutT(kT,numT :byte; head :PntrT; pomem :ptArray; pofi :pofiArray;
               var fiexp :fiExpType);
PROCEDURE CutCompnt(poNeed :LongInt; var co,ro :byte; var fi :compntfi);
PROCEDURE ModCompnt(poNeed :LongInt; oldrec :compntRec; var fi :compntfi);

```

implementation

```

var   strx                : strArray;
       valstr             : valArray;
       startX,startY     : byte;
       rec                : compntrec;
       fi                 : compntfi;
       i,j,g,k           : byte;   {INDEX of FOR or ARRAY}
       ch,ExitOut        : char;
       check,ins         : boolean;
       opt                : byte;
       choice             : strChoice;

var   fiExp               : fiExpType;
       strExp             : strRowArray;
       valExp            : valRowArray;
       nameExp           : nameArray;
       valT               : real;
       valP,valX1,valY1  : PXYArray;
       SearchPntr        : PntrT;

```

```
Function chkdiskOK : boolean;
```

```

begin
  chkdiskOK := true;
  if (diskfree(0) < 1024) then
    begin
      write(#7); chkdiskOK := false;
      setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
      windowOpen(20,19,60,22);
      gotoxy(5,2); write('DISK FULL...');
      ch := readkey;
      windowClose;
    end;
end;

Function chkMemOK : boolean;
begin
  chkMemOK := true;
  if (memAvail < 1024) then
    begin
      write(#7); chkMemOK := false;
      setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
      windowOpen(20,19,60,22);
      gotoxy(5,2); write('OUT OF MEMORY...');
      ch := readkey;
      windowClose;
    end;
end;

procedure openfile(var fi : compntfi);
begin
  assign(fi,'compnt.dta');
  {$i-} reset(fi); {$i+}
  if iorresult <> 0 then
    begin
      write(#7);
      setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
      windowOpen(20,19,60,22);
      gotoxy(5,1); write('CANNOT FIND COMPNT.DTA');
      gotoxy(5,2); write('Press any key...');
      ch := readkey;
      gotoxy(5,2); write('CREATING NEW FILE...');
      rewrite(fi); close(fi); reset(fi);
      windowClose;
    end;
end; {OPEN FILE}

procedure writefile(name1:str15; valtc,valpc,valome,valm,valn,valdel,
  valwnew:real; var fi:compntfi);
begin
  if chkDiskOK then
    begin
      openfile(fi);
      if filesize(fi) < (maxPage#16) then
        begin
          seek(fi,filesize(fi));
          with rec do

```

```

begin
  name := name1;      tc := valtc;
  pc := valpc;        w := valome;
  m := valm;          n := valn;
  del := valdel;      wnew := valwnew;
end;
write(fi,rec);
close(fi)
end else
begin
  write(#7); close(fi);
  setInitWin(2,15,6, ' WARNING ',15,3,0,7,0);
  windowOpen(20,19,60,22);
  gotoxy(5,2); write('DATA OUT OF RANGE...');
  ch := readkey;
  windowClose;
end;
end;
end; {WRITE FILE}

PROCEDURE Editor(x1,y1,x2,y2,startX,startY : byte; var strx : strArray;
  var ch : char );
var stop : boolean;

procedure deletestr(n:integer);
begin
  delete(strx[wherey],n,1);
  gotoxy(1,wherey);
  write(strx[wherey], ' ');
  gotoxy(n,wherey);
end; {DELETE STRING}

procedure insertstr(ch: char);
var x : byte;
begin
  x := wherex;
  if (x = x2-x1+1) and (length(strx[wherey]) = x2-x1) then write(#7)
  else
    begin
      insert(ch,strx[wherey],x); gotoxy(1,wherey);
      write(strx[wherey]); gotoxy(x+1,wherey)
    end;
end; {INSERT STRING}

procedure pongphisanu(ch:char);
begin
  if ins = false then
    begin
      if wherex = x2-x1+1 then write(#7)
      else
        begin
          delete(strx[wherey],wherex,1);
          insertstr(ch);
        end;
    end
end

```



```

    else insertstr(ch) ;
end; {INSERT OR NOT}

begin {EDITOR}
  cursoron; textAttr := 7+0*16;
  window(x1,y1,x2,y2); gotoxy(startX,startY);
  stop := false;
  Repeat
  if ins = false then bigcursor else normcursor;
  ch := upcase(readkey);
  case ch of
{Esc} #27 : stop := true;
{BS} #8 : if wherex = 1 then write(#7) else deletestr(wherex-1);
{Enter} #13 : if wherey <> y2-y1+1 then begin write(#13); write(#10) end
           else write(#7);
           end;
  if ch = #0 then
  begin
    ch := readkey;
    case ch of
  {up} #72 : gotoxy(wherex,wherey-1);
  {Left} #75 : gotoxy(wherex-1,wherey);
  {Right} #77 : gotoxy(wherex+1,wherey);
  {Down} #80 : gotoxy(wherex,wherey+1);
  {Home} #71 : gotoxy(1,wherey);
  {End} #79 : gotoxy(length(strx[wherey])+1,wherey);
  {Del} #83 : deletestr(wherex);
  {Ins} #82 : ins := not ins;
  {F2} #68 : stop := true;
  {F10} #68 : stop := true;
           end; {case}
    end {if #0}
  else if ch > #31 then pongphisanu(ch);
  Until (stop = true);
  window(1,1,80,25);
end; { EDITOR }

procedure modstrx(line: byte; var strx: strArray);
begin
  for j := 1 to line do
  begin
    while (strx[j,length(strx[j])] = #32) and (strx[j] <> '') do
      delete(strx[j],length(strx[j]),1);
    while (strx[j,1] = #32) and (strx[j] <> '') do
      delete(strx[j],1,1);
    end;
  end;
end;

procedure checkStr(var check :boolean; var startX,startY :byte;
                  var strx :strArray; var valstr :valArray);
var res : intArray;
    ch : char;
begin
  cursoroff;
  modstrx(8,strx);

```

```

check := true;
for j := 2 to 8 do val(strx[j],valstr[j],res[j]);
startx := 1;
for j := 8 downto 5 do if (res[j] <> 0) then
  begin check := false; startY := j; end;
for j := 4 downto 2 do if (res[j] <> 0) or (valstr[j] <= 0) then
  begin check := false; startY := j; end;
if (strx[1] = '') then
  begin check := false; startY := 1; end;

if check = false then
  begin
  write(#7);
  setInitwin(2,15,6,' ERROR ',15,3,2,7,2);
  windowOpen(22,18,56,21);
  gotoxy(2,1); write('Invalid name or value');
  gotoxy(2,2); write('Tc,Pc and acentric factor > 0');
  repeat ch := readkey until ch <> #0;
  windowClose;
  end; { check=false}
end; { CHANGE STRINGS TO VALUE }

```

```

PROCEDURE AddData(var changed :boolean);
begin {** AddData **}
  window(1,1,80,25); clrscr;
  ins := true; changed := false;
  tableAdd(4);
  REPEAT
  window(47,7,62,14); clrscr; window(1,1,80,25);
  for i := 1 to maxLineEditor do strx[i] := '';
  startx := 1; startY := 1;
  repeat
  window(16,18,80,25); clrscr; window(1,1,80,25);
  editor(47,7,62,14,startx,starty,strx,ch);
  if ch = #60 then checkStr(check,startx,starty,strx,valstr);
  until (ch = #68) or (check = true);

```

```

if ch = #60 then
  begin
  changed := true; gotoxy(51,16);
  textattr := white+black#16+blink;
  write('SAVING'); textattr := lightgray+black#16;
  writefile(strx[1],valstr[2],valstr[3],valstr[4],valstr[5],valstr[6],
  valstr[7],valstr[8],fi);
  gotoxy(51,16); write(' ');
  end; {if}
  UNTIL ch = #68;
  cursoroff;
end; {**AddData**}

```

```

PROCEDURE LoadCompnt(var fi :compntfi; var n,1,lastX,lastY : byte;
  var page :pageType);

```

```

{ ---- Open file and Find position of the last component -----}

```

```

procedure start;
var a : byte;
begin
  openfile(fi);
  l := filesize(fi);
  if l mod 16 <> 0 then n:= (l div 16)+1 else n := l div 16;

  a := l mod 16;
  if a <> 0 then
    begin
      if (a mod 4) = 0 then
        begin
          lastY := a div 4;
          lastX := 4
        end
      else
        begin
          lastY := (a div 4)+1;
          lastX := a mod 4
        end
      end
    else
      begin
        lastY := 4;
        lastX := 4
      end;
end; {START}

{----- read component from file to variable "page" -----}
procedure writetopage;
begin
  i := 1; j := 1; g:= 1;
  while not eof(fi) do
    begin
      read(fi,rec);
      page[i,j,g] := rec;
      j := j+1;
      if j = 5 then begin j := 1; g := g+1; end;
      if g = 5 then begin g := 1; i := i+1; end;
      if i > maxPage then i:= maxPage;
    end; {while}
  close(fi);
end; {OUT FILE TO PAGE}

begin {LoadCompnt}
  start;
  writeToPage;
end;

PROCEDURE Display(numwin,n,l,lastX,lastY : byte; page : pageType;
  var comp :comptype; var quit :boolean; var ip,co,ro :byte);
var xy : xytype;
  m,ll : byte;

procedure inversetext(j,g : integer);

```

```

var i : byte;
begin
  textattr := black+lightgray#16; write(' ',xy[j,g].name);
  for i := 1 to 15-length(xy[j,g].name) do write(' ');
end; {INVERSE TEXT}

procedure normaltext(j,g : integer);
var i : byte;
begin
  textattr := lightgray+black#16; write(' ',xy[j,g].name);
  for i := 1 to 15-length(xy[j,g].name) do write(' ');
end; {NORMAL TEXT}

procedure showprop;
begin
  if numwin = 1 then gotoxy(47,5) else gotoxy(39+(k-1)*17,7);
  write(xy[co,ro].name);
  if numwin = 1 then gotoxy(47,6) else gotoxy(39+(k-1)*17,8);
  write(xy[co,ro].tc:14:4);
  if numwin = 1 then gotoxy(47,7) else gotoxy(39+(k-1)*17,9);
  write(xy[co,ro].pc:14:4);
  if numwin = 1 then gotoxy(47,8) else gotoxy(39+(k-1)*17,10);
  write(xy[co,ro].w:14:4);
  if numwin = 1 then gotoxy(47,9) else gotoxy(39+(k-1)*17,11);
  write(xy[co,ro].m:14:4);
  if numwin = 1 then gotoxy(47,10) else gotoxy(39+(k-1)*17,12);
  write(xy[co,ro].n:14:4);
  if numwin = 1 then gotoxy(47,11) else gotoxy(39+(k-1)*17,13);
  if xy[co,ro].del = -99.9 then write('-':12) else write(xy[co,ro].del:14:4);
  if numwin = 1 then gotoxy(47,12) else gotoxy(39+(k-1)*17,14);
  if xy[co,ro].wnew = -99.9 then write('-':12) else write(xy[co,ro].wnew:14:4);
end;

Begin {#DISPLAY#}
  cursoroff;
  if l = 0 then
    begin
      setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
      windowOpen(20,19,60,22);
      gotoxy(5,1); write('NO DATA');
      gotoxy(5,2); write('PLEASE ADD DATA BEFORE');
      ch := readkey;
      windowClose;
      quit := true;
      exit
    end;
  window(1,1,80,25); clrscr;
  if numwin = 1 then tableAdd(2) else tableSel;
  ip := 1;
  frame; gotoxy(6,17);
  quit := false;
  for k := 1 to numwin do
    begin
      Repeat
        ll := 1; j := 1; g := 1; m := 1; gotoxy(5,17);

```

```

xy := page[ip];

textAttr := 7+0#16;
while (g < 5) and (ll < l) do
begin
write(' ',xy[j,g].name);
ll := (ip-1)*16 + j + (g-1)*4;
j := j+1;
gotoxy(18*m+5,wherey); m := m+1;
if j = 5 then
begin
gotoxy(5,wherey+1); m := 1;
j := 1; g := g+1;
end;
end; .(while)

textAttr := 15+0#16;
gotoxy(7,23); write('total data = ',l);
gotoxy(40,23); write(ip,'/',n);
gotoxy(65,23); if ip = 1 then write('PgDn') else
if ip = n then write('PgUp') else write('PgDn/PgUp');

gotoxy(18*(co-1)+5,ro+16); inversetext(co,ro);

REPEAT
if numwin = 1 then window(47,5,61,12)
else window(39+(k-1)*17,7,54+(k-1)*17,14);
textAttr := 7+0#16; clrscr;
window(1,1,80,25); showprop;
ch := readkey;
if ch = #0 then
begin
ch := readkey;
case ch of
(F10) #68 : begin
quit := true; exit;
end;
(PgDn) #81 : begin
ip := ip+1; co := 1; ro := 1;
window(5,17,74,20); clrscr; window(1,1,80,25);
if ip > n then ip := n;
end;
(PgUp) #73 : begin
ip := ip-1; co := 1; ro := 1;
window(5,17,74,20); clrscr; window(1,1,80,25);
if ip = 0 then ip := 1;
end;
(Right) #77 : begin
if (ip = n)and(co = lastX)and(ro = lastY) then begin end
else begin
gotoxy(18*(co-1)+5,ro+16);
normaltext(co,ro);
co := co+1;
if co > 4 then
begin

```



