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program movimiento_en_campo_gravitatorio_4;
{Movimientos de dos soles diferentes y planetas exteriores}
{tiempo aconsejable const t=2000 o menor}
uses
  Crt, Graph;
const
  t=2000;           {constantes generales}
  pi=3.141592653598793;
  g=6.67392E-11;
  mA=1.9891E+30;
  mB=1.9891E+30;
  e=0.7*150/5E+11;   {factor de escala}
var
  GraphDriver : integer; { The Graphics device driver }
  GraphMode   : integer; { The Graphics mode value }
  MaxX, MaxY  : word;     { The maximum resolution of the screen }
  ErrorCode   : integer; { Reports any graphics errors }
  OldExitProc : Pointer;  { Saves exit procedure address }

  asa,asax,asay,rsa0,rsax0,rsay0,vsax0,vsay0,physa0,psisa:real; {sol A}
  asb,asbx,asby,rsb0,rsbx0,rsby0,vsbx0,vsby0,physb0,psisb:real; {sol B}

  a,aa,ab,ax,ay,rpa0,rpax0,rpax0,rpax0,rpax0,rpax0,rpax0,rpax0,rpax0,rpax0,
  si:real;{planeta1}

  a2,a2a,a2b,a2x,a2y,r2pa0,r2pax0,r2pay0,r2pb0,r2pbx0,r2pby0,r20,r2x0,r2y0,
  v2x0,v2y0,phy20,psi2:real; {planeta2}

  a3,a3a,a3b,a3x,a3y,r3pa0,r3pax0,r3pay0,r3pb0,r3pbx0,r3pby0,r30,r3x0,r3y0,
  v3x0,v3y0,phy30,psi3:real; {planeta3}

  a4,a4a,a4b,a4x,a4y,r4pa0,r4pax0,r4pay0,r4pb0,r4pbx0,r4pby0,r40,r4x0,r4y0,
  v4x0,v4y0,phy40,psi4:real; {planeta4}

  rab:real;

{$F+}
procedure MyExitProc;
begin
  ExitProc := OldExitProc; { Restore exit procedure address }
  CloseGraph;              { Shut down the graphics system }
end; { MyExitProc }
{$F-}

procedure Inicia_modos_grafico;
{ Inicializa el modo grafico e informa de los errores que puedan ocurrir}
var
  InGraphicsMode : boolean; { Flags initialization of graphics mode }
  PathToDriver   : string;   { Stores the DOS path to *.BGI & *.CHR }
begin
  { when using Crt and graphics, turn off Crt's memory-mapped writes }
  DirectVideo := False;
  OldExitProc := ExitProc;           { save previous exit proc }
  ExitProc := @MyExitProc;          { insert our exit proc in chain }
  PathToDriver := '';

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repeat

{$IFDEF Use8514}                                { check for Use8514 $DEFINE }
    GraphDriver := IBM8514;
    GraphMode := IBM8514Hi;
{$ELSE}
    GraphDriver := Detect;                        { use autodetection }
{$ENDIF}

    InitGraph(GraphDriver, GraphMode, PathToDriver);
    ErrorCode := GraphResult;                    { preserve error return }
    if ErrorCode <> grOK then                     { error? }
    begin
        Writeln('Graphics error: ', GraphErrorMsg(ErrorCode));
        if ErrorCode = grFileNotFound then { Can't find driver file }
        begin
            Writeln('Enter full path to BGI driver or type <Ctrl-Break> to
quit:');
            Readln(PathToDriver);
            Writeln;
        end
        else
            Halt(1);                            { Some other error: terminate }
        end;
    until ErrorCode = grOK;
    MaxX := GetMaxX;                            { Get screen resolution values }
    MaxY := GetMaxY;
end; { Initialize }

