MATLAB

PROGRAMMING

Prepared by

Masrul huda (parvez)

EQUATION SOLUATION

Solve the equation:

$$x^3 + 2x^2 + lnx + 6x - 32 = 0$$

$$f(x) = x^3 + 2x^2 + lnx + 6x - 32$$

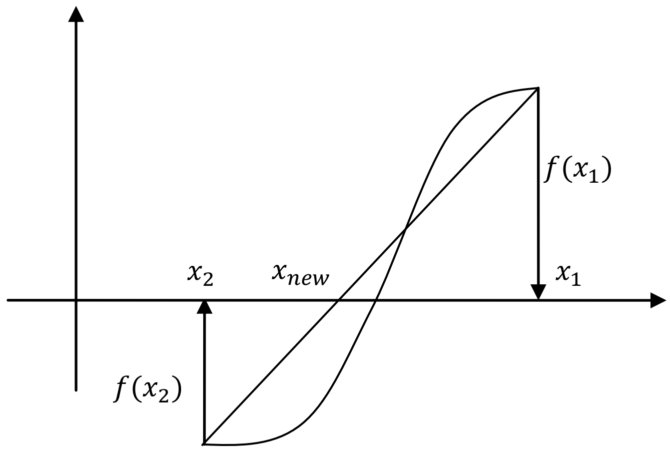
```
Function [z]= func(x)
z=x.^3+2*x.^2+log(x)+6*x-32
end
```

Bisection method

```
function [root,nitteration]=bisec(x1,x2)
fx1=func(x1);
fx2=func(x2);
i=0;
if (fx1*fx2)>0
    error('reassign arguments according to bisection method')
end

    while  i>=0
        i=i+1;
        fx1=func(x1);
        fx2=func(x2);
        xnew=(x1+x2)/2;
        fxnew=func(xnew);
      if (fx1*fxnew)>0
        x1=xnew;
      else
        x2=xnew;
      end
        if abs(x1-x2)<0.001
          break
        end
    end
    root=xnew;
    nitteration=i;
end
```

Regula falsi method



$$\frac{-f(x_2)}{x_{new}-x_2}=\frac{f(x_1)}{x_1-x_{new}}=\frac{f(x_1)-f(x_2)}{x_1-x_2}$$

$$x_1 - x_{new} = \frac{f(x_1)(x_1 - x_2)}{f(x_1) - f(x_2)}$$

$$x_{new} = x_1 - \frac{f(x_1)(x_1 - x_2)}{f(x_1) - f(x_2)}$$

```
function[root nitteration]=rf(x1,x2)
fx1=func(x1);
fx2=func(x2);
i=0;
if fx1*fx2>0
    error('reassign arguments according to regulafalsi method')
end

while i>=0
    i=i+1;
    fx1=func(x1);
    fx2=func(x2);
    xnew=(x1-(fx1*(x1-x2))/(fx1-fx2));
    fxnew=func(xnew);
      if fx1*fxnew>0
        x1=xnew;
      else
        x2=xnew;
      end
       if abs(x1-x2)<0.001
        break
       end
 end
 root=xnew;
 nitteration=i;
end
```

Fixed point method

For this method we have to create a equation, which will find value of x

$$x^3 + 2x^2 + lnx + 6x - 32 = 0;$$

$$or, 6x = 32 - x^3 - 2x^2 - lnx$$

$$or, x = \frac{1}{6}(32 - x^3 - 2x^2 - lnx)$$

Then we have to create a function to find x

```
function [z]=xcalc(x)
Z=(1/6)*(32-x.^3-2*x.^2-log(x);
end



function [root nitteration]=fp(x)

i=0;

while i>=0
    i=i+1;
    xold=x;
    xnew=xcalc(x);
    x=xnew;
 if abs(xold-xnew)<0.001
    break
 end
end

root=x;
nitteration=i;
end
```