```

        co := 1; ro := ro+1;
        if ro = 5 then begin ro := 4; co := 4 end;
        end;
        gotoxy(18*(co-1)+5,ro+16);
        inversetext(co,ro)
        end;
{Left} #75 : begin
        gotoxy(18*(co-1)+5,ro+16);
        normaltext(co,ro);
        co := co-1;
        if co = 0 then
            begin
                co := 4; ro := ro-1;
                if ro = 0 then begin ro := 1; co := 1 end;
            end;
        gotoxy(18*(co-1)+5,ro+16);
        inversetext(co,ro)
        end;
{Down} #80 : begin
        if (ip = n) and ((ro = lastY) or ((ro = lastY-1) and
            (co > lastX)))
            then begin end
            else begin
                gotoxy(18*(co-1)+5,ro+16);
                normaltext(co,ro);
                ro := ro+1; if ro > 4 then ro := 4;
                gotoxy(18*(co-1)+5,ro+16);
                inversetext(co,ro)
                end;
        end;
{Up} #72 : begin
        gotoxy(18*(co-1)+5,ro+16);
        normaltext(co,ro);
        ro := ro-1; if ro = 0 then ro := 1;
        gotoxy(18*(co-1)+5,ro+16);
        inversetext(co,ro)
        end;
    end; {case}
end; {if}

    UNTIL (ch = #81) or (ch = #73) or (ch = #13);
    Until ch = #13;
    comp[k] := page[ip,co,ro];
    textattr := white+black#16; showprop;
end; {for}
End; (DISPLAY)

    { ***** EXPERIMENTAL DATA ***** }

procedure openfiVLE(var fiExp : fiExpType);
begin
    assign(fiExp,'vle.dta');
    {%i-} reset(fiExp); {%i+}
    if ioresult <> 0 then

```

```

begin
  write(#7);
  setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
  windowOpen(20,19,60,22);
  gotoxy(5,1); write('CANNOT FIND VLE.DTA');
  gotoxy(5,2); write('Press any key...');
  ch := readkey;
  gotoxy(5,2); write('CREATING NEW FILE...');
  rewrite(fiExp); close(fiExp); reset(fiExp);
  windowClose;
end;
end;

procedure checkExp1(var check : boolean; var startX,startY : byte;
  var strx : strArray);
var resT : integer;

begin
  cursoroff;
  modstrx(3,strx);
  check := true;
  val(strx[3],valstr[3],resT);

  startX := 1;
  if (resT <> 0) then
    begin check := false; startY := 3; end;
  for j := 2 downto 1 do if (strx[j] = '') then
    begin check := false; startY := j; end;

  if check = false then
    begin
      write(#7);
      setInitwin(2,15,6,' ERROR ',15,3,2,7,2);
      windowOpen(3,17,39,20);
      gotoxy(2,2); write('Invalid name or value !');
      repeat ch := readkey until ch <> #0;
      windowClose;
    end; { check=false}
  end; { CHANGE STRING TO VALUE }

procedure checkExp2(row :byte; strExp :strRowArray; var valExp :valRowArray;
  var check : boolean; var startX,startY : byte);
var res : integer;

procedure checkFalse(k,j:byte);
begin
  cursoroff;
  write(#7); check := false;
  setInitwin(2,15,6,' ERROR ',15,3,2,7,2);
  windowOpen(3,17,39,20);
  gotoxy(2,1); write('Invalid value !');
  gotoxy(2,2); write('0 <= X1 <= 1    0 <= Y1 <= 1');
  repeat ch := readkey until ch <> #0;
  windowClose;
  startX := 11*j-10; startY := k;

```

```

end;

begin
  check := true;
  for k := 1 to row do
    begin
      val(strExp[k,1],valExp[k,1],res);
      if res <> 0 then begin checkFalse(k,1); exit; end;
    end;
  for k := 1 to row do
    for j := 2 to 3 do
      begin
        val(strExp[k,j],valExp[k,j],res);
        if (res <> 0) or (valExp[k,j] > 1) then
          begin checkFalse(k,j); exit; end;
      end;
    end;
end; { CHANGE STRING TO VALUE }

procedure listChoice(startx,starty,numChoice,startChoice: byte;
  choice :strchoice);
begin
  cursoroff;
  textAttr := 7+0*16; gotoxy(startx,starty);
  for i := 1 to numChoice do
    begin write(choice[i]); gotoxy(startx,starty+i) end;
  textAttr := 0+7*16; gotoxy(startx,starty-1+startChoice);
  write(choice[startChoice]); textAttr := 7+0*16;
end;

procedure getKey(startx,starty,numChoice: byte; choice :strChoice;
  var exitOut : char; var dum : byte);
begin
  exitOut := readkey;
  if exitOut = #0 then
    begin
      exitOut := readkey;
      textAttr := 7+0*16;
      gotoxy(startx,starty+dum-1); write(choice[dum]);
      case exitOut of
        {Dn} #80 : begin
          dum := dum+1;
          if dum > numChoice then dum := 1;
          end;
        {Up} #72 : begin
          dum := dum-1;
          if dum < 1 then dum := numChoice;
          end;
        {PUp}#73 : dum := 1;
        {PDn}#81 : dum := numChoice;
      end; {case}
      textAttr := 0+7*16;
      gotoxy(startx,starty+dum-1); write(choice[dum]);
    end; {if}
  textAttr := 7+0*16;
end;

```

```

PROCEDURE ChooseChoice(startx,starty,numChoice,startChoice :byte;
    choice :strChoice; exitIn :Exitset; var dum : byte; var exitOut :char);
begin
    listChoice(startx,starty,numChoice,startChoice,choice);
    dum := startChoice;
    repeat getKey(startx,starty,numChoice,choice,exitOut,dum)
    until exitOut in ExitIn;
end; {chooseChoice}

PROCEDURE AddExp(head :PntrT);
var tx,px,row : byte;
    tail,dum : PntrT;

procedure editorExp(x1,y1,x2,y2 : byte; var startX,startY,row : byte;
    var strExp : strRowArray; var ch : char);
var stop : boolean;
    liney : byte;

procedure deletestrExp(n:byte);
begin
    delete(strExp[wherey,wherex div 11 + 1],n mod 11,1);
    if wherex < 11 then gotoxy(1,wherey) else if wherex < 22 then
        gotoxy(12,wherey) else gotoxy(23,wherey);
    write(strExp[wherey,wherex div 11 + 1], ' ');
    gotoxy(n,wherey);
end;

procedure insertstrExp(ch: char);
var x : byte;
begin
    x := wherex;
    if (length(strExp[wherey,x div 11 + 1]) = 9) and (x in [10,21,32])
    then write(#7)
    else begin
        if length(strExp[wherey,x div 11 + 1]) = 9 then
            delete(strExp[wherey,x div 11 + 1],9,1);
        insert(ch,strExp[wherey,x div 11 + 1],x mod 11);
        if x < 11 then gotoxy(1,wherey) else if x < 22 then
            gotoxy(12,wherey) else gotoxy(23,wherey);
        write(strExp[wherey,x div 11 + 1]); gotoxy(x+1,wherey);
        if wherex in [11,22] then
            gotoxy(length(strExp[wherey,x div 11 + 1])+wherex-10,wherey);
        end;
    end;
end;

procedure pongphisanuExp(ch:char);
begin
    if ins = false then
        begin
            if wherex in [10,21,32] then write(#7)
            else
                begin
                    delete(strExp[wherey,wherex div 11 + 1],wherex mod 11,1);
                    insertstrExp(ch);
                end;
        end;
end;

```

```

        end
    else insertstrExp(ch);
end;

begin {#EDITOR#}
    cursoron; window(x1,y1,x2,y2);
    gotoxy(startX,startY); textAttr := 7+8#16;
    stop := false;
    Repeat
        if ins = false then bigcursor else normcursor;
        ch := readkey;
        case ch of
{BS}    #8 : if wherex in [1,12,23] then write(#7)
            else deletestrExp(wherex-1);
{Enter} #13 : if wherey = y2-y1+1 then write(#7)
            else if wherex < 11 then gotoxy(1,wherey+1)
            else if wherex < 22 then gotoxy(12,wherey+1)
            else gotoxy(23,wherey+1);
{TAB}   #9 : if wherex < 11 then gotoxy(12,wherey)
            else if wherex < 22 then gotoxy(23,wherey)
            else if wherey <> 18 then gotoxy(1,wherey+1)
            else gotoxy(1,1);
        end;
        if ch = #0 then
            begin
                ch := readkey;
                case ch of
{Shift Tab} #15 : if wherex > 22 then gotoxy(12,wherey)
                    else if wherex > 11 then gotoxy(1,wherey)
                    else if wherey <> 1 then gotoxy(23,wherey-1)
                    else gotoxy(23,18);
{up}    #72 : gotoxy(wherex,wherey-1);
{Left}  #75 : if wherex in [12,23] then gotoxy(wherex-2,wherey)
            else gotoxy(wherex-1,wherey);
{Right} #77 : if wherex in [10,21] then gotoxy(wherex+2,wherey)
            else gotoxy(wherex+1,wherey);
{Down}  #80 : gotoxy(wherex,wherey+1);
{Home}  #71 : gotoxy(1,wherey);
{End}   #79 : gotoxy((wherex div 11 * 11)+1+
                    length(strExp[wherey,wherex div 11+1]),wherey);
{Del}   #83 : deletestrExp(wherex);
{PgUp}  #73 : gotoxy(wherex,1);
{PgDn}  #81 : begin
                liney := maxRowExp+1;
                repeat
                    liney := liney-1;
                until (strExp[liney,wherex div 11 + 1] <> '') or
                    (liney = 1);
                gotoxy(wherex,liney);
            end;
{Ins}   #82 : ins := not ins;
{F2}   #60 : begin
                stop := true; row := wherey;
                startx := wherex; starty := wherey;
            end;
        end;
    until stop;
end;

```

```

(F10)      #68 : stop := true;
           end; {case}
           end {if #0}
           else if ch in [#46,#48..#57] then pongphisanuExp(ch);
           Until stop = true;
           window(1,1,80,25);
           end; { EDITOR EXP}

procedure chooseUnit(var tx,px :byte);

procedure chooseUnitT;
begin
  gotoxy(7,2); textAttr := 15+0#16;
  write('SELECT UNIT OF TEMPERATURE');
  choice[1] := ' KELVIN      (K)  ';
  choice[2] := ' CENTIGRADE (C)  ';
  choice[3] := ' FAHRENHEIT (F)  ';
  chooseChoice(12,4,3,1,choice,[#13],tx,exitOut);
end; {chooseUnitT}

procedure chooseUnitP;
begin
  gotoxy(8,9); textAttr := 15+0#16;
  write('SELECT UNIT OF PRESSURE');
  choice[1] := ' atm      ';
  choice[2] := ' psia     ';
  choice[3] := ' MPa      ';
  chooseChoice(15,11,3,1,choice,[#13],px,exitOut)
end; {chooseUnitP}

begin {chooseUnit}
  cursoroff;
  setInitWin(3,15,6,' SET UNIT OF SYSTEM ',15,3,0,7,0);
  windowbox(20,6,60,21);
  chooseUnitT;
  chooseUnitP;
  window(1,1,80,25);
end; {chooseUnit}

procedure chooseOptExp(var opt:byte);
begin
  choice[1] := ' New Components/Temperature ';
  choice[2] := ' New Units                    ';
  choice[3] := ' EXIT                               ';
  setInitWin(4,15,6,' ',15,3,0,7,0);
  windowOpen(5,15,36,19);
  choosechoice(2,1,3,1,choice,[#13],opt,exitOut);
  windowClose;
end;

begin {** Add Experimental Data **}
  if chkMemOK and chkDiskOK then
  begin
    for i := 1 to 3 do strx[i] := '';
    startX := 1; startY := 1;

```

```

REPEAT {Loop 1}
  clrscr; chooseUnit(tx,px); clrscr;
  tableExp1(tx);
  textAttr := 7+0*16;
  for i := 1 to 3 do begin gotoxy(23,4+i); write(strx[i]) end;
  tableExp2(px);

  ins := true;
  REPEAT {Loop 2}
    REPEAT {Loop 3}
      editor(23,5,38,7,startX,startY,strx,ch);
      if ch = #60 then checkExp1(check,startX,startY,strx)
    UNTIL (check = true) or (ch = #60); {End Loop 3}
    if ch = #60 then begin cursoroff; exit end;

  startX := 1; startY := 1;
  for i := 1 to maxRowExp do
    for j := 1 to 3 do strExp[i,j] := '';

  REPEAT {Loop 4}
    window(3,15,40,18); clrscr; window(1,1,80,25);
    REPEAT {Loop 5}
      editorExp(44,5,75,22,startX,startY,row,strExp,ch);
      if ch = #60 then checkExp2(row,strExp,valExp,check,startX,startY);
    UNTIL (check = true) or (ch = #60); {End Loop 5}

    if ch = #60 then begin cursoroff; exit end;
    gotoxy(77,row+4); textAttr := 15+3*16+128;
    write(row); textAttr := 7+0*16;
    setInitWin(2,15,6, ' WARNING ',15,3,2,7,2);
    windowOpen(3,15,39,18);
    gotoxy(2,1); write('This program will save ');
    textAttr := 15+2*16; write(row);
    textAttr := 7+2*16; write(' row(s).');
    gotoxy(2,2); write('Are you sure ? [Y/n] ');
    normcursor;
    Repeat ch := readkey Until ch in ['Y','n'];
    windowClose; gotoxy(77,row+4);
    textAttr := 15+0*16; write(row); textAttr := 7+0*16;
  UNTIL ch in ['Y']; {End Loop 4}

  nameExp[1] := strx[1];
  nameExp[2] := strx[2];
  for i := 1 to row do
    begin
      valP[i] := valExp[i,1];
      valX1[i] := valExp[i,2];
      valY1[i] := valExp[i,3];
    end;
  case tx of
    1 : valT := valstr[3];
    2 : valT := valstr[3]+273.16;
    3 : valT := (valstr[3]-32)*5/9 + 273.16;
  end;
  case px of

```

