Scilab Manual for Numerical techniques lab by Prof Kanika Gupta Others ABES Engineering College,Ghaziabad[1]

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Experiment: 1

To find out the root of the Algebraic and Transcendental equations using Bisection method

Scilab code Solution 1.1 Bisection Method

```
1 //Operating System - Windows 10
2 //SCILAB version 5.5.2
3 //Experiment No.1
4 //Objective-Root of algebraic and transcendental
     equations using bisection
5 //for example for solution of given equation
6 //axˆ4+bxˆ3+cxˆ2+dx+e=0
7 //For Example Enter the value of a,b,c,d and e for
     the polynomial as
8 //a=1
9 //b=0
10 //c=0
11 //d=-1
12 //e=-10
13 //Enter the range p and q for checking the function
```

```
14 //p= 1.8
15 //q= 1.9
16 //such that f(p) is positive and f(q) is negative
17 //then x=(a+b)/2
18 //the graph will be plotted
19 clc
20 clear
21 disp("Enter value of a,b,c,d,e ax^4+bx^3+cx^2+dx+e=0
     ")
22 a=input("Enter a: ");
23 b=input("Enter b: ");
24 c=input("Enter c: ");
25 d=input("Enter d: ");
26 e=input("Enter e: ");
27 function y=fun(x)
28     y=a*x.^4+b*x.^3+c*x.^2+d*x+e;
29 endfunction
30 //deff["fun(int x)=(a*x^4)+(b*x^3)+(c*x^2)+(d*x)+e",
     x];
31    p=input("Enter 1st initial approximation: ");
32    q=input("Enter 2nd initial approximation: ");
33 while(fun(p)*fun(q)>0)
34     disp("Enter correct range of approximations");
35     p=input("Enter 1st initial approximation: ");
36     q=input("Enter 2nd initial approximation: ");
37 end
38 p1=[p:.1:q]
39  x=(p+q)/2;
40 i=0;
41 z=0;
42 while(abs(fun(x))>0.0000001)
43  x=(p+q)/2;
44 if(fun(x)*fun(q)<0) then
45     p=x;
46 else
47     q=x;
48 end
49 i=i+1;
```

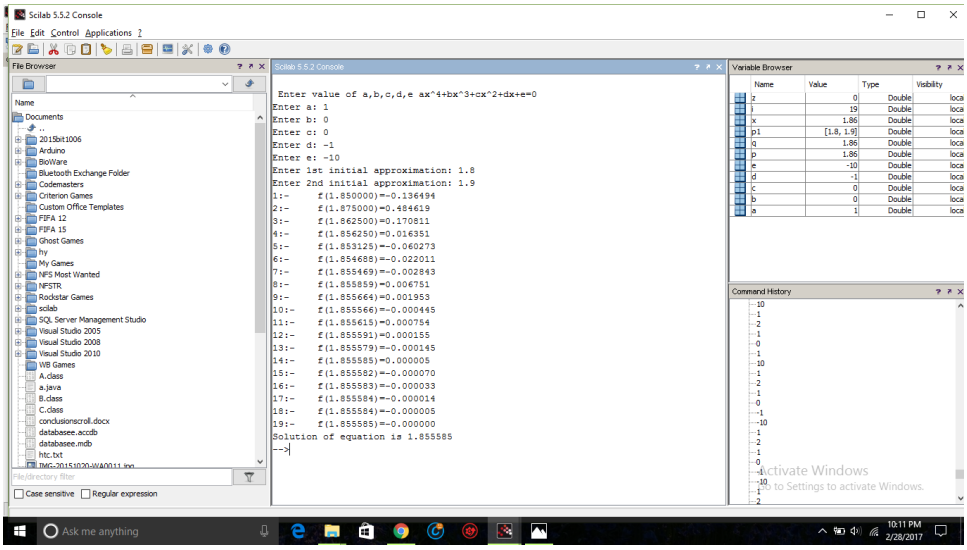

Figure 1.1: Bisection Method

```
50 mprintf('%d:-\tf(%f)=%f\n',i,x,fun(x))
51 end
52 mprintf("Solution of equation is %f",x)
53 plot(p1,fun(p1))
```

