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exercice1.m

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function [res]=exercice1()

clc;
clf;
hold off;

res=question1(3/10.0,10);           %OK

res=question2(1/10.0,10);           %OK
res=question2(3/100.0,10);          %OK

res=question3(1/10.0,1e-14);        %OK
res=question3(3/100.0,1e-14);       %OK

limit=question4(1e-14);             %OK
nbPoints = 100;
res = question5(1e-3,limit,nbPoints); %OK

IterMax= 50;
res = question6(1e-14,IterMax);      %OK
res = question7(1e-8,IterMax);       %OK

end

%%%%%%%%%%%%% QUESTION 1 %%%%%%
function [res]= question1(v0,n)
%Ici On traite graphiquement la question 2
u0 =1;
u=[u0];
v=[v0];
textu=['u' num2str(0)];
textv=['v' num2str(0)];

for i=1:n
    [u1,v1] = suite(u0,v0);
    u0=u1;v0=v1;
    u=[u;u1];
    v=[v;v1];
    textu=[textu; ['u' num2str(i)']];
    textv=[textv; ['v' num2str(i)']];
end

figure( 1 );
hold off;
%u=log(u);v=log(v);
plot(u,u,'b.');
plot(v,v,'r.');
hold on;
text(u,u,textu,'verticalalignment', 'bottom', 'horizontalalignment', 'right');
text(v,v,textv,'verticalalignment', 'bottom', 'horizontalalignment', 'right');
res=0;
end
%%-----
-----
function [u1,v1]= suite(u0,v0)
    u1 = (u0+v0)/2;
    v1 = sqrt(u0 * v0);

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end
%%%%%% QUESTION 2 %%%%%%
%%%%%%

function [res]= question2(v0,n)
fprintf('%s\n','-----')
fprintf('Cas ou v0 = %10.9f \n',v0);
fprintf('%s\n','-----')
printf('%s\n',' n | un | vn | un-vn |');
printf('%s\n','-----|-----|-----|-----|');
format = '%3d%16.14f%16.14f%10.4e\n';
u0=1.0;
u=[u0];
v=[v0];

for i=1:n
[u1,v1] = suite(u0,v0);
u0=u1;v0=v1;
u=[u;u1];
v=[v;v1];
end

I = (0:n)';

fprintf(1,format,[I,u,v,u-v]');
fprintf(1,'%s\n','-----');
res=0;

end
%%%%%% QUESTION 3 %%%%%%
%%%%%%

function [res]= question3(v0,epsilon)
[L,m,u,v]=traqueLimite(v0,epsilon);
fprintf(1,'L=%1.32e \n m=%d\n',L,m);
res=traqueOrdre(L,m,u,v);
end
%%

function [L,m,u,v]=traqueLimite(v0,epsilon)
u0=1.0;
u=[u0];
v=[v0];
doitContinuer = abs(u0-v0) > epsilon;

while (doitContinuer)
[u1,v1] = suite(u0,v0);
u0=u1;v0=v1;
u=[u;u1];
v=[v;v1];
doitContinuer = abs(u1-v1) > epsilon;
end
L=(u(end) + v(end))/2.;
m = length(u); % pas n@cessaire de se poser la question m+1 ou m ou m-1?
end
%%

function [res]=traqueOrdre(L,m,u,v)

format = '%f\t%f\t%f\t%f\n';

uL=abs(u-L); uL(end)=[];
vL=abs(v-L); vL(end)=[];

eun = uL(2:end,1)./uL(1:end-1,1);

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eu2n = uL(2:end,1)./(uL(1:end-1,1).^2);
evn = vL(2:end,1)./vL(1:end-1,1);
ev2n = vL(2:end,1)./(vL(1:end-1,1).^2);

Ind = (1:length(uL)-1)';
legd= ['eun'; 'eu2n'; 'evn'; 'ev2n'];

figure(3);
title('Courbe des erreurs');
plot(Ind,[eun,eu2n,evn,ev2n],'-*');
legend(legd)

fprintf(1,format,[eun,eu2n,evn,ev2n]');

res=0;

%[uL(2:end,1)./uL(1:end-1,1),uL(2:end,1)./(uL(1:end-1,1).^2), ...
%vL(2:end,1)./vL(1:end-1,1),vL(2:end,1)./(vL(1:end-1,1).^2)]';%pour debug
%uL; % pour debug

end
%%%%%%%
function [limit]= question4(epsilon)
limit = @(v) traqueLimite(v,epsilon);
end

%%%%%%
function [res]= question5(bord,limit,nbPoints)
x=linspace(bord,1-bord,nbPoints);
y=[];
for i=1:length(x)
y=[y; limit(x(i))];
end
figure(5);
z=3./4 *ones(length(x),1);
plot(x,y,'-*',x,z);
res=0;
end
%%%%%
function [res]= question6(epsilon,IterMax)
f= inline('x*x-2','x');
[x,n]= dicho(f,0,2,epsilon,IterMax);
fprintf(1,'racine de x*x=2 sur [0,2] est x = %1.10e par dicho avec n = %3d itÃ©rations \n',x,n);
res=0;
end
%%-----
```

```

function [x,niter]= dicho(f,a,b,epsilon,Nmax)

a1 = a;
b1 = b;

fa1 = f(a1);
fb1 = f(b1);

if ( fa1 * fb1 > 0 )
error('condition nonremplie');
end
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niter = 0;

doitContinuer = (abs(a1-b1) > 2*epsilon) & (niter < Nmax);

while (doitContinuer)

    c = (a1+b1)/2;
    fc = f(c);

    if(fc * fal > 0)
        a1=c; fal = fc;
    end

    if(fc * fbl > 0);
        b1 = c; fbl = fc;
    end

    niter = niter + 1;

    doitContinuer = (abs(a1-b1) > 2*epsilon) & (niter < Nmax);

end
x = c;
end
%%%%%%%
function [res]= question7(epsilon,IterMax)

limite = question4(epsilon);

f = @(v) (limite(v) -3/4.0);

a0=3/100.;

% traquer le domaine de rÃ©solution en se dÃ©plaÃ§ant de a0 dans les deux directions
hIncrement = 0.1;
[a0,b0]= recherIntervalleCompatible(a0, f, hIncrement);

% rÃ©solution
[x,n]= dichotomie(f,a0,b0,epsilon,IterMax);

% Postprocessing

fprintf(1, 'racine de L(v)=3/4 sur [%f,%f] est v0 = %1.10f avec n = %3d itÃ©rations de dichotomie ',a0,b0,x, n);

figure(5); % on dessine sur la figure de l'exercice 5
hold on;

xc=[x,x];
yc=[0,3/4.0];
plot(xc,yc,'m-o');

text(x,3/8,'x=v0','horizontalalignment','left');
text(0.2,3/4,'y=3/4','verticalalignment','bottom');

res=x;
end

%%-----
function [a0,b0]= recherIntervalleCompatible(a0, f, h)
bleft = a0;

bright = a0;

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fa0 = f(a0);

while((fa0 *f(bleft) >0) && ( (fa0 * f(bright)) >0) )
    bleft = bleft -h;
    bright = bright + h;
end

if(fa0 * f(bleft) <= 0)
    b0 = bleft;
end

end
```