```

1 : for i := 1 to row do valP[i] := valExp[i,1];
2 : for i := 1 to row do valP[i] := valExp[i,1]*0.068046;
3 : for i := 1 to row do valP[i] := valExp[i,1]/0.101325;
end;

tail := head;
while tail^.next <> nil do tail := tail^.next;
new(dum);
with dum^.expre do
begin
name := nameExp;
t := valT;
p := valP;
rw := row;
for i := 1 to row do
begin
x[i,1] := valx1[i]; x[i,2] := 1-valx1[i];
y[i,1] := valy1[i]; y[i,2] := 1-valy1[i];
end;
end; {with}
tail^.next := dum;
dum^.next := nil;

openfivle(fiexp);
seek(fiexp, filesize(fiexp));
write(fiexp, dum^.expre);
close(fiexp);

chooseOptExp(opt);
if opt = 1 then
begin
startx := 1; starty := 1;
window(43,2,78,25); clrscr; window(1,1,80,25);
tableExp2(px);
end;
UNTil opt in [2,3];      (End Loop 2)
UNTIL opt = 3;          (End Loop 1)
end; {if}
end; { ** Add Experimental Data ** }

PROCEDURE LoadfiExp(var fiExp :fiExpType; var head :PntrT);
var tem,dum : PntrT;
begin
openFivLE(fiExp);
head := nil;
while not eof(fiExp) do
begin
new(dum);
if head = nil then head := dum else tem^.next := dum;
tem := dum;
read(fiExp, tem^.expre);
end;
tem^.next := nil;
close(fiExp);
end;
end;

```



```

PROCEDURE InitDispExp(head :PtrT; comp :compType; var ncomp: compType;
    var numT,Neos :byte; var pomem :ptArray; var pofi :pofiarray);
var countpo : byte;

procedure checkC1C2(CinFi :nameArray);
var Cinput : nameArray;
begin
    Cinput[1] := comp[1].name;
    Cinput[2] := comp[2].name;
    if ((CinFi[1] = Cinput[1]) and (CinFi[2] = Cinput[2])) or
        ((CinFi[1] = Cinput[2]) and (CinFi[2] = Cinput[1])) then
        begin
            numT := numT+1;
            pomem[numT] := searchPtr;
            pofi[numT] := countpo-1;
            if (CinFi[1] = Cinput[1]) and (CinFi[2] = Cinput[2]) then
                begin
                    ncomp[1] := comp[1];
                    ncomp[2] := comp[2];
                end else
                begin
                    ncomp[1] := comp[2];
                    ncomp[2] := comp[1];
                end;
            end;
        end;
    end;

procedure sortT;
var i,j,k : byte;
    min : real;
    x : pointer;
    Ptr1,Ptr2 : PtrT;
    swap : boolean;
begin
    for i := 1 to numT-1 do
        begin
            Ptr1 := pomem[i];
            min := Ptr1^.expRe.t; k := i; swap := false;
            for j := i+1 to numT do
                begin
                    Ptr2 := pomem[j];
                    if Ptr2^.expRe.t < min then
                        begin
                            min := Ptr2^.expRe.t; k := j; swap := true;
                        end;
                end;
            if swap then
                begin
                    x := pomem[i]; pomem[i] := pomem[k]; pomem[k] := x;
                end;
            end; {for i}
        end;
    end;

Begin {InitDispExp}
    numT := 0;

```

```

searchPntr := head;
countpo := 0;
ncomp := comp;
while (searchPntr^.next <> nil) and (numT < maxTemp-1) do
begin
  countpo := countpo+1;
  checkC1C2(searchPntr^.expRe.name);
  searchPntr := searchPntr^.next;
end;
countpo := countpo+1;
checkC1C2(searchPntr^.expRe.name);
textAttr := 7+0#16;
if numT = 0 then
begin
  setInitWin(2,15,6,'',15,3,0,7,0);
  windowOpen(20,19,60,22);
  gotoxy(5,1); write('NO EXPERIMENTAL DATA');
  gotoxy(5,2); write('Press any key...');
  write(#7); ch := readkey;
  windowClose;
end
else
begin
  if (ncomp[1].del = -99.9) or (ncomp[2].del = -99.9) or
    (ncomp[1].wnew = -99.9) or (ncomp[2].wnew = -99.9) then
    Neos := 8 else Neos := 10;
  sortT;
end;
End; {##InitDispExp##}

PROCEDURE ChooseT(ncomp : compType; pomem : ptArray; numT,startT :byte;
  var kT:byte; var exitOut :char; var strTem : strChoice);
var st : string[10];

procedure dispPXY(kT : byte);
begin
  window(43,2,80,23); clrscr; window(1,1,80,25);
  tableExp2(1);
  searchPntr := pomem[kT-1];
  with searchPntr^.ExpRe do
  for i := 1 to rw do
  begin
    gotoxy(44,4+i); write(p[i]:9:4);
    gotoxy(55,4+i); write(x[i,1]:9:4);
    gotoxy(66,4+i); write(y[i,1]:9:4);
  end;
end;

begin {chooseT}
if numT <> 0 then
begin
  window(1,1,41,23); clrscr; window(1,1,80,25);
  gotoxy(5,2); write('COMPONENT 1: ',ncomp[1].name);
  gotoxy(5,3); write('COMPONENT 2: ',ncomp[2].name);

```

```

strTem[1] := ' EVERY T ';
for i:= 1 to numT do
begin
  searchPtr := pomem[i];
  str(searchPtr^.expRe.t:9:3,st);
  strTem[i+1] := ' '+st+' ';
end;
strTem[numT+2]:= ' ALL T ';

setInitWin(1,15,6,' TEMPERATURE (K) ',15,3,0,7,0);
windowbox(5,5,25,numT+8);
window(1,1,80,25);
listChoice(7,6,numT+2,startT,strTem);
kT := startT;
repeat
  if (kT = 1) or (kT = numT+2) then
  begin
    window(43,2,80,23); clrscr; window(1,1,80,25);
  end else dispPXY(kT);
  getkey(7,6,numT+2,strTem,exitout,kT);
until exitout in [#13,#63,#62,#27,#68];
end;
end;

PROCEDURE chooseModeMeth(Neos :byte; var mode,meth :byte;
  var quit,backl :boolean);
begin
  cursoroff; clrscr; textAttr := 15+0#16;
  gotoxy(20,5); write('SELECT EQUATION OF STATE AND YOUR METHOD');
  gotoxy(2,25); textAttr := 7+0#16; write(' ');
  textAttr := 15+3#16; write(' F10 : Main Menu ');
  textAttr := 7+0#16; write(' ');
  textAttr := 15+3#16; write(' Esc : New Compnt ');
  textAttr := 7+0#16; write(' ');
  choice[1] := ' SRK - FUGACITY ';
  choice[2] := ' SRK - BUBBLE POINT PRESSURE ';
  choice[3] := ' PR - FUGACITY ';
  choice[4] := ' PR - BUBBLE POINT PRESSURE ';
  choice[5] := ' PT - FUGACITY ';
  choice[6] := ' PT - BUBBLE POINT PRESSURE ';
  choice[7] := ' MSRK - FUGACITY ';
  choice[8] := ' MSRK - BUBBLE POINT PRESSURE ';
  choice[9] := ' MPR - FUGACITY ';
  choice[10] := ' MPR - BUBBLE POINT PRESSURE ';
  setInitWin(3,15,6,' ',15,3,0,7,0);
  windowbox(23,7,56,8+Neos);
  quit := false; backl := false;
  chooseChoice(2,1,Neos,1,choice,[#13,#27,#68],opt,ExitOut);
  if ExitOut = #27 then begin backl := true; exit end;
  if ExitOut = #68 then begin quit := true; exit end;

  case opt of
    1 : begin mode := 1; meth := 1 end;
    2 : begin mode := 1; meth := 2 end;
    3 : begin mode := 2; meth := 1 end;
  end;
end;

```



```
4 : begin mode := 2; meth := 2 end;
5 : begin mode := 3; meth := 1 end;
6 : begin mode := 3; meth := 2 end;
7 : begin mode := 4; meth := 1 end;
8 : begin mode := 4; meth := 2 end;
9 : begin mode := 5; meth := 1 end;
10 : begin mode := 5; meth := 2 end;
    end;
window(1,1,80,25);
end;
```

```
PROCEDURE WriteModeMeth(mode,meth :byte);
var form,eos : string[5];
begin
  case mode of
    1 : eos := 'SRK';
    2 : eos := 'PR';
    3 : eos := 'PT';
    4 : eos := 'MSRK';
    5 : eos := 'MPR';
  end;
  case meth of
    1 : form := 'FUGA';
    2 : form := 'BBP';
    3 : form := '   ';
  end;
  textAttr := 7+0%16;
  gotoxy(1,24); write('by : ',eos,' ',form);
end;
```

```
PROCEDURE WriteKijTime(kij :real; h,m,s :word);
begin
  gotoxy(1,25); textAttr := 7+0%16;
  write('Kij .... = ',Kij;7:4);
  gotoxy(24,25); write('Time : ');
  if h<10 then write('0',h,':') else write(h,':');
  if m<10 then write('0',m,':') else write(m,':');
  if s<10 then write('0',s) else write(s);
end;
```

```
PROCEDURE InputRange(var chout :char; var left,right :real);
var strang : strArray;
   passed : boolean;
```

```
procedure checkRange(st :str15; var passed :boolean);
var tic1,tic2,v : byte;
   res1,res2 : integer;
   leftSt,rightSt : str15;
```

```
procedure RangeError;
var ch : char;
begin
  setInitWin(2,15,6,' ERROR ',15,3,2,7,2);
  windowopen(3,15,39,18); cursoroff;
  gotoxy(2,1); write('Invalid Range !');
```



```

gotoxy(2,2); write('(LOWER BOUND <= UPPER BOUND) <= 1');
ch := readkey;
textAttr := 7+0#16;
windowclose;
end;

begin {CheckRange}
passed := true;
v := length(st);
if v = 0 then begin passed := false; RangeError; exit end;
while (st[v] = #32) and (v <> 1) do v := v-1;
tic1 := v;
while (st[v] <> #32) and (v <> 1) do v := v-1;
if v = 1 then begin passed := false; RangeError; exit end;
while (st[v] = #32) and (v <> 1) do v := v-1;
tic2 := v;
if (st[tic2] = #46) or (st[tic1] = #46) then
begin passed := false; RangeError; exit end;
leftSt := copy(st,1,tic2);
rightSt := copy(st,tic2+1,tic1-tic2);
val(leftSt,left,res1);
val(rightSt,right,res2);
if (res1 <> 0) or (res2 <> 0) or (left > 1) or
(right > 1) or (left > right) then
begin passed := false; RangeError; exit end;
end;

begin {InputRange}
ins := true;
repeat
strang[1] := '';
gotoxy(60,1); write(' ');
editor(60,1,75,1,1,1,strang,chout);
if chout = #60 then checkRange(strang[1],passed);
until (chout = #27) or (passed = true);
end; {inputRange}

PROCEDURE CutP(ptmem : pointer; ptfi : word; var fiexp : fiExpType);
begin
gotoxy(5,25); write(' ');
textAttr := 15+7#16;
gotoxy(44,25); write('Esc :Choose T');
gotoxy(61,25); write('Enter :Choose P');
cursoron; textAttr := 7+0#16;
searchPntr := ptmem;
with searchPntr^.expRe do
begin
if rw = 1 then
begin
setInitWin(2,15,6, ' WARNING ',15,3,2,7,2);
windowOpen(20,19,60,22);
gotoxy(5,2); write('CANNOT DELETE THE PRESSURE');
write(#7); ch := readkey;
windowclose;
exit

```

```

end;
opt := 1; gotoxy(79,opt+4);

repeat
repeat
ch := readkey;
if ch = #0 then
begin
ch := readkey;
case ch of
#80 : begin
opt := opt+1; if opt = rw+1 then opt := 1;
gotoxy(79,opt+4);
end;
#72 : begin
opt := opt-1; if opt = 0 then opt := rw;
gotoxy(79,opt+4);
end;
end; (case)
end else if ch = #27 then exit;
until (ch = #13);
gotoxy(77,opt+4); textAttr := 15+3#16+128; write(opt);
setInitWin(2,15,6,' WARNING ',15,3,0,7,0);
windowOpen(20,19,60,22);
gotoxy(5,1); write('DELETE PRESSURE !!!');
gotoxy(5,2); write('Are you sure ? [Y/n] ');
repeat ch := readkey until ch in ['Y','n'];
windowClose;
gotoxy(77,opt+4); textAttr := 15+0#16; write(opt);
until ch = 'Y';
for i := opt to rw-1 do
begin
p[i] := p[i+1];
for j := 1 to 2 do
begin
x[i,j] := x[i+1,j];
y[i,j] := y[i+1,j];
end;
end;
rw := rw-1;
end; (with)
openfile(fiexp);
seek(fiexp,ptfi);
write(fiexp,searchPntr^.expRe);
close(fiexp);
end;