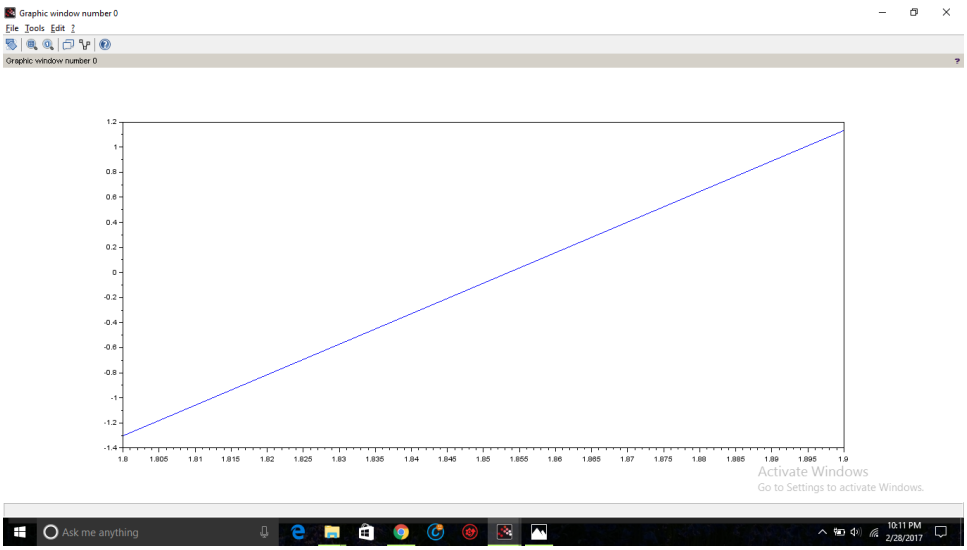

Figure 1.2: Bisection Method

Experiment: 2

To find out the root of the Algebraic and Transcendental equations using Regula-falsi method

Scilab code Solution 2.2 REGULA FALSI

```
1 //Operating System - Windows 10
2 //SCILAB version 5.5.2
3 //Experiment No.2
4 //Objective-Root of algebraic and transcendental
     equations using Regula-falsi
5 //for example for solution of given equation
6 //axˆ4+bxˆ3+cxˆ2+dx+e=0
7 //For Example Enter the value of a,b,c,d and e for
     the polynomial as
8 //a=1
9 //b=0
```