Newton raphson method

For this method we have find out differential of given function

$$f(x) = x^3 + 2x^2 + lnx + 6x - 32$$

$$\frac{d}{dx}f(x) = 3x^2 + 4x + \frac{1}{x} + 6$$

```
function [z]= dfunc(x)
z=3*x.^2+4*x+(1/x)+6;
end
```

```
function[root nitteration]=nr(x)
i=0;
while i>=0
    i=i+1;
    xold=x;
    fx=func(x);
    dfx=dfunc(x);
    xnew=x-(fx/dfx);
    x=xnew;
if abs(xold-xnew)<0.001
break
end
root=x;
nitteration=i;
end
```

Secant method

```
function[root nitteration]=sec(x1,x2)
i=0;

while i>=0
    i=i+1;
    fx1=func(x1);
    fx2=func(x2);
    dfx=(fx1-fx2)/(x1-x2);
    x3=x2-(fx2/dfx);
    x1=x2;
    x2=x3;
        if  abs(x1-x2)<0.001
             break
        end
end
root=x3;
nitteration=i;
end
```

Grading

```
[A,B]=xlsread('Che310','sheet1','A3:C11');
marks=A(:,3);
marks=round((marks/300)*100);
a=length(marks);

for i=1:a
    if marks(i,1) >=80
       GRADE(i,1)={'A+'};
        GPA(i,1)=4;

    elseif marks(i,1) >=75
     GPA(i,1)=3.75;
     GRADE(i,1)={'A'};

    elseif marks(i,1) >=70
     GPA(i,1)=3.5;
     GRADE(i,1)={'A-'};

    elseif marks(i,1) >=65
     GPA(i,1)=3.25;
     GRADE(i,1)={'B+'};

    elseif marks(i,1) >=60
     GPA(i,1)=3;
     GRADE(i,1)={'B'};

    elseif marks(i,1) >=55
     GPA(i,1)=2.75;
     GRADE(i,1)={'B-'};

    elseif marks (i,1)>=50
    GPA(i,1)=2.50;
    GRADE(i,1)={'C+'};

    elseif marks(i,1) >=45
     GPA(i,1)=2.25;
     GRADE(i,1)={'C'};

    elseif marks(i,1)>=40
     GPA(i,1)=2;
```

```
     GRADE(i,1)={'D'};

    else
     GPA(i,1)=0;
     GRADE(i,1)={'F'};
    end
end

xlswrite('che310',GPA,'sheet1','D4:D11')
xlswrite('che310',GRADE,'sheet1','E4:E11')
xlswrite('che310',{'GPA'},'sheet1','D3')
xlswrite('che310',{'GRADE'},'sheet1','E3')
```

Ordinary differential equation solve

$$\frac{dy}{dx} = x - 2y$$

$When\ x = 0, y = 1\ ;$

$y(1) = ?$

```
function [z]=dfx(x,y)
z=x-2*y;
end
```

Euler method

```
function[u]=elr(xf,x0,y0,h)
x=x0:h:xf;
n=length(x);
for i=1:n-1
   ynew=y0+dfx(x0,y0)*h;
   y0=ynew;
   x0=x0+h;
end
u= ynew;

end
```

Modified euler method

```
function[u]=meu(xf,x0,y0,h)
x=x0:h:xf;
n=length(x);
for i=1:n-1
    dfx1=dfx(x0,y0);
    ynew=y0+dfx1*h;
    xnew=x0+h;
    dfx2=dfx(xnew,ynew);
    dfxac=(dfx1+dfx2)/2;
    yac=y0+dfxac*h;
    y0=yac;
    x0=xnew;
end

u=yac;

end
```

runge katta method

```
function[u]=rkm(xf,x0,y0,h)
x=x0:h:xf;
n=length(x);
for i=1:n-1
   k1=dfx(x0,y0);
   k2=dfx(x0+0.5*h,y0+.5*k1*h);
   k3=dfx(x0+0.5*h,y0+.5*k2*h);
   k4=dfx(x0+h,y0+k3*h);
   y=y0+(1/6)*(k1+2*k2+2*k3+k4)*h;
   y0=y;
   x0=x0+h;
end
u=y;
end
```