procedure dibuja_los_ejes;
begin
    { ejes }
    SetLineStyle(DottedLn,0,NormWidth);
    SetColor(4);
    Line(MaxX div 2,MaxY div 2 +230,MaxX div 2,MaxY div 2 -230);{
vertical }
    Line(MaxX div 2 -310,MaxY div 2,MaxX div 2 +310,MaxY div 2);{
horizontal }
    { sol
    SetLineStyle(SolidLn,0,NormWidth);setColor(14);
    Line(MaxX div 2,MaxY div 2 +6,MaxX div 2,MaxY div 2 -6);
    Line(MaxX div 2 -4,MaxY div 2,MaxX div 2 +4,MaxY div 2);
    PutPixel(MaxX div 2 +6, MaxY div 2, 15);
    PutPixel(MaxX div 2 -6, MaxY div 2, 15);
    PutPixel(MaxX div 2, MaxY div 2 +9, 15);
    PutPixel(MaxX div 2, MaxY div 2 -9, 15);
    PutPixel(MaxX div 2 +1, MaxY div 2 +1, 15);
    PutPixel(MaxX div 2 +1, MaxY div 2 -1, 15);
    PutPixel(MaxX div 2 -1, MaxY div 2 +1, 15);
    PutPixel(MaxX div 2 -1, MaxY div 2 -1, 15);
    PutPixel(MaxX div 2 +3, MaxY div 2 +3, 15);
    PutPixel(MaxX div 2 +3, MaxY div 2 -3, 15);
    PutPixel(MaxX div 2 -3, MaxY div 2 +3, 15);
    PutPixel(MaxX div 2 -3, MaxY div 2 -3, 15); }
end;

procedure presentacion;
begin

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SetTextStyle(TriplexFont,0,3);SetTextJustify(CenterText,CenterText);
SetColor(15);OutTextXY(320,70,'GRAVITY.EXE');
SetColor(15);
OutTextXY(540,410,'Pulsa Enter');
Readln;ClearViewPort;
end;
procedure DatosIniciales;
begin
    rab:=1.556E+12;rsay0:=0;rsby0:=0;{2*d(Sol,Jupiter)}
    if ma=mb then
        begin
            rsax0:=-7.78E+11; {sol A}{-d(Sol,Jupiter)}
            rsbx0:=7.78E+11; {sol B}{ d(Sol,Jupiter)}
        end
    else
        begin
            rsax0:=-7.78E+11;
            rsbx0:=rab+rsax0;
        end;
    vsax0:=0;vsay0:=-6500; {sol A}
    vsbx0:=0;vsby0:= 6500; {sol B}

    rx0:=rab+rsax0;;ry0:=1.49598E+11; {planeta1 azul}
    r0:=sqrt(rx0*rx0+ry0*ry0);
    vx0:=-28786;vy0:=vsby0;

    r2x0:=rab+rsax0;;r2y0:=2.35E+11; {planeta2 rojo}
    r20:=sqrt(r2x0*r2x0+r2y0*r2y0);
    v2x0:=-24131;v2y0:=vsby0;

    r3x0:=rsax0-1.08209E11;r3y0:=0; {planeta3 verde}
    r30:=sqrt(r3x0*r3x0+r3y0*r3y0);
    v3x0:=0;v3y0:=vsay0-35021;

    r4x0:=rsax0-5.7894E10;r4y0:=0; {planeta4 naranja}
    r40:=sqrt(r4x0*r4x0+r4y0*r4y0);
    v4x0:=0;v4y0:=vsay0-47872;
end;
procedure calcula_phy;
begin
    if (ry0>0)and(rx0>0)then phy0:=arctan(ry0/rx0);
{planeta1}
    if (ry0>0)and(rx0<0)then phy0:=arctan(ry0/rx0)+pi;
    if (ry0<0)and(rx0<0)then phy0:=arctan(ry0/rx0)+pi;
    if (ry0<0)and(rx0>0)then phy0:=arctan(ry0/rx0);

    if (r2y0>0)and(r2x0>0)then phy20:=arctan(r2y0/r2x0);
{planeta2}
    if (r2y0>0)and(r2x0<0)then phy20:=arctan(r2y0/r2x0)+pi;
    if (r2y0<0)and(r2x0<0)then phy20:=arctan(r2y0/r2x0)+pi;
    if (r2y0<0)and(r2x0>0)then phy20:=arctan(r2y0/r2x0);

    if (r3y0>0)and(r3x0>0)then phy30:=arctan(r3y0/r3x0);
{planeta3}
    if (r3y0>0)and(r3x0<0)then phy30:=arctan(r3y0/r3x0)+pi;
    if (r3y0<0)and(r3x0<0)then phy30:=arctan(r3y0/r3x0)+pi;
    if (r3y0<0)and(r3x0>0)then phy30:=arctan(r3y0/r3x0);