PROCEDURE CutT(kT,numT :byte; head :PntrT; pomem :ptArray; pofi :pofiArray;
var fiexp :fiExpType);
var preL,tail :PntrT;
i :byte;

procedure cutOneT(i :byte);
begin
searchPntr := pomem[i];

```

```

preL := head; tail := head;
if preL^.next <> nil then
  begin
    while preL^.next^.next <> nil do preL := preL^.next;
    tail := preL^.next
  end;

searchPntr^.ExpRe := tail^.expRe;

openfiVle(fiExp);
seek(fiExp,pofi[i]);
write(fiExp,tail^.expRe);
seek(fiExp,filesize(fiExp)-1);
truncate(fiExp);
close(fiExp);

preL^.next := nil;
dispose(tail);
end;

begin
  if kT in [2..numT+1] then cutOneT(kT-1)
  else for i := 1 to numT do cutOneT(i);
end;

PROCEDURE CutCompnt(poNeed :LongInt; var co,ro :byte; var fi :compntfi);
var last      : CompntRec;
    poLast    : LongInt;
begin
  openfile(fi);
  poLast := filesize(fi)-1;
  if poLast = poNeed then
    begin co := 1; ro := 1 end
  else
    begin
      seek(fi,poLast);
      read(fi,last);
      seek(fi,poNeed);
      write(fi,last);
    end;
    seek(fi,poLast);
    truncate(fi);
    close(fi);
end;

PROCEDURE ModCompnt(poNeed :LongInt; oldrec :compntRec; var fi :compntfi);
begin
  openfile(fi);
  windowclose;
  ins := true;
  with oldrec do
    begin
      strx[1] := name;
      str(tc:15:6,strx[2]);   str(pc:15:6,strx[3]);
      str(w:15:6,strx[4]);   str(m:15:6,strx[5]);
    end;
end;

```

```

    str(n:15:6,strx[6]);   str(del:15:6,strx[7]);
    str(wnew:15:6,strx[8]);
  end;
  modstrx(8,strx);
  textAttr := 7+0*16;
  window(47,5,62,12); clrscr; window(1,1,80,25);
  for i := 1 to 8 do
    begin gotoxy(47,i+4); write(strx[i]) end;
  startX := 1; startY := 1;
  repeat
    editor(47,5,62,12,startx,starty,strx,ch);
    if ch <> #27 then checkStr(check,startx,starty,strx,valstr);
  until (ch = #27) or (check = true);
  if ch <> #27 then
    begin
      gotoxy(51,14);   textAttr := 15+0*16+128;
      write('SAVING'); textAttr := 7+0*16;
      seek(fi,poNeed);
      with rec do
        begin
          name := strx[1];   tc := valstr[2];
          pc := valstr[3];   w := valstr[4];
          m := valstr[5];   n := valstr[6];
          del := valstr[7];  wnew := valstr[8];
        end;
      write(fi,rec);
    end;
  cursoroff;
  close(fi);
  gotoxy(51,14); write(' ');
end;