Numerical intregration

$$\int_{.2}^{.9} \mathbf{10(\mathit{sin}\,\mathit{x} + \mathit{e}^{\mathit{x}})} = ?$$

```
function[z]=fx(x)
z=10*(sin(x)+exp(x));
end
```

Trapezoidal rule

Formula for trapezoidal method

$$\int_{x_0}^{x_n} f(x) = \frac{h}{2}\left[f(x_0) + 2\sum_{i=1}^{n-1} f(x_i) + f(x_n)\right]$$

```
function[intregration]= trapi(x0,xn,n)
h=(xn-x0)/n;
x=(x0+h):h:xn;
a=0;
for i=1:(n-1)
    a=a+2*fx(x(i));
end
intregration=(.5*h)*(fx(x0)+a+fx(xn));
```

Simpson 1/3

Formula for simpson one third method

$$\int_{x_0}^{x_n} f(x) = \frac{h}{3}\left[f(x_0) + 4\sum_{i=1,3,5.....}^{n-1} f(x_i) + 2\sum_{i=2,4,6.....}^{n-2} f(x_i) + f(x_n)\right]$$

$$Wher\ ,\ n = even$$

```
function[intregration ]= simone(x0,xn,n)
check=n/2;
if fix(check)~=check
    error('divison number must be multiple of 2')
end
  h=(xn-x0)/n;
  x=(x0+h):h:xn;
  a=0;
for i=1:2:(n-1)
    a=a+4*fx(x(i));
end

for i=2:2:(n-2)
    a=a+2*fx(x(i));
end

intregration=(h/3)*(fx(x0)+a+fx(xn));
```

Simpson 3/8

Formula for simpson three − eight method

$$\int_{x_0}^{x_n} f(x) = \frac{3h}{8}\left[f(x_0) + 3\sum_{i=1,2,4,5,7,8,\ldots}^{n-1} f(x_i) + 2\sum_{i=3,6,9\ldots\ldots}^{n-3} f(x_i) + f(x_n)\right]$$

$$Wher\ ,\ n = multiple\ of\ 3$$

```
function[intregration ]= simthree(x0,xn,n)
check=n/3;

if fix(check)~=check
    error('divison number must be multiple of 3')
end

  h=(xn-x0)/n;
  x=(x0+h):h:xn;
  a=0;

for i=1:3:(n-1)
    a=a+3*fx(x(i));
end

for i=2:3:(n-1)
    a=a+3*fx(x(i));
end

for i=3:3:(n-3)
    a=a+2*fx(x(i));
end
intregration=((3*h)/8)*(fx(x0)+a+fx(xn));
```

Weddle method

Formula for weddle method

$$\int_{x_0}^{x_n} f(x) = \frac{3h}{10}\left[f(x_0) + 5\sum_{i=1,7,13..}^{n-5} f(x_i) + \sum_{i=2,8,14}^{n-4} f(x_i) + 6\sum_{i=3,9,15}^{n-3} f(x_i) + \sum_{i=4,10,16}^{n-2} f(x_i) + 5\sum_{i=5,11,17}^{n-1} f(x_i) + 2\sum_{i=6,12,18}^{n-6} f(x_i) + f(x_n) \right]$$

$Wher\ ,\ n = multiple\ of\ 6$

```
function[intregration ]= weddle(x0,xn,n)
check=n/6;
if fix(check)~=check
    error('divison number must be multiple of 6')
end
h=(xn-x0)/n;
x=(x0+h):h:xn;
a=0;

for i=1:6:(n-5)
    a=a+5*fx(x(i));
end
for i=2:6:(n-4)
    a=a+fx(x(i));
end
for i=3:6:(n-3)
    a=a+6*fx(x(i));
end
for i=4:6:(n-2)
    a=a+fx(x(i));
end
for i=5:6:(n-1)
    a=a+5*fx(x(i));
end
for i=6:6:(n-6)
    a=a+2*fx(x(i));
end
intregration=((3*h)/10)*(fx(x0)+a+fx(xn));
```