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        if (r4y0>0) and (r4x0>0) then phy40:=arctan(r4y0/r4x0);
{planeta4}
        if (r4y0>0) and (r4x0<0) then phy40:=arctan(r4y0/r4x0)+pi;
        if (r4y0<0) and (r4x0<0) then phy40:=arctan(r4y0/r4x0)+pi;
        if (r4y0<0) and (r4x0>0) then phy40:=arctan(r4y0/r4x0);

        if (rsay0>0) and (rsax0>0) then physa0:=arctan(rsay0/rsax0);
        if (rsay0>0) and (rsax0<0) then physa0:=arctan(rsay0/rsax0)+pi;
        if (rsay0<0) and (rsax0<0) then physa0:=arctan(rsay0/rsax0)+pi;
        if (rsay0<0) and (rsax0>0) then physa0:=arctan(rsay0/rsax0);

        physb0:=physa0+pi;
        if physb0>2*pi then physb0:=physb0-2*pi;
    end;
procedure calcula_psi;
var psia,psib,axa,aya,axb,ayb:real;
begin
    if ((ry0-rsay0)>0) and ((rx0-rsax0)>0) then psia:=arctan((ry0-
rsay0)/(rx0-rsax0))+pi;
    if ((ry0-rsay0)>0) and ((rx0-rsax0)<0) then psia:=arctan((ry0-
rsay0)/(rx0-rsax0));
    if ((ry0-rsay0)<0) and ((rx0-rsax0)<0) then psia:=arctan((ry0-
rsay0)/(rx0-rsax0));
    if ((ry0-rsay0)<0) and ((rx0-rsax0)>0) then psia:=arctan((ry0-
rsay0)/(rx0-rsax0))+pi;
    axa:=aa*cos(psia);aya:=aa*sin(psia);
    if ((ry0-rsby0)>0) and ((rx0-rsbx0)>0) then psib:=arctan((ry0-
rsby0)/(rx0-rsbx0))+pi;
    if ((ry0-rsby0)>0) and ((rx0-rsbx0)<0) then psib:=arctan((ry0-
rsby0)/(rx0-rsbx0));
    if ((ry0-rsby0)<0) and ((rx0-rsbx0)<0) then psib:=arctan((ry0-
rsby0)/(rx0-rsbx0));
    if ((ry0-rsby0)<0) and ((rx0-rsbx0)>0) then psib:=arctan((ry0-
rsby0)/(rx0-rsbx0))+pi;
    axb:=ab*cos(psib);ayb:=ab*sin(psib);
    ax:=axa+axb;ay:=aya+ayb;
end;
procedure calcula_psi2;
var psia,psib,axa,aya,axb,ayb:real;
begin
    if ((r2y0-rsay0)>0) and ((r2x0-rsax0)>0) then psia:=arctan((r2y0-
rsay0)/(r2x0-rsax0))+pi;
    if ((r2y0-rsay0)>0) and ((r2x0-rsax0)<0) then psia:=arctan((r2y0-
rsay0)/(r2x0-rsax0));
    if ((r2y0-rsay0)<0) and ((r2x0-rsax0)<0) then psia:=arctan((r2y0-
rsay0)/(r2x0-rsax0));
    if ((r2y0-rsay0)<0) and ((r2x0-rsax0)>0) then psia:=arctan((r2y0-
rsay0)/(r2x0-rsax0))+pi;
    axa:=a2a*cos(psia);aya:=a2a*sin(psia);
    if ((r2y0-rsby0)>0) and ((r2x0-rsbx0)>0) then psib:=arctan((r2y0-
rsby0)/(r2x0-rsbx0))+pi;
    if ((r2y0-rsby0)>0) and ((r2x0-rsbx0)<0) then psib:=arctan((r2y0-
rsby0)/(r2x0-rsbx0));
    if ((r2y0-rsby0)<0) and ((r2x0-rsbx0)<0) then psib:=arctan((r2y0-
rsby0)/(r2x0-rsbx0));
    if ((r2y0-rsby0)<0) and ((r2x0-rsbx0)>0) then psib:=arctan((r2y0-
rsby0)/(r2x0-rsbx0))+pi;
    axb:=a2b*cos(psib);ayb:=a2b*sin(psib);