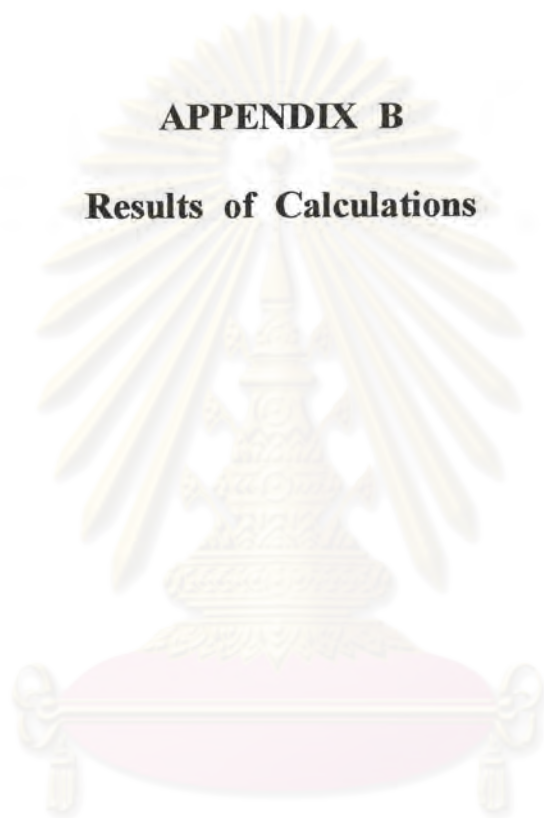
end. { END OF UNIT DATA12X }

```

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

APPENDIX B

Results of Calculations



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

AAD = 4.0906 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Y1cal	DY1
3.2382	0.1618	0.9597	0.0023
6.5080	0.2920	0.9785	0.0015
13.2427	0.3673	0.9877	0.0003
20.2459	0.0941	0.9905	0.0002
35.1980	1.2480	0.9919	0.0001
56.3676	2.0676	0.9899	0.0001
71.1227	3.2227	0.9849	0.0001
88.1844	6.7444	0.9639	0.0081

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1
3.4000	0.0340	0.9620
6.8000	0.0690	0.9800
13.6100	0.1390	0.9880
20.3400	0.2090	0.9907
33.9500	0.3500	0.9918
54.3000	0.5340	0.9900
67.9000	0.6560	0.9850
81.4400	0.8050	0.9720

by : SRK BBP
 Kij = 0.0052

T(K) : 227.560
 Time : 00:00:18

...Press any key...

AAD = 3.7569 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Y1cal	DY1
1.3088	0.0512	0.6132	0.0098
3.2426	0.1574	0.8383	0.0077
6.5121	0.2879	0.9148	0.0026
27.1009	0.1191	0.9703	0.0001
41.5876	0.8276	0.9742	0.0004
69.9382	2.0382	0.9709	0.0001
100.1977	5.1477	0.9516	0.0015
115.7678	7.1078	0.9243	0.0074

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1
1.3600	0.0063	0.6230
3.4000	0.0212	0.8460
6.8000	0.0461	0.9174
27.2200	0.1950	0.9704
40.7600	0.2925	0.9746
67.9000	0.4700	0.9710
95.0500	0.6510	0.9531
108.6600	0.7580	0.9317

by : SRK BBP
 Kij = 0.0125

T(K) : 255.360
 Time : 00:00:17

...Press any key...

AAD = 4.3663 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DY1
3.2260	0.1740	0.9571	0.0049
6.4787	0.3213	0.9771	0.0029
13.1888	0.4212	0.9868	0.0012
20.1812	0.1588	0.9898	0.0009
35.1580	1.2080	0.9912	0.0006
56.4587	2.1587	0.9889	0.0011
71.3507	3.4507	0.9832	0.0018
88.4426	7.0026	0.9601	0.0119

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
3.4000	0.0340	0.9620	1
6.8000	0.0690	0.9800	2
13.6100	0.1390	0.9880	3
20.3400	0.2090	0.9907	4
33.9500	0.3500	0.9918	5
54.3000	0.5340	0.9900	6
67.9000	0.6560	0.9850	7
81.4400	0.8050	0.9720	8
			9
			10
			11
			12
			13
			14
			15
			16
			17
			18

by : PR BBP
 Kij = 0.0135

T(K) : 227.560
 Time : 00:00:17

...Press any key...

AAD = 3.9754 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DY1
1.3143	0.0457	0.6043	0.0187
3.2309	0.1691	0.8331	0.0129
6.4741	0.3259	0.9117	0.0057
26.9819	0.2381	0.9688	0.0016
41.4979	0.7379	0.9726	0.0020
70.0858	2.1858	0.9685	0.0025
100.7211	5.6711	0.9467	0.0064
116.0571	7.3971	0.9181	0.0136

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
1.3600	0.0063	0.6230	1
3.4000	0.0212	0.8460	2
6.8000	0.0461	0.9174	3
27.2200	0.1950	0.9704	4
40.7600	0.2925	0.9746	5
67.9000	0.4700	0.9710	6
95.0500	0.6510	0.9531	7
108.6600	0.7580	0.9317	8
			9
			10
			11
			12
			13
			14
			15
			16
			17
			18

by : PR BBP
 Kij = 0.0198

T(K) : 255.360
 Time : 00:00:21

...Press any key...

AAD = 3.3996 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Yical	DY1
3.2588	0.1412	0.9586	0.0034
6.5426	0.2574	0.9779	0.0021
13.2942	0.3158	0.9873	0.0007
20.2967	0.0433	0.9901	0.0006
35.1750	1.2250	0.9915	0.0003
56.0201	1.7201	0.9894	0.0006
70.3380	2.4380	0.9843	0.0007
86.6181	5.1781	0.9637	0.0083

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1
3.4000	0.0340	0.9620
6.8000	0.0690	0.9800
13.6100	0.1390	0.9880
20.3400	0.2090	0.9907
33.9500	0.3500	0.9918
54.3000	0.5340	0.9900
67.9000	0.6560	0.9850
81.4400	0.8050	0.9720

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by : PT BBP
 Kij = -0.0010

T(K) : 227.560
 Time : 00:00:22

...Press any key...

AAD = 3.0802 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Yical	DY1
1.3184	0.0416	0.6112	0.0118
3.2604	0.1396	0.8370	0.0090
6.5419	0.2581	0.9139	0.0035
27.1451	0.0749	0.9696	0.0008
41.5699	0.8099	0.9733	0.0013
69.5717	1.6717	0.9697	0.0013
99.0124	3.9624	0.9497	0.0034
113.8634	5.2034	0.9222	0.0095

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1
1.3600	0.0063	0.6230
3.4000	0.0212	0.8460
6.8000	0.0461	0.9174
27.2200	0.1950	0.9704
40.7600	0.2925	0.9746
67.9000	0.4700	0.9710
95.0500	0.6510	0.9531
108.6600	0.7580	0.9317

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by : PT BBP
 Kij = 0.0042

T(K) : 255.360
 Time : 00:00:22

...Press any key...

AAD = 4.9462 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYl
3.2049	0.1951	0.9594	0.0026
6.4443	0.3557	0.9784	0.0016
13.1311	0.4789	0.9877	0.0003
20.1079	0.2321	0.9905	0.0002
35.0983	1.1483	0.9919	0.0001
56.6089	2.3089	0.9900	0.0000
71.8782	3.9782	0.9850	0.0000
89.9472	8.5072	0.9638	0.0082

ENTER RANGE : -0.05 0.10

P (atm)	Xl	Yl
3.4000	0.0340	0.9620
6.8000	0.0690	0.9800
13.6100	0.1390	0.9880
20.3400	0.2090	0.9907
33.9500	0.3500	0.9918
54.3000	0.5340	0.9900
67.9000	0.6560	0.9850
81.4400	0.8050	0.9720

by : MSRK BBP
 Kij = -0.0031

T(K) : 227.560
 Time : 00:00:17

...Press any key...

AAD = 4.8396 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYl
1.2958	0.0642	0.6121	0.0109
3.2083	0.1917	0.8378	0.0082
6.4452	0.3548	0.9146	0.0028
26.9445	0.2755	0.9704	0.0000
41.5032	0.7432	0.9743	0.0003
70.3976	2.4976	0.9712	0.0002
101.9974	6.9474	0.9524	0.0007
118.7857	10.1257	0.9252	0.0065

ENTER RANGE : -0.05 0.10

P (atm)	Xl	Yl
1.3600	0.0063	0.6230
3.4000	0.0212	0.8460
6.8000	0.0461	0.9174
27.2200	0.1950	0.9704
40.7600	0.2925	0.9746
67.9000	0.4700	0.9710
95.0500	0.6510	0.9531
108.6600	0.7580	0.9317

by : MSRK BBP
 Kij = -0.0052

T(K) : 255.360
 Time : 00:00:16

...Press any key...

AAD = 4.5713 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Yical	DYI
3.2096	0.1904	0.9584	0.0036
6.4501	0.3499	0.9778	0.0022
13.1375	0.4725	0.9873	0.0007
20.1102	0.2298	0.9902	0.0005
35.0611	1.1111	0.9917	0.0001
56.3745	2.0745	0.9899	0.0001
71.3270	3.4270	0.9854	0.0004
88.8361	7.3961	0.9669	0.0051

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
3.4000	0.0340	0.9620	1
6.8000	0.0690	0.9800	2
13.6100	0.1390	0.9880	3
20.3400	0.2090	0.9907	4
33.9500	0.3500	0.9918	5
54.3000	0.5340	0.9900	6
67.9000	0.6560	0.9850	7
81.4400	0.8050	0.9720	8
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by : MPR BBP
 Kij = 0.0208

T(K) : 227.560
 Time : 00:00:17

...Press any key...

AAD = 4.7539 %
 COMPONENT 1: METHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Yical	DYI
1.2945	0.0655	0.6088	0.0142
3.1955	0.2045	0.8360	0.0100
6.4133	0.3867	0.9136	0.0038
26.7953	0.4247	0.9703	0.0001
41.2687	0.5087	0.9745	0.0001
69.9669	2.0669	0.9722	0.0012
101.3636	6.3136	0.9558	0.0027
118.4618	9.8018	0.9306	0.0011

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
1.3600	0.0063	0.6230	1
3.4000	0.0212	0.8460	2
6.8000	0.0461	0.9174	3
27.2200	0.1950	0.9704	4
40.7600	0.2925	0.9746	5
67.9000	0.4700	0.9710	6
95.0500	0.6510	0.9531	7
108.6600	0.7580	0.9317	8
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by : MPR BBP
 Kij = 0.0292

T(K) : 255.360
 Time : 00:00:20

...Press any key...

AAD = 1.5779 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE
 P_{cal} DP Y_{1cal} DY₁
 35.6162 0.6406 0.7768 0.0202
 38.2428 0.2731 0.7909 0.0041
 42.8117 0.5336 0.8112 0.0068
 46.4935 1.2067 0.8239 0.0091

ENTER RANGE : 0 0.10

P (atm)	X ₁	Y ₁
34.9756	0.4820	0.7970
37.9697	0.5240	0.7950
43.3453	0.5960	0.8180
47.7002	0.6530	0.8330

by : SRK BBP
 Kij = 0.0285

T(K) : 338.716
 Time : 00:00:13

...Press any key...

AAD = 1.0871 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE
 P_{cal} DP Y_{1cal} DY₁
 35.5595 0.9240 0.5641 0.0109
 37.2760 0.0549 0.5796 0.0194
 40.4101 0.0093 0.6037 0.0103
 41.6739 0.0383 0.6122 0.0058
 44.8453 0.4733 0.6304 0.0086
 45.8216 1.1981 0.6347 0.0153

ENTER RANGE : 0 0.10

P (atm)	X ₁	Y ₁
34.6354	0.2990	0.5750
37.2212	0.3220	0.5990
40.4193	0.3640	0.6140
41.7122	0.3810	0.6180
45.3186	0.4240	0.6390
47.0198	0.4370	0.6500

by : SRK BBP
 Kij = 0.0354

T(K) : 366.493
 Time : 00:00:21

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AAD = 1.4971 %
 COMPONENT 1: ETHANF
 COMPONENT 2: N-BUTANE
 Pcal DP Ylcal DYI
 35.5853 0.6097 0.7746 0.0224
 38.2276 0.2579 0.7886 0.0064
 42.8395 0.5058 0.8084 0.0096
 46.5558 1.1445 0.8207 0.0123

ENTER RANGE : 0 0.1

P (atm)	X1	Y1	
34.9756	0.4820	0.7970	1
37.9697	0.5240	0.7950	2
43.3453	0.5960	0.8180	3
47.7002	0.6530	0.8330	4
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by : PR BBP
 Kij = 0.0278

T(K) : 338.716
 Time : 00:00:15

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AAD = 1.0279 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE
 Pcal DP Ylcal DYI
 35.5056 0.8702 0.5622 0.0128
 37.2403 0.0191 0.5774 0.0216
 40.4030 0.0163 0.6011 0.0129
 41.6788 0.0334 0.6093 0.0087
 44.8779 0.4408 0.6269 0.0121
 45.8395 1.1803 0.6313 0.0187

ENTER RANGE : 0 0.10

P (atm)	X1	Y1	
34.6354	0.2990	0.5750	1
37.2212	0.3220	0.5990	2
40.4193	0.3640	0.6140	3
41.7122	0.3810	0.6180	4
45.3186	0.4240	0.6390	5
47.0198	0.4370	0.6500	6
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by : PR BBP
 Kij = 0.0326

T(K) : 366.493
 Time : 00:00:28

...Press any key...

AAD = 1.5488 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYI
35.5485	0.5729	0.7765	0.0205
38.1759	0.2063	0.7905	0.0045
42.7487	0.5966	0.8106	0.0074
46.4420	1.2582	0.8232	0.0098

ENTER RANGE : 0 0.10

P (atm)	XI	YI
34.9756	0.4820	0.7970
37.9697	0.5240	0.7950
43.3453	0.5960	0.8180
47.7002	0.6530	0.8330

by : PT BBP
 Kij = 0.0250

T(K) : 338.716
 Time : 00:00:15

...Press any key...

AAD = 1.1658 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYI
35.6746	1.0392	0.5651	0.0099
37.4048	0.1836	0.5803	0.0187
40.5611	0.1418	0.6038	0.0102
41.8328	0.1206	0.6120	0.0060
45.0251	0.2935	0.6296	0.0094
45.9790	1.0408	0.6340	0.0160

ENTER RANGE : 0 0.10

P (atm)	XI	YI
34.6354	0.2990	0.5750
37.2212	0.3220	0.5990
40.4193	0.3640	0.6140
41.7122	0.3810	0.6180
45.3186	0.4240	0.6390
47.0198	0.4370	0.6500

by : PT BBP
 Kij = 0.0333

T(K) : 366.493
 Time : 00:00:28

...Press any key...

AAD = 1.3806 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DY1
35.5278	0.5521	0.7809	0.0161
38.1978	0.2281	0.7950	0.0000
42.8655	0.4798	0.8150	0.0030
46.6336	1.0666	0.8274	0.0056

ENTER RANGE : 0 0.10

P (atm)	X1	Y1
34.9756	0.4820	0.7970
37.9697	0.5240	0.7950
43.3453	0.5960	0.8180
47.7002	0.6530	0.8330

by : MSRK BBP
 Kij = 0.0215

T(K) : 338.716
 Time : 00:00:12

...Press any key...

AAD = 0.9407 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DY1
35.4617	0.8263	0.5698	0.0052
37.2117	0.0095	0.5852	0.0138
40.4071	0.0123	0.6094	0.0046
41.6982	0.0140	0.6178	0.0002
44.9454	0.3733	0.6359	0.0031
45.9169	1.1028	0.6406	0.0094

ENTER RANGE : 0 0.10

P (atm)	X1	Y1