Simultaneous equation solve

- **Forward elimination**
- **Backward elimination**
- **Gauss zordan elimination**

Forward elimination

```
a=input('co-efficient matrix');
b=input('constant matrix');
n=length(a);
for i=1:n-1
    for j=i+1:n
        m=a(j,i)/a(i,i);
        a(j,:)=a(j,:)-m*a(i,:)
        b(j)=b(j)-m*b(i);
    end
end
x=zeros(n,1);
x(n)=b(n)/a(n,n);
for k=(n-1):(-1):1
    x(k)=(b(k)-a(k,k+1:n)*x(k+1:n))/a(k,k);
end
disp(x)
```

backward elimination

```
a=input('coefficient matrix');
b=input('constant matrix');
n=length(a);

for i=n:-1:2
    for j=i-1:-1:1;
        m=a(j,i)/a(i,i);
        a(j,:)=a(j,:)-a(i,:)*m;
        b(j)=b(j)-b(i)*m;
    end
end
x=zeros(n,1);
x(1)=b(1)/a(1,1);
for k=2:n
    x(k)=(b(k)-a(k,1:k-1)*x(1:k-1))/a(k,k);
end

disp(x)
```

Gauss zordan elimination

```
a=input('co-efficient matrix');
b=input('constant matrix');
n=length(a);

for i=1:n-1
    for j=i+1:n
        m=a(j,i)/a(i,i);
        a(j,:)=a(j,:)-m*a(i,:)
        b(j)=b(j)-m*b(i)
    end
end


for i=n:-1:2
    for j=i-1:-1:1;
        m=a(j,i)/a(i,i);
        a(j,:)=a(j,:)-a(i,:)*m;
        b(j)=b(j)-b(i)*m;
    end
end
for k=1:n
    x(k)=b(k)/a(k,k);
end
disp(x)
```

Curve fitting

- Linear curve fitting
- Polynomial curve fitting

Linear curve fitting

$$Y = ax + b$$

$$a = \frac{n * sxy - sx * sy}{n * sxx - sx^2}$$

$$b = \frac{sxx * sy - sxy * sx}{n * sxx - sx^2}$$

$$R^2 = \frac{ssy - sse}{ssy}, where\ ssy = \sum_{i=1}^{n} (y_i - \bar{y})^2 \quad and\ \ sse = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 = \sum_{i=1}^{n} (y_i - ax_i - b)^2$$

```
x=input('enter value of x')
y=input('enter value of y')
sxx=sum(x.*x);
syy=sum(y.*y);
sxy=sum(x.*y);
sx=sum(x);
sy=sum(y);
n=length(x);
intercept=(sxx*sy-sxy*sx)/(n*sxx-sx.^2)
slope=(n*sxy-sx*sy)/(n*sxx-sx.^2)
ymean=mean(y);
ssy=0;
sse=0;
for i=1:n
    ssy=ssy+(y(i)-ymean).^2;
end
for i=1:n
    sse=sse+(y(i)-slope*x(i)-intercept).^2;
end
Rsqure=(ssy-sse)/ssy
x=x';
y=y';
A=zeros(n,2);
A(:,1)=x;
A(:,2)=1;
coefficient=inv(A'*A)*A'*y
```

Polynomial curve fitting

```
x=input('enter value of x')
y=input('enter value of y')
p=input('order of polynomial')
x=x';
y=y';
n=length(x);
A=zeros(n,p+1);
j=0;
for power=p:-1:0
    j=j+1;
    A(:,j)=x.^power;
end
coefficient=inv(A'*A)*A'*y
```