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        a2x:=axa+axb;a2y:=aya+ayb;
    end;
procedure calcula_psi3;
var psia,psib,axa,aya,axb,ayb:real;
begin
    if ((r3y0-rsay0)>0)and((r3x0-rsax0)>0)then psia:=arctan((r3y0-
rsay0)/(r3x0-rsax0))+pi;
    if ((r3y0-rsay0)>0)and((r3x0-rsax0)<0)then psia:=arctan((r3y0-
rsay0)/(r3x0-rsax0));
    if ((r3y0-rsay0)<0)and((r3x0-rsax0)<0)then psia:=arctan((r3y0-
rsay0)/(r3x0-rsax0));
    if ((r3y0-rsay0)<0)and((r3x0-rsax0)>0)then psia:=arctan((r3y0-
rsay0)/(r3x0-rsax0))+pi;
    axa:=a3a*cos(psia);aya:=a3a*sin(psia);
    if ((r3y0-rsby0)>0)and((r3x0-rsbx0)>0)then psib:=arctan((r3y0-
rsby0)/(r3x0-rsbx0))+pi;
    if ((r3y0-rsby0)>0)and((r3x0-rsbx0)<0)then psib:=arctan((r3y0-
rsby0)/(r3x0-rsbx0));
    if ((r3y0-rsby0)<0)and((r3x0-rsbx0)<0)then psib:=arctan((r3y0-
rsby0)/(r3x0-rsbx0));
    if ((r3y0-rsby0)<0)and((r3x0-rsbx0)>0)then psib:=arctan((r3y0-
rsby0)/(r3x0-rsbx0))+pi;
    axb:=a3b*cos(psib);ayb:=a3b*sin(psib);
    a3x:=axa+axb;a3y:=aya+ayb;
end;

procedure calcula_psi4;
var psia,psib,axa,aya,axb,ayb:real;
begin
    if ((r4y0-rsay0)>0)and((r4x0-rsax0)>0)then psia:=arctan((r4y0-
rsay0)/(r4x0-rsax0))+pi;
    if ((r4y0-rsay0)>0)and((r4x0-rsax0)<0)then psia:=arctan((r4y0-
rsay0)/(r4x0-rsax0));
    if ((r4y0-rsay0)<0)and((r4x0-rsax0)<0)then psia:=arctan((r4y0-
rsay0)/(r4x0-rsax0));
    if ((r4y0-rsay0)<0)and((r4x0-rsax0)>0)then psia:=arctan((r4y0-
rsay0)/(r4x0-rsax0))+pi;
    axa:=a4a*cos(psia);aya:=a4a*sin(psia);
    if ((r4y0-rsby0)>0)and((r4x0-rsbx0)>0)then psib:=arctan((r4y0-
rsby0)/(r4x0-rsbx0))+pi;
    if ((r4y0-rsby0)>0)and((r4x0-rsbx0)<0)then psib:=arctan((r4y0-
rsby0)/(r4x0-rsbx0));
    if ((r4y0-rsby0)<0)and((r4x0-rsbx0)<0)then psib:=arctan((r4y0-
rsby0)/(r4x0-rsbx0));
    if ((r4y0-rsby0)<0)and((r4x0-rsbx0)>0)then psib:=arctan((r4y0-
rsby0)/(r4x0-rsbx0))+pi;
    axb:=a4b*cos(psib);ayb:=a4b*sin(psib);
    a4x:=axa+axb;a4y:=aya+ayb;
end;
procedure calculos;
begin
    calcula_phy;

    rpa0:=sqrt((rx0-rsax0)*(rx0-rsax0)+(ry0-rsay0)*(ry0-
rsay0));{planeta1}
    rpb0:=sqrt((rx0-rsbx0)*(rx0-rsbx0)+(ry0-rsby0)*(ry0-rsby0));
    aa:=g*ma/(rpa0*rpa0);ab:=g*mb/(rpb0*rpb0);
    calcula_psi;