34.6354	0.2990	0.5750
37.2212	0.3220	0.5990
40.4193	0.3640	0.6140
41.7122	0.3810	0.6180
45.3186	0.4240	0.6390
47.0198	0.4370	0.6500

by : MSRK BBP
 Kij = 0.0257

T(K) : 366.493
 Time : 00:00:20

...Press any key...

AAD = 1.3989 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYI
35.5429	0.5673	0.7765	0.0205
38.2044	0.2347	0.7905	0.0045
42.8559	0.4894	0.8103	0.0077
46.6383	1.0620	0.8222	0.0108

ENTER RANGE : 0 0.10

P (atm)	X1	Y1	
34.9756	0.4820	0.7970	1
37.9697	0.5240	0.7950	2
43.3453	0.5960	0.8180	3
47.7002	0.6530	0.8330	4
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by : MPR BBP
 Kij = 0.0271

T(K) : 338.716
 Time : 00:00:15

... Press any key ...

AAD = 0.9742 %
 COMPONENT 1: ETHANE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYI
35.5171	0.8817	0.5647	0.0103
37.2662	0.0450	0.5799	0.0191
40.4535	0.0342	0.6036	0.0104
41.7417	0.0295	0.6119	0.0061
44.9807	0.3379	0.6294	0.0096
45.9488	1.0710	0.6339	0.0161

ENTER RANGE : 0 0.10

P (atm)	X1	Y1	
34.6354	0.2990	0.5750	1
37.2212	0.3220	0.5990	2
40.4193	0.3640	0.6140	3
41.7122	0.3810	0.6180	4
45.3186	0.4240	0.6390	5
47.0198	0.4370	0.6500	6
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by : MPR BBP
 Kij = 0.0326

T(K) : 366.493
 Time : 00:00:28

... Press any key ...

AAD = 1.7605 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Yical	DYI
0.4861	0.0139	0.3293	0.0217
0.7142	0.0358	0.5636	0.0656
1.0147	0.0147	0.7120	0.0090
1.2461	0.0461	0.7778	0.0138
1.5112	0.0112	0.8287	0.0077
2.0066	0.0066	0.8883	0.0043
2.9953	0.0047	0.9501	0.0005
4.0001	0.0001	0.9839	0.0006

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
0.5000	0.0350	0.3510	1
0.7500	0.0880	0.4980	2
1.0000	0.1580	0.7030	3
1.2000	0.2120	0.7640	4
1.5000	0.2740	0.8210	5
2.0000	0.3900	0.8840	6
3.0000	0.6210	0.9496	7
4.0000	0.8500	0.9845	8
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by : SRK BBP
 Kij = 0.0073

T(K) : 273.160
 Time : 00:00:04

...Press any key...

AAD = 1.6494 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Yical	DYI
4.9240	0.0760	0.1988	0.0018
6.9444	0.0556	0.4602	0.0058
8.4022	0.4022	0.5725	0.0085
9.9136	0.0864	0.6552	0.0098
12.8086	0.1914	0.7616	0.0114
14.7657	0.2343	0.8116	0.0104
19.7093	0.2907	0.8992	0.0078
24.8747	0.1253	0.9625	0.0037

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
5.0000	0.0460	0.1970	1
7.0000	0.1470	0.4660	2
8.0000	0.2180	0.5810	3
10.0000	0.2900	0.6650	4
13.0000	0.4230	0.7730	5
15.0000	0.5090	0.8220	6
20.0000	0.7110	0.9070	7
25.0000	0.8940	0.9662	8
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by : SRK BBP
 Kij = 0.0052

T(K) : 348.160
 Time : 00:00:09

...Press any key...

AAD = 1.5197 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DY1
0.4935	0.0065	0.3205	0.0305
0.7185	0.0315	0.5538	0.0558
1.0154	0.0154	0.7040	0.0010
1.2442	0.0442	0.7711	0.0071
1.5069	0.0069	0.8233	0.0023
1.9985	0.0015	0.8847	0.0007
2.9831	0.0169	0.9486	0.0010
3.9864	0.0136	0.9834	0.0011

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
0.5000	0.0350	0.3510	1
0.7500	0.0880	0.4980	2
1.0000	0.1580	0.7030	3
1.2000	0.2120	0.7640	4
1.5000	0.2740	0.8210	5
2.0000	0.3900	0.8840	6
3.0000	0.6210	0.9496	7
4.0000	0.8500	0.9845	8
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by : PR BBP
 Kij = 0.0063

T(K) : 273.160
 Time : 00:00:05

...Press any key...

AAD = 1.7334 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DY1
4.9079	0.0921	0.2015	0.0045
6.9542	0.0458	0.4632	0.0028
8.4232	0.4232	0.5745	0.0065
9.9406	0.0594	0.6562	0.0088
12.8307	0.1693	0.7611	0.0119
14.7723	0.2277	0.8104	0.0116
19.6595	0.3405	0.8974	0.0096
24.7591	0.2409	0.9615	0.0047

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1	
5.0000	0.0460	0.1970	1
7.0000	0.1470	0.4660	2
8.0000	0.2180	0.5810	3
10.0000	0.2900	0.6650	4
13.0000	0.4230	0.7730	5
15.0000	0.5090	0.8220	6
20.0000	0.7110	0.9070	7
25.0000	0.8940	0.9662	8
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by : PR BBP
 Kij = 0.0094

T(K) : 348.160
 Time : 00:00:10

...Press any key...

AAD = 1.2590 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DYI
0.4883	0.0117	0.3240	0.0270
0.7135	0.0365	0.5578	0.0598
1.0106	0.0106	0.7073	0.0043
1.2000	0.0000	0.7794	0.0154
1.5022	0.0022	0.8256	0.0046
1.9936	0.0064	0.8862	0.0022
2.9766	0.0234	0.9493	0.0003
3.9776	0.0224	0.9836	0.0009

ENTER RANGE : -0.05 0.10

P (atm)	XI	YI
0.5000	0.0350	0.3510
0.7500	0.0880	0.4980
1.0000	0.1580	0.7030
1.2000	0.2120	0.7640
1.5000	0.2740	0.8210
2.0000	0.3900	0.8840
3.0000	0.6210	0.9496
4.0000	0.8500	0.9845

by : PT BBP
 Kij = 0.0052

T(K) : 273.160
 Time : 00:00:06

...Press any key...

AAD = 1.8376 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DYI
4.8922	0.1078	0.2024	0.0054
6.9413	0.0587	0.4647	0.0013
8.4123	0.4123	0.5760	0.0050
9.9320	0.0680	0.6576	0.0074
12.8189	0.1811	0.7624	0.0106
14.7603	0.2397	0.8116	0.0104
19.6426	0.3574	0.8982	0.0088
24.7266	0.2734	0.9619	0.0043

ENTER RANGE : -0.05 0.10

P (atm)	XI	YI
5.0000	0.0460	0.1970
7.0000	0.1470	0.4660
8.0000	0.2180	0.5810
10.0000	0.2900	0.6650
13.0000	0.4230	0.7730
15.0000	0.5090	0.8220
20.0000	0.7110	0.9070
25.0000	0.8940	0.9662

by : PT BBP
 Kij = 0.0073

T(K) : 348.160
 Time : 00:00:12

...Press any key...

AAD = 1.5983 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DYl
0.4903	0.0097	0.3217	0.0293
0.7147	0.0353	0.5553	0.0573
1.0109	0.0109	0.7053	0.0023
1.2393	0.0393	0.7723	0.0083
1.5015	0.0015	0.8244	0.0034
1.9926	0.0074	0.8856	0.0016
2.9766	0.0234	0.9491	0.0005
3.9792	0.0208	0.9836	0.0009

ENTER RANGE : -0.05 0.10

P (atm)	Yl	Yl	
0.5000	0.0350	0.3510	1
0.7500	0.0880	0.4980	2
1.0000	0.1580	0.7030	3
1.2000	0.2120	0.7640	4
1.5000	0.2740	0.8210	5
2.0000	0.3900	0.8840	6
3.0000	0.6210	0.9496	7
4.0000	0.8500	0.9845	8
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by : MSRK BBP

T(K) : 273.160

Kij = 0.0063

Time : 00:00:04

...Press any key...

AAD = 1.7753 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DYl
4.9001	0.0999	0.2021	0.0051
6.9446	0.0554	0.4646	0.0014
8.4135	0.4135	0.5762	0.0048
9.9313	0.0687	0.6581	0.0069
12.8242	0.1758	0.7632	0.0098
14.7706	0.2294	0.8125	0.0095
19.6621	0.3379	0.8991	0.0079
24.7536	0.2464	0.9623	0.0039

ENTER RANGE : -0.05 0.10

P (atm)	Xl	Yl	
5.0000	0.0460	0.1970	1
7.0000	0.1470	0.4660	2
8.0000	0.2180	0.5810	3
10.0000	0.2900	0.6650	4
13.0000	0.4230	0.7730	5
15.0000	0.5090	0.8220	6
20.0000	0.7110	0.9070	7
25.0000	0.8940	0.9662	8
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by : MSRK BBP

T(K) : 348.160

Kij = 0.0083

Time : 00:00:09

...Press any key...

AAD = 1.2960 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DYl
0.4934	0.0066	0.3201	0.0309
0.7178	0.0322	0.5532	0.0552
1.0134	0.0134	0.7032	0.0002
1.2000	0.0000	0.7757	0.0117
1.5015	0.0015	0.8225	0.0015
1.9882	0.0118	0.8838	0.0002
2.9591	0.0409	0.9479	0.0017
3.9457	0.0543	0.9831	0.0014

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1
0.5000	0.0350	0.3510
0.7500	0.0880	0.4980
1.0000	0.1580	0.7030
1.2000	0.2120	0.7640
1.5000	0.2740	0.8210
2.0000	0.3900	0.8840
3.0000	0.6210	0.9496
4.0000	0.8500	0.9845

by : MPR BBP
 Kij = 0.0073

T(K) : 273.160
 Time : 00:00:05

...Press any key...

AAD = 1.8666 %
 COMPONENT 1: PROPANE
 COMPONENT 2: ISOPENTANE

Pcal	DP	Ylcal	DYl
4.8976	0.1024	0.2020	0.0050
6.9461	0.0539	0.4638	0.0022
8.4152	0.4152	0.5748	0.0062
9.9312	0.0688	0.6564	0.0086
12.8154	0.1846	0.7609	0.0121
14.7507	0.2493	0.8101	0.0119
19.6165	0.3835	0.8971	0.0099
24.6908	0.3092	0.9613	0.0049

ENTER RANGE : -0.05 0.10

P (atm)	X1	Y1
5.0000	0.0460	0.1970
7.0000	0.1470	0.4660
8.0000	0.2180	0.5810
10.0000	0.2900	0.6650
13.0000	0.4230	0.7730
15.0000	0.5090	0.8220
20.0000	0.7110	0.9070
25.0000	0.8940	0.9662

by : MPR BBP
 Kij = 0.0104

T(K) : 348.160
 Time : 00:00:10

...Press any key...

AAD = 0.5330 %
 COMPONENT 1: NITROGEN
 COMPONENT 2: METHANE

Pcal	DP	Ylcal	DYl
12.2830	0.1028	0.1520	0.0009
13.8720	0.0927	0.2420	0.0016
17.0309	0.0535	0.3718	0.0035
20.3748	0.0290	0.4654	0.0075
26.9018	0.0784	0.5805	0.0026
33.5791	0.1036	0.6499	0.0019
39.9510	0.4683	0.6894	0.0027

ENTER RANGE : 0 0.2

P (atm)	X1	Y1	
12.1802	0.0284	0.1529	1
13.7793	0.0514	0.2404	2
16.9775	0.0985	0.3683	3
20.3458	0.1503	0.4579	4
26.9802	0.2579	0.5779	5
33.6828	0.3778	0.6480	6
40.4193	0.5034	0.6867	7
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by : SRK BBP
 Kij = 0.0278

T(K) : 149.827
 Time : 00:00:17

...Press any key...

AAD = 0.6412 %
 COMPONENT 1: NITROGEN
 COMPONENT 2: METHANE

Pcal	DP	Ylcal	DYl
25.6632	0.4522	0.0190	0.0004
26.7713	0.2333	0.0514	0.0012
27.5292	0.2428	0.0720	0.0019
30.7835	0.0414	0.1488	0.0044
34.0713	0.0483	0.2104	0.0053
37.3444	0.0809	0.2596	0.0050
40.5151	0.1764	0.2975	0.0034

ENTER RANGE : 0 0.2

P (atm)	X1	Y1	
25.2110	0.0060	0.0194	1
26.5379	0.0169	0.0525	2
27.2864	0.0245	0.0740	3
30.8248	0.0576	0.1532	4
34.0230	0.0924	0.2157	5
37.4253	0.1287	0.2646	6
40.6915	0.1657	0.3009	7
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by : SRK BBP
 Kij = 0.0403

T(K) : 172.049
 Time : 00:00:21

...Press any key...

AAD = 0.5908 %
 COMPONENT 1: NITROGEN
 COMPONENT 2: METHANE

Pcal	DP	Ylcal	DY1
12.3000	0.1197	0.1523	0.0006
13.8941	0.1148	0.2424	0.0020
17.0608	0.0834	0.3721	0.0038
20.4096	0.0639	0.4656	0.0077
26.9381	0.0421	0.5805	0.0026
33.6026	0.0802	0.6498	0.0018
39.9665	0.4528	0.6895	0.0028

ENTER RANGE : 0 0.2

P (atm)	X1	Y1
12.1802	0.0284	0.1529
13.7793	0.0514	0.2404
16.9775	0.0985	0.3683
20.3458	0.1503	0.4579
26.9802	0.2579	0.5779
33.6828	0.3778	0.6480
40.4193	0.5034	0.6867

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by : PT BBP
 Kij = 0.0319

T(K) : 149.827
 Time : 00:00:21

...Press any key...

AAD = 1.6227 %
 COMPONENT 1: NITROGEN
 COMPONENT 2: METHANE

Pcal	DP	Ylcal	DY1
25.4947	0.2837	0.0180	0.0013
26.5125	0.0255	0.0490	0.0035
27.2106	0.0758	0.0690	0.0050
30.2266	0.5982	0.1441	0.0091
33.2995	0.7235	0.2060	0.0097
36.4028	1.0225	0.2566	0.0080
39.4460	1.2455	0.2969	0.0040

ENTER RANGE : 0 0.02

P (atm)	X1	Y1
25.2110	0.0060	0.0194
26.5379	0.0169	0.0525
27.2864	0.0245	0.0740
30.8248	0.0576	0.1532
34.0230	0.0924	0.2157
37.4253	0.1287	0.2646
40.6915	0.1657	0.3009

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by : PT BBP
 Kij = 0.0200

T(K) : 172.049
 Time : 00:00:26

...Press any key...

AAD = 0.2053 %
 COMPONENT 1: NITROGEN
 COMPONENT 2: METHANE

Pcal	DP	Y1cal	DY1
12.2126	0.0324	0.1534	0.0005
13.8090	0.0297	0.2441	0.0037
16.9858	0.0083	0.3744	0.0061
20.3529	0.0072	0.4682	0.0103
26.9386	0.0417	0.5832	0.0053
33.6909	0.0081	0.6521	0.0041
40.1392	0.2801	0.6908	0.0041