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    rx0:=rx0+vx0*t+(ax*t*t)/2;ry0:=ry0+vy0*t+(ay*t*t)/2;
    PutPixel(MaxX div 2 +round(rx0*e*0.8), MaxY div 2 -round(ry0*e),
9);
    vx0:=vx0+ax*t;vy0:=vy0+ay*t;

    r2pa0:=sqrt((r2x0-rsax0)*(r2x0-rsax0)+(r2y0-rsay0)*(r2y0-rsay0));
    r2pb0:=sqrt((r2x0-rsbx0)*(r2x0-rsbx0)+(r2y0-rsby0)*(r2y0-rsby0));
    a2a:=g*ma/(r2pa0*r2pa0);a2b:=g*mb/(r2pb0*r2pb0);
    calcula_psi2;
    r2x0:=r2x0+v2x0*t+(a2x*t*t)/2;r2y0:=r2y0+v2y0*t+(a2y*t*t)/2;
    PutPixel(MaxX div 2 +round(r2x0*e*0.8), MaxY div 2 -
round(r2y0*e), 12);
    v2x0:=v2x0+a2x*t;v2y0:=v2y0+a2y*t;

    r3pa0:=sqrt((r3x0-rsax0)*(r3x0-rsax0)+(r3y0-rsay0)*(r3y0-rsay0));
    r3pb0:=sqrt((r3x0-rsbx0)*(r3x0-rsbx0)+(r3y0-rsby0)*(r3y0-rsby0));
    a3a:=g*ma/(r3pa0*r3pa0);a3b:=g*mb/(r3pb0*r3pb0);
    calcula_psi3;
    r3x0:=r3x0+v3x0*t+(a3x*t*t)/2;r3y0:=r3y0+v3y0*t+(a3y*t*t)/2;
    PutPixel(MaxX div 2 +round(r3x0*e*0.8), MaxY div 2 -
round(r3y0*e), 2);
    v3x0:=v3x0+a3x*t;v3y0:=v3y0+a3y*t;

    r4pa0:=sqrt((r4x0-rsax0)*(r4x0-rsax0)+(r4y0-rsay0)*(r4y0-rsay0));
    r4pb0:=sqrt((r4x0-rsbx0)*(r4x0-rsbx0)+(r4y0-rsby0)*(r4y0-rsby0));
    a4a:=g*ma/(r4pa0*r4pa0);a4b:=g*mb/(r4pb0*r4pb0);
    calcula_psi4;
    r4x0:=r4x0+v4x0*t+(a4x*t*t)/2;r4y0:=r4y0+v4y0*t+(a4y*t*t)/2;
    PutPixel(MaxX div 2 +round(r4x0*e*0.8), MaxY div 2 -
round(r4y0*e), 6);
    v4x0:=v4x0+a4x*t;v4y0:=v4y0+a4y*t;

    rsa0:=sqrt(rsax0*rsax0+rsay0*rsay0);
    asa:=g*mb/(rab*rab);psisa:=physb0;

    asax:=asa*cos(psisa);asay:=asa*sin(psisa);

    rsax0:=rsax0+vsax0*t+(asax*t*t)/2;rsay0:=rsay0+vsay0*t+(asay*t*t)/2;
    PutPixel(MaxX div 2 +round(rsax0*e*0.8), MaxY div 2 -
round(rsay0*e), 13);
    vsax0:=vsax0+asax*t;vsay0:=vsay0+asay*t;

    rsb0:=sqrt(rsbx0*rsbx0+rsby0*rsby0);
    asb:=g*ma/(rab*rab);psisb:=physa0;

    asbx:=asb*cos(psisb);asby:=asb*sin(psisb);

    rsbx0:=rsbx0+vsbx0*t+(asbx*t*t)/2;rsby0:=rsby0+vsby0*t+(asby*t*t)/2;
    PutPixel(MaxX div 2 +round(rsbx0*e*0.8), MaxY div 2 -
round(rsby0*e), 14);
    vsbx0:=vsbx0+asbx*t;vsby0:=vsby0+asby*t;

    end;
begin
    Inicia_modo_grafico;Presentacion;DatosIniciales;
    dibuja_los_ejes;
    DatosIniciales;
    repeat calculos until keypressed;

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end.