ENTER RANGE : 0 0.2

P (atm)	X1	Y1
12.1802	0.0284	0.1529
13.7793	0.0514	0.2404
16.9775	0.0985	0.3683
20.3458	0.1503	0.4579
26.9802	0.2579	0.5779
33.6828	0.3778	0.6480
40.4193	0.5034	0.6867

by : MSRK BBP
 Kij = 0.0250

T(K) : 149.827
 Time : 00:00:17

...Press any key...

AAD = 0.3397 %
 COMPONENT 1: NITROGEN
 COMPONENT 2: METHANE

Pcal	DP	Y1cal	DY1
25.4848	0.2738	0.0194	0.0000
26.6152	0.0773	0.0525	0.0000
27.3888	0.1023	0.0736	0.0004
30.7111	0.1138	0.1515	0.0017
34.0695	0.0465	0.2138	0.0019
37.4145	0.0108	0.2631	0.0015
40.6544	0.0371	0.3010	0.0001

ENTER RANGE : 0 0.2

P (atm)	X1	Y1
25.2110	0.0060	0.0194
26.5379	0.0169	0.0525
27.2864	0.0245	0.0740
30.8248	0.0576	0.1532
34.0230	0.0924	0.2157
37.4253	0.1287	0.2646
40.6915	0.1657	0.3009

by : MSRK BBP
 Kij = 0.0347

T(K) : 172.049
 Time : 00:00:21

...Press any key...

AAD = 0.8097 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DY1
19.9706	0.0294	0.1005	0.0035
22.9331	0.3869	0.1988	0.0242
29.4438	0.5562	0.3454	0.0156
39.7119	0.2881	0.4763	0.0147
50.1971	0.1971	0.5495	0.0255
60.4566	0.4566	0.5892	0.0158
70.6409	0.6409	0.6053	0.0097
77.0203	0.0203	0.6003	0.0047

ENTER RANGE : 0 0.2

P (atm)	X1	Y1
20.0000	0.0100	0.1040
23.3200	0.0230	0.2230
30.0000	0.0530	0.3610
40.0000	0.1050	0.4910
50.0000	0.1660	0.5750
60.0000	0.2370	0.6050
70.0000	0.3260	0.6150
77.0000	0.4000	0.6050

by : SRK BBP
 Kij = 0.0889

T(K) : 250.000
 Time : 00:00:24

...Press any key...

AAD = 0.3358 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DY1
36.5549	0.3052	0.1000	0.0048
37.8721	0.2703	0.1232	0.0041
43.3174	0.0211	0.2035	0.0051
51.0078	0.1444	0.2858	0.0027
58.7947	0.1418	0.3436	0.0015
60.6277	0.1273	0.3543	0.0000
69.9092	0.0054	0.3949	0.0048

ENTER RANGE : 0 0.2

P (atm)	X1	Y1
36.2497	0.0183	0.1048
37.6018	0.0235	0.1273
43.2963	0.0457	0.2086
51.1522	0.0793	0.2885
58.6528	0.1167	0.3451
60.7550	0.1261	0.3543
69.9038	0.1785	0.3901

by : SRK BBP
 Kij = 0.1139

T(K) : 270.000
 Time : 00:00:20

...Press any key...

AAD = 1.4009 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DY1
19.7817	0.2183	0.1014	0.0026
22.7600	0.5600	0.2003	0.0227
29.3213	0.6787	0.3471	0.0139
39.7000	0.3000	0.4775	0.0135
50.3475	0.3475	0.5497	0.0253
60.8080	0.8080	0.5881	0.0169
71.2189	1.2189	0.6021	0.0129
77.7074	0.7074	0.5948	0.0102

ENTER RANGE : 0 0.2

P (atm)	X1	Y1
20.0000	0.0100	0.1040
23.3200	0.0230	0.2230
30.0000	0.0530	0.3610
40.0000	0.1050	0.4910
50.0000	0.1660	0.5750
60.0000	0.2370	0.6050
70.0000	0.3260	0.6150
77.0000	0.4000	0.6050

by : PR BBP
 Kij = 0.0889

T(K) : 250.000
 Time : 00:00:29

...Press any key...

AAD = 0.2474 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DY1
36.2733	0.0236	0.1009	0.0039
37.6050	0.0033	0.1243	0.0030
43.1181	0.1782	0.2049	0.0037
50.9227	0.2295	0.2869	0.0016
58.8444	0.1916	0.3440	0.0011
60.7122	0.0428	0.3546	0.0003
70.1839	0.2802	0.3937	0.0036

ENTER RANGE : 0 0.2

P (atm)	X1	Y1
36.2497	0.0183	0.1048
37.6018	0.0235	0.1273
43.2963	0.0457	0.2086
51.1522	0.0793	0.2885
58.6528	0.1167	0.3451
60.7550	0.1261	0.3543
69.9038	0.1785	0.3901

by : PR BBP
 Kij = 0.1097

T(K) : 270.000
 Time : 00:00:24

...Press any key...

AAD = 1.2083 %

COMPONENT 1: METHANE

COMPONENT 2: CARBON DIOXIDE

Pcal	DP	YIcal	DYI
19.7727	0.2273	0.1031	0.0009
22.7922	0.5278	0.2032	0.0198
29.4196	0.5804	0.3508	0.0102
39.8462	0.1538	0.4808	0.0102
50.4515	0.4515	0.5526	0.0224
60.7774	0.7774	0.5908	0.0142
70.9577	0.9577	0.6055	0.0095
77.2928	0.2928	0.5994	0.0056

ENTER RANGE : 0 0.2

P (atm)	XI	YI	
20.0000	0.0100	0.1040	1
23.3200	0.0230	0.2230	2
30.0000	0.0530	0.3610	3
40.0000	0.1050	0.4910	4
50.0000	0.1660	0.5750	5
60.0000	0.2370	0.6050	6
70.0000	0.3260	0.6150	7
77.0000	0.4000	0.6050	8
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by : PT BBP

T(K) : 250.000

Kij = 0.0861

Time : 00:00:30

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AAD = 0.2118 %

COMPONENT 1: METHANE

COMPONENT 2: CARBON DIOXIDE

Pcal	DP	YIcal	DYI
36.2527	0.0030	0.1022	0.0026
37.5943	0.0075	0.1257	0.0016
43.1342	0.1621	0.2069	0.0017
50.9495	0.2027	0.2893	0.0008
58.8480	0.1952	0.3466	0.0015
60.7051	0.0499	0.3572	0.0029
70.0915	0.1877	0.3968	0.0067

ENTER RANGE : 0 0.2

P (atm)	XI	YI	
36.2497	0.0183	0.1048	1
37.6018	0.0235	0.1273	2
43.2963	0.0457	0.2086	3
51.1522	0.0793	0.2885	4
58.6528	0.1167	0.3451	5
60.7550	0.1261	0.3543	6
69.9038	0.1785	0.3901	7
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by : PT BBP

T(K) : 270.000

Kij = 0.1083

Time : 00:00:26

...Press any key...

AAD = 1.4160 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DY1
19.8197	0.1803	0.1008	0.0032
22.7700	0.5500	0.1995	0.0235
29.2722	0.7278	0.3467	0.0143
39.5844	0.4156	0.4781	0.0129
50.2034	0.2034	0.5518	0.0232
60.7026	0.7026	0.5917	0.0133
71.2585	1.2585	0.6078	0.0072
77.9455	0.9455	0.6023	0.0027

ENTER RANGE : 0 0.2

P (atm)	X1	Y1	
20.0000	0.0100	0.1040	1
23.3200	0.0230	0.2230	2
30.0000	0.0530	0.3610	3
40.0000	0.1050	0.4910	4
50.0000	0.1660	0.5750	5
60.0000	0.2370	0.6050	6
70.0000	0.3260	0.6150	7
77.0000	0.4000	0.6050	8
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by : MSRK BBP
 Kij = 0.0750

T(K) : 250.000
 Time : 00:00:24

...Press any key...

AAD = 0.2985 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DY1
36.3639	0.1142	0.1008	0.0040
37.6854	0.0836	0.1242	0.0031
43.1588	0.1375	0.2051	0.0035
50.9187	0.2335	0.2878	0.0007
58.8159	0.1630	0.3460	0.0009
60.6811	0.0739	0.3567	0.0024
70.1683	0.2645	0.3975	0.0074

ENTER RANGE : 0 0.2

P (atm)	X1	Y1	
36.2497	0.0183	0.1048	1
37.6018	0.0235	0.1273	2
43.2963	0.0457	0.2086	3
51.1522	0.0793	0.2885	4
58.6528	0.1167	0.3451	5
60.7550	0.1261	0.3543	6
69.9038	0.1785	0.3901	7
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by : MSRK BBP
 Kij = 0.0944

T(K) : 270.000
 Time : 00:00:20

...Press any key...

AAD = 2.1846 %

COMPONENT 1: METHANE

COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DYI
19.7607	0.2393	0.0972	0.0068
22.6174	0.7026	0.1938	0.0292
28.9654	1.0346	0.3406	0.0204
39.1920	0.8080	0.4753	0.0157
49.9484	0.0516	0.5532	0.0218
60.8380	0.8380	0.5975	0.0075
72.1130	2.1130	0.6186	0.0036
79.5260	2.5260	0.6173	0.0123

ENTER RANGE : 0 0.2

P (atm)	X1	Y1	
20.0000	0.0100	0.1040	1
23.3200	0.0230	0.2230	2
30.0000	0.0530	0.3610	3
40.0000	0.1050	0.4910	4
50.0000	0.1660	0.5750	5
60.0000	0.2370	0.6050	6
70.0000	0.3260	0.6150	7
77.0000	0.4000	0.6050	8
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by : MPR BBP
Kij = 0.0986

T(K) : 250.000
Time : 00:00:26

...Press any key...

AAD = 0.4819 %

COMPONENT 1: METHANE

COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DYI
36.2174	0.0323	0.0988	0.0060
37.5194	0.0823	0.1220	0.0053
42.9471	0.3493	0.2032	0.0054
50.7384	0.4138	0.2881	0.0004
58.8141	0.1612	0.3493	0.0042
60.7372	0.0178	0.3610	0.0067
70.7045	0.8007	0.4064	0.0163

ENTER RANGE : 0 0.2

P (atm)	X1	Y1	
36.2497	0.0183	0.1048	1
37.6018	0.0235	0.1273	2
43.2963	0.0457	0.2086	3
51.1522	0.0793	0.2885	4
58.6528	0.1167	0.3451	5
60.7550	0.1261	0.3543	6
69.9038	0.1785	0.3901	7
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by : MPR BBP
Kij = 0.1250

T(K) : 270.000
Time : 00:00:23

...Press any key...

AAD = 14.2621 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DYI
18.9359	1.0641	0.0729	0.0311
20.9192	2.4008	0.1508	0.0722
25.3778	4.6222	0.2814	0.0796
32.7401	7.2599	0.4182	0.0728
40.8081	9.1919	0.5094	0.0656
49.4672	10.5328	0.5710	0.0340
59.2625	10.7375	0.6134	0.0016
66.4925	10.5075	0.6304	0.0254

F4 :Kij=0

P (atm)	XI	YI	
20.0000	0.0100	0.1040	1
23.3200	0.0230	0.2230	2
30.0000	0.0530	0.3610	3
40.0000	0.1050	0.4910	4
50.0000	0.1660	0.5750	5
60.0000	0.2370	0.6050	6
70.0000	0.3260	0.6150	7
77.0000	0.4000	0.6050	8
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by : PT
 Kij = 0.0000

T(K) : 250.000
 Time : 00:00:01

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AAD = 11.1116 %
 COMPONENT 1: METHANE
 COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Ylcal	DYI
34.5319	1.7178	0.0750	0.0298
35.4110	2.1907	0.0937	0.0336
39.1062	4.1901	0.1625	0.0461
44.5168	6.6354	0.2417	0.0468
50.2772	8.3756	0.3058	0.0393
51.6792	9.0758	0.3189	0.0354
59.1748	10.7290	0.3761	0.0140

F4 :Kij=0

P (atm)	XI	YI	
36.2497	0.0183	0.1048	1
37.6018	0.0235	0.1273	2
43.2963	0.0457	0.2086	3
51.1522	0.0793	0.2885	4
58.6528	0.1167	0.3451	5
60.7550	0.1261	0.3543	6
69.9038	0.1785	0.3901	7
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by : PT
 Kij = 0.0000

T(K) : 270.000
 Time : 00:00:01

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AAD = 17.9777 %

F4 : Kij=0

COMPONENT 1: ETHANE

COMPONENT 2: CARBON DIOXIDE

Pcal	DP	Y1cal	DY1
13.1676	1.0624	0.9419	0.0534
13.4977	2.1823	0.8675	0.0901
13.8510	3.0790	0.7901	0.0910
14.1542	3.8858	0.7252	0.0949
14.5918	4.6382	0.6335	0.0809
15.0423	4.9877	0.5408	0.0444
15.3854	5.1746	0.4706	0.0228
15.9732	5.0168	0.3492	0.0243
16.3528	4.7172	0.2680	0.0518
16.7375	4.0625	0.1806	0.0727
17.0518	2.9382	0.1016	0.0767
17.1851	2.2149	0.0646	0.0658
17.3115	1.1985	0.0263	0.0359

P (atm)	X1	Y1	
14.2300	0.9556	0.8885	1
15.6800	0.8965	0.7774	2
16.9300	0.8320	0.6991	3
18.0400	0.7755	0.6303	4
19.2300	0.6917	0.5526	5
20.0300	0.6020	0.4964	6
20.5600	0.5308	0.4478	7
20.9900	0.4010	0.3735	8
21.0700	0.3100	0.3198	9
20.8000	0.2092	0.2533	10
19.9900	0.1171	0.1783	11
19.4000	0.0740	0.1304	12
18.5100	0.0299	0.0622	13
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by : PT

Kij = 0.0000

T(K) : 250.000

Time : 00:00:01

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จุฬาลงกรณ์มหาวิทยาลัย

AAD = 31.5814 %

COMPONENT 1: CARBON DIOXIDE
COMPONENT 2: PROPANE

Pcal	DP	Ylcal	DYI
3.0255	1.9418	0.4752	0.1837
3.3980	2.3859	0.5447	0.1686
4.3333	3.0837	0.6673	0.1147
4.6319	3.1253	0.6963	0.0982
5.5180	3.5661	0.7641	0.0654
6.7441	3.7554	0.8295	0.0285
8.1324	3.2993	0.8808	0.0020
9.8675	2.6870	0.9261	0.0194
10.9152	2.0475	0.9473	0.0277
11.7262	1.6788	0.9615	0.0299

F4 :Kij=0

P (atm)	X1	Y1
4.9674	0.1134	0.6589
5.7839	0.1453	0.7133
7.4170	0.2245	0.7820
7.7572	0.2495	0.7945
9.0841	0.3229	0.8295
10.4995	0.4226	0.8580
11.4317	0.5329	0.8828
12.5545	0.6672	0.9067
12.9628	0.7464	0.9196
13.4051	0.8067	0.9316

by : PT T(K) : 244.271
 Kij = 0.0000 Time : 00:00:01 ...Press any key...

AAD = 27.4974 %

COMPONENT 1: CARBON DIOXIDE
COMPONENT 2: PROPANE

Pcal	DP	Ylcal	DYI
5.5719	2.3894	0.3515	0.1692
7.0946	3.4525	0.5141	0.1258
7.4702	3.9955	0.5442	0.1265
9.0093	4.4298	0.6423	0.0830
11.1147	5.2843	0.7339	0.0543
12.3316	5.4964	0.7732	0.0347
13.3404	6.6651	0.8008	0.0310
15.3555	6.0450	0.8456	0.0067
18.3798	5.5044	0.8965	0.0214
21.8112	3.4339	0.9394	0.0237
23.0431	2.7463	0.9524	0.0259

F4 :Kij=0

P (atm)	X1	Y1
7.9614	0.0886	0.5207
10.5471	0.1620	0.6399
11.4658	0.1798	0.6707
13.4391	0.2515	0.7253
16.3991	0.3464	0.7882
17.8281	0.3996	0.8079
20.0055	0.4428	0.8318
21.4005	0.5266	0.8523
23.8841	0.6470	0.8751
25.2451	0.7750	0.9157
25.7894	0.8189	0.9265

by : PT T(K) : 266.493
 Kij = 0.0000 Time : 00:00:01 ...Press any key...

AAD = 14.8061 %
 COMPONENT 1: CARBON DIOXIDE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYI
14.6530	0.4568	0.0506	0.0258
15.9307	1.2122	0.1155	0.0528
18.0388	2.5090	0.2036	0.0714
21.6935	4.3711	0.3176	0.0850
28.2034	6.6350	0.4494	0.0731
38.7507	10.6547	0.5690	0.0596
50.8330	12.3795	0.6411	0.0241
56.6489	13.4424	0.6621	0.0022

F4 :Kij=0

P (atm)	XI	YI	
15.1098	0.0099	0.0764	1
17.1429	0.0243	0.1683	2
20.5477	0.0478	0.2750	3
26.0646	0.0878	0.4026	4
34.8384	0.1568	0.5225	5
49.4054	0.2631	0.6286	6
63.2124	0.3782	0.6652	7
70.0913	0.4320	0.6643	8
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by : PT T(K) : 368.160
 Kij = 0.0000 Time : 00:00:01

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AAD = 7.5513 %
 COMPONENT 1: CARBON DIOXIDE
 COMPONENT 2: N-BUTANE

Pcal	DP	Ylcal	DYI
23.1560	0.4512	0.0360	0.0146
24.4478	1.1332	0.0744	0.0272
27.1134	2.0107	0.1427	0.0401
30.7135	3.6511	0.2170	0.0491
37.3859	6.0289	0.3169	0.0517

F4 :Kij=0

P (atm)	XI	YI	
23.6072	0.0109	0.0506	1
25.5811	0.0236	0.1016	2
29.1241	0.0496	0.1828	3
34.3647	0.0844	0.2661	4
43.4148	0.1480	0.3686	5
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by : PT T(K) : 393.160
 Kij = 0.0000 Time : 00:00:01

...Press any key...

F4 :Kij=0

AAD = 23.6497 %
 COMPONENT 1: CARBON DIOXIDE
 COMPONENT 2: N-PENTANE

Pcal	DP	Y1cal	DY1
3.3907	0.6920	0.1482	0.1226
4.8491	1.4111	0.3918	0.1277
4.9615	1.5029	0.4048	0.1319
6.1743	2.4675	0.5151	0.1269
10.2983	4.2635	0.6974	0.0789
15.5293	6.6537	0.7900	0.0527
20.7142	9.0219	0.8356	0.0372
27.5839	11.2704	0.8690	0.0246
35.8010	13.1921	0.8916	0.0124
43.9105	14.2008	0.9048	0.0057
54.0160	14.2341	0.9146	0.0019
59.7132	14.1167	0.9179	0.0054
68.5930	13.1983	0.9205	0.0160
76.3354	12.1244	0.9202	0.0288

F4 :Kij=0

P (atm)	X1	Y1
4.0828	0.0072	0.2708
6.2602	0.0268	0.5195
6.4644	0.0283	0.5367
8.6418	0.0444	0.6420
14.5618	0.0979	0.7763
22.1830	0.1631	0.8427
29.7361	0.2249	0.8728
38.8543	0.3026	0.8936
48.9931	0.3897	0.9040
58.1113	0.4698	0.9105
68.2501	0.5623	0.9127
73.8299	0.6111	0.9125
81.7913	0.6830	0.9045
88.4598	0.7425	0.8914

by : PT
 Kij = 0.0000

T(K) : 344.160
 Time : 00:00:01

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AAD = 14.9874 %
 COMPONENT 1: CARBON DIOXIDE
 COMPONENT 2: N-PENTANE

Pcal	DP	Y1cal	DY1
13.2997	0.5172	0.0764	0.0371
15.8328	1.7246	0.1958	0.0725
20.3284	3.4861	0.3382	0.1006
27.4509	4.9399	0.4709	0.0934
34.3649	14.1128	0.5468	0.0782
45.4888	9.4236	0.6168	0.0642
61.0060	10.9210	0.6610	0.0298

F4 :Kij=0

P (atm)	X1	Y1
13.8169	0.0108	0.1135
17.5574	0.0323	0.2683
23.8145	0.0699	0.4388
32.3908	0.1281	0.5643
48.4777	0.1832	0.6250
54.9124	0.2695	0.6810
71.9270	0.3880	0.6908

by : PT
 Kij = 0.0000

T(K) : 408.160
 Time : 00:00:01

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APPENDIX C

The average binary interaction parameters, percent AAD and computing time of all systems for selected EOS using fugacity and bubble point pressure methods



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The average binary interaction parameters, percent AAD and computation time of all systems for selected equations of state using fugacity and bubblepoint pressure criteria

SYSTEM	Range of T (K)	N		SRK EOS		PR EOS		PT EOS		MSRK EOS		MPR EOS	
				FUGA	BBP	FUGA	BBP	FUGA	BBP	FUGA	BBP	FUGA	BBP
Methane – Ethane	130.370–280.000	100	Kij	0.0028	-0.0028	0.0042	-0.0028	0	-0.0056	-0.0014	-0.0014	0.0056	0.0014
			AAAD (%)	2.1825	1.9778	2.0947	2.048	2.6435	1.8602	1.7584	2.1919	1.6088	1.9334
			t (m:s)	00:25	02:58	00:28	3:23	0:35	02:28	0:24	02:59	0:28	03:20
Methane – Propane	144.260–213.710	62	Kij	0.0125	0.0094	0.0167	0.0177	0.0083	0.0073	0.0135	0.0104	0.0208	0.0208
			AAAD (%)	2.4091	2.1052	2.3685	1.9352	2.1122	2.0286	2.7411	2.4495	1.4973	1.4973
			t (m:s)	0:16	1:49	00:18	02:00	00:22	02:30	00:16	01:46	00:18	02:01
Methane – n-Butane	166.493–283.160	76	Kij	0.0146	0.0115	0.0229	0.0188	0.0104	0.0063	0.0104	0.0083	0.025	0.0229
			AAAD (%)	3.7481	3.4016	3.5217	3.1406	3.7546	3.2543	5.0777	4.909	3.116	2.8964
			t (m:s)	00:21	02:25	00:23	02:44	00:29	03:23	00:20	02:22	00:23	02:41
Methane – Isobutane	310.938–344.271	31	Kij	0.0333	0.0319	0.0444	0.0306	0.025	0.0194	-0.0236	-0.0264	0.0389	0.0385
			AAAD (%)	1.798	1.7253	2.1904	1.4244	1.7976	1.4967	1.1174	1.1004	1.8719	1.8708
			t (m:s)	00:12	01:28	00:14	01:44	00:18	02:07	00:12	01:27	00:13	01:36
Methane – n-Pentane	176.221–377.604	56	Kij	0.0111	0.0181	0.0292	0.0264	0.0056	0.0083	0.0028	0.0111	0.0222	0.0292
			AAAD (%)	7.2292	6.6065	6.0848	6.2389	6.5261	6.389	8.705	8.1923	6.9431	5.9402
			t (m:s)	00:16	01:55	00:17	02:13	00:24	02:50	00:17	01:58	00:16	02:09
Methane – Isopentane	344.271–377.604	15	Kij	0.0236	0.0292	0.0319	0.0319	0.0083	0.0083	-0.0722	-0.0653	0.025	0.0319
			AAAD (%)	1.788	1.5464	2.0025	2.0025	2.256	2.256	2.3453	2.0441	1.8933	1.3642
			t (m:s)	00:07	00:51	00:09	01:02	00:11	01:15	00:08	00:49	00:09	00:56
Methane – Neopentane	344.271–377.604	14	Kij	0.0514	0.0417	0.0611	0.0417	0.0417	0.0222	-0.0292	-0.0458	0.0375	0.0319
			AAAD (%)	2.363	2.1195	3.221	2.4829	3.0297	2.5088	2.3922	1.9049	1.9094	1.9855
			t (m:s)	00:07	00:51	00:09	01:01	00:11	01:14	00:08	00:49	00:09	00:56
Methane – n-Hexane	190.510–273.170	64	Kij	0.0451	0.0458	0.0528	0.0521	0.0306	0.0299	0.0389	0.0389	0.0514	0.0514
			AAAD (%)	2.2547	2.2406	2.4624	2.4306	2.807	2.826	3.7865	3.7865	2.9213	2.9213
			t (m:s)	00:12	01:27	00:13	01:35	00:18	01:59	00:12	01:24	00:14	01:38
Ethane – Propane	195.000–270.000	123	Kij	0.0052	0.0000	0.0042	-0.0021	0.0042	-0.0010	0.0052	0.0000	0.0063	0.0021
			AAAD (%)	3.0091	2.5195	2.6506	1.7434	2.7126	2.0625	2.6198	1.9511	2.1908	1.6846
			t (m:s)	00:25	03:01	00:31	03:40	00:21	02:41	00:30	03:30	00:31	03:40
Ethane – n-Butane	338.716–366.493	10	Kij	0.0417	0.0326	0.0403	0.0306	0.0368	0.0292	0.0278	0.0243	0.0382	0.0306
			AAAD (%)	1.7269	1.4564	4.8204	1.3646	1.6275	1.3836	1.2412	1.2236	1.594	1.2610
			t (m:s)	00:05	00:35	00:07	00:50	00:09	01:01	00:04	00:30	00:06	00:45
Ethane – Isobutane	311.271–344.493	14	Kij	0.0115	-0.0156	0.0125	-0.0115	0.0094	-0.0146	0.0042	-0.0156	0.0135	-0.0083
			AAAD (%)	4.0485	1.2064	3.8717	1.1578	3.672	1.1504	3.302	1.0343	3.5701	1.1965
			t (m:s)	00:07	00:51	00:09	01:01	00:11	01:14	00:08	00:49	00:09	00:56
Propane – Propylene	230.000–340.000	108	Kij	0.0094	0.0115	0.0094	0.0104	0.0104	0.0125	0.0104	0.0104		
			AAAD (%)	1.3371	1.3569	0.6735	0.6497	0.8682	0.8386	0.585	0.585		
			t (m:s)	00:27	03:00	00:30	03:25	00:38	02:31	00:26	03:01		
Propane – Isopentane	273.160–423.160	50	Kij	0.0031	0.0208	0.0042	-0.0042	0.0031	0.0073	0.0042	0.0000	0.0052	-0.0094
			AAAD (%)	3.4264	3.719	3.1214	4.6452	3.1666	2.6284	3.4486	3.7062	3.2235	6.0162
			t (m:s)	00:13	01:52	00:15	02:00	00:21	02:45	00:14	01:55	00:14	02:06

(Continued)

SYSTEM	Range of T (K)	N		SRK EOS		PR EOS		PT EOS		MSRK EOS		MPR EOS	
				FUGA	BBP	FUGA	BBP	FUGA	BBP	FUGA	BBP	FUGA	BBP
Nitrogen - Methane	113.716-172.049	54	Kij	0.0306	0.0306	0.0347	0.0306	0.0333	0.0694	0.0306	0.0292	0.0514	0.1181
			AAD(%)	0.9053	0.9053	0.9214	0.8059	0.7901	6.6883	1.3909	0.8204	0.6941	13.8478
			t (m:s)	00:15	01:54	00:16	02:12	00:23	02:49	00:16	01:57	00:15	02:08
Nitrogen - Ethane	138.716-280.000	54	Kij	0.0437	0.0417	0.0583	0.0542	0.0479	0.0479	0.0354	0.0375	0.0792	0.0771
			AAD(%)	3.2333	3.354	3.4963	3.6035	3.1901	3.1901	8.0019	7.8672	3.7808	3.8315
			t (m:s)	00:16	01:55	00:17	02:13	00:24	02:50	00:17	01:56	00:16	02:09
Nitrogen - Carbon dioxide	220.000-270.000	40	Kij	-0.0215	-0.0267	-0.0024	-0.0111	-0.0333	-0.0285	-0.1153	-0.0962	0.0514	0.0479
			AAD(%)	2.2007	2.2728	2.8103	2.6305	2.2204	2.2478	5.3097	5.1303	3.6122	3.6929
			t (m:s)	00:08	01:40	00:10	01:55	00:17	02:40	00:11	01:50	00:09	02:01
Carbon dioxide - Methane	219.260-270.000	43	Kij	0.1056	0.0986	0.1056	0.0986	0.1	0.0958	0.0958	0.0889	0.1181	0.1069
			AAD(%)	2.37	1.7179	4.3576	2.1644	2.9962	1.8639	2.8174	2.3729	3.9571	3.1708
			t (m:s)	00:10	01:42	00:12	01:57	00:19	02:42	00:13	01:53	00:12	02:04
Carbon dioxide - Ethane	250.000	13	Kij	0.1292	0.1347	0.125	0.1319	0.1306	0.1375	0.1319	0.1403	0.1236	0.1319
			AAD(%)	0.9351	0.4264	1.1774	0.4237	1.0997	0.4218	1.337	0.4893	1.5256	0.6448
			t (m:s)	00:06	00:50	00:08	01:00	00:10	01:13	00:07	00:48	00:08	00:55
Carbon dioxide - Propane	244.271-266.493	21	Kij	0.1319	0.1347	0.1264	0.1292	0.1306	0.1333	0.125	0.1361	0.125	0.1292
			AAD(%)	1.9771	2.0059	1.816	1.8643	1.8111	1.8022	2.1313	1.8871	2.1313	2.1004
			t (m:s)	00:12	00:56	00:14	01:07	00:16	01:20	00:13	00:54	00:14	00:61
Carbon dioxide - n-Butane	368.160-393.160	13	Kij	0.1917	0.1653	0.175	0.1500	0.1806	0.1569	0.1833	0.1611	0.1764	0.1542
			AAD(%)	2.3485	0.7164	2.2359	0.5666	2.1302	0.5645	1.6878	0.6284	1.9221	0.6088
			t (m:s)	00:06	00:50	00:08	01:00	00:10	01:13	00:07	00:48	00:08	00:55
Carbon dioxide - i-Butane	310.938-344.271	14	Kij	0.1417	0.1347	0.1306	0.1250	0.1333	0.1500	0.1389	0.1347	0.1306	0.1292
			AAD(%)	1.9446	1.832	1.712	0.674	1.7459	3.5407	1.8024	1.8031	1.9507	1.9522
			t (m:s)	00:07	00:51	00:09	01:01	00:11	01:14	00:08	00:49	00:09	00:56
Carbon dioxide - n-Pentane	277.660-438.160	54	Kij	0.1583	0.1403	0.1486	0.1319	0.1486	0.1319	0.1528	0.1389	0.15	0.1319
			AAD(%)	5.1257	3.9798	5.2274	3.7125	5.1432	3.7183	4.727	3.6789	5.3676	3.7061
			t (m:s)	00:17	01:56	00:18	02:14	00:25	02:51	00:18	01:57	00:17	02:10
Carbon dioxide - i-Pentane	408.160	9	Kij	0.2236	0.1694	0.1986	0.1500	0.2014	0.1528	0.2083	0.1542	0.2014	0.1528
			AAD(%)	5.1059	1.2176	4.8516	1.2907	4.7978	1.4259	4.9727	1.7084	4.8375	1.3493
			t (m:s)	00:04	00:34	00:06	00:49	00:08	01:00	00:05	00:28	00:05	00:44
Carbon dioxide - n-Heptane	310.660-477.216	45	Kij	0.1167	0.1125	0.1097	0.1000	0.1014	0.0917	0.1111	0.1069		
			AAD(%)	2.5043	2.1455	3.7464	2.6949	3.9968	2.9486	3.3983	3.1278		
			t (m:s)	00:10	01:50	00:10	01:55	00:17	02:41	00:10	01:51		
Carbon dioxide - n-Decane	462.560-583.660	16	Kij	0.1472	0.1500	0.1194	0.1167	0.0778	0.0722	0.1111	0.1056		
			AAD(%)	3.6182	3.7719	3.1596	2.9978	2.8798	2.4923	1.9101	1.6407		
			t (m:s)	00:09	00:53	00:11	01:05	00:12	01:17	00:10	00:53		



VITA

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