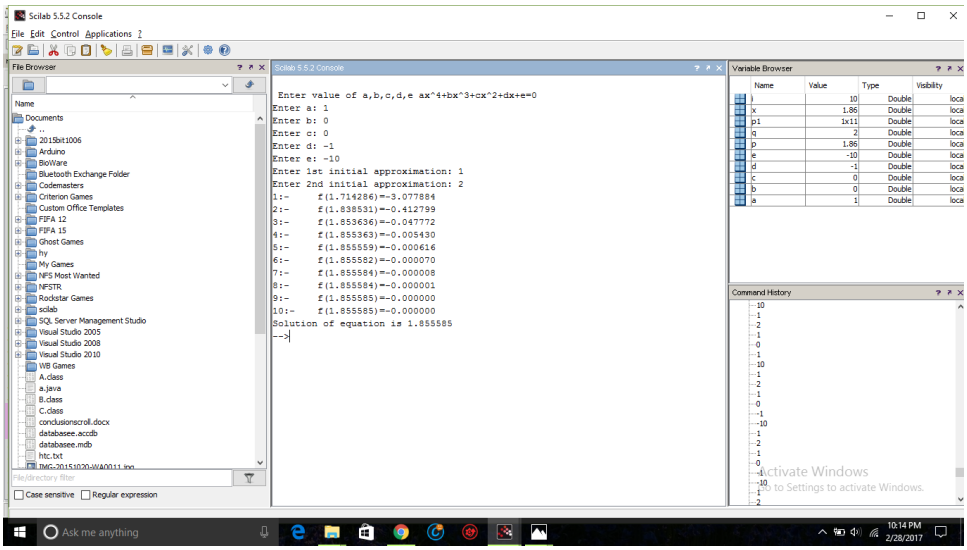

Figure 2.1: REGULA FALSI

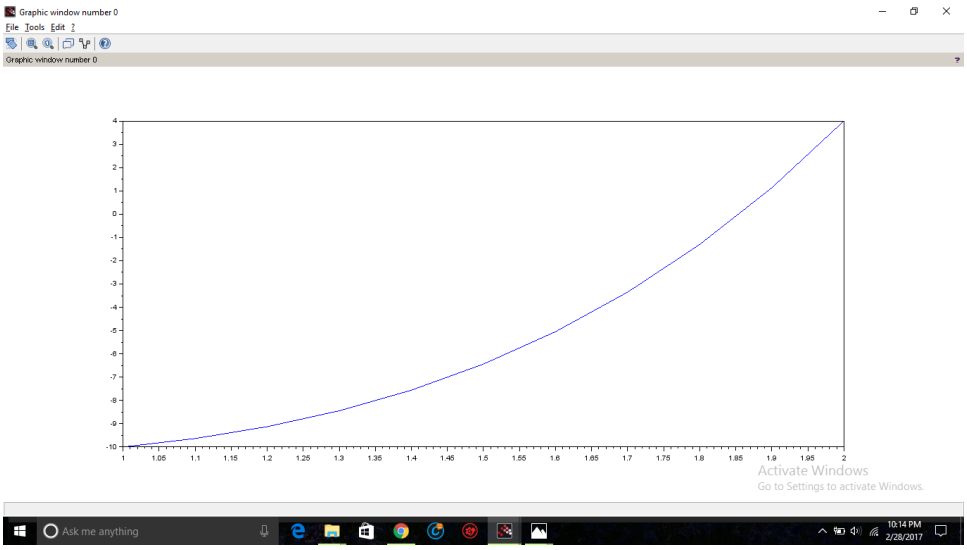

Figure 2.2: REGULA FALSI

```
10 //c=0
11 //d=-1
12 //e=-10
13 //Enter the range p and q for checking the function
14 //p=1
15 //q=2
16 //such that f(p) is positive and f(q) is negative
17 //then x=(a+b)/2
18 //the graph will be plotted
19 clc
20 clear
21 disp("Enter value of a,b,c,d,e ax^4+bx^3+cx^2+dx+e=0
     ")
22 a=input("Enter a: ");
23 b=input("Enter b: ");
24 c=input("Enter c: ");
25 d=input("Enter d: ");
26 e=input("Enter e: ");
27 function y=fun(x)
28     y=a*x.^4+b*x.^3+c*x.^2+d*x+e;
29 endfunction
30 //deff["fun(int x)=(a*x^4)+(b*x^3)+(c*x^2)+(d*x)+e",
     x];
31     p=input("Enter 1st initial approximation: ");
32     q=input("Enter 2nd initial approximation: ");
33 while(fun(p)*fun(q)>0)
34     disp("Enter correct range of approximations");
35     p=input("Enter 1st initial approximation: ");
36     q=input("Enter 2nd initial approximation: ");
37 end
38 p1=[p:.1:q]
39 x=(p*fun(q)-q*fun(p))/(fun(q)-fun(p));
40 i=0;
41 while(abs(fun(x))>.0000001)
42 x=(p*fun(q)-q*fun(p))/(fun(q)-fun(p));
43 if(fun(x)*fun(q)<0) then
44     p=x;
45 else
```

```
46      q=x;
47  end
48  i=i+1;
49  mprintf('%d:-\tf(%f)=%f\n',i,x,fun(x))
50  end
51  mprintf('Solution of equation is %f',x)
52  plot(p1,fun(p1))
```

Experiment: 3

To find out the root of the Algebraic and Transcendental equations using Newton Raphson

Scilab code Solution 3.3 NewtonRaphson

```
1 //Operating System - Windows 10
2 //SCILAB version 5.5.2
3 //Experiment No.3
4 //Objective-Root of algebraic and transcendental
    equations using Newton Raphson
5 //for example for solution of given equation
6 //axˆ4+bxˆ3+cxˆ2+dx+e=0
7 //Enter the value of a,b,c,d and e for the
    polynomial as
8 //a= 1
9 //b= 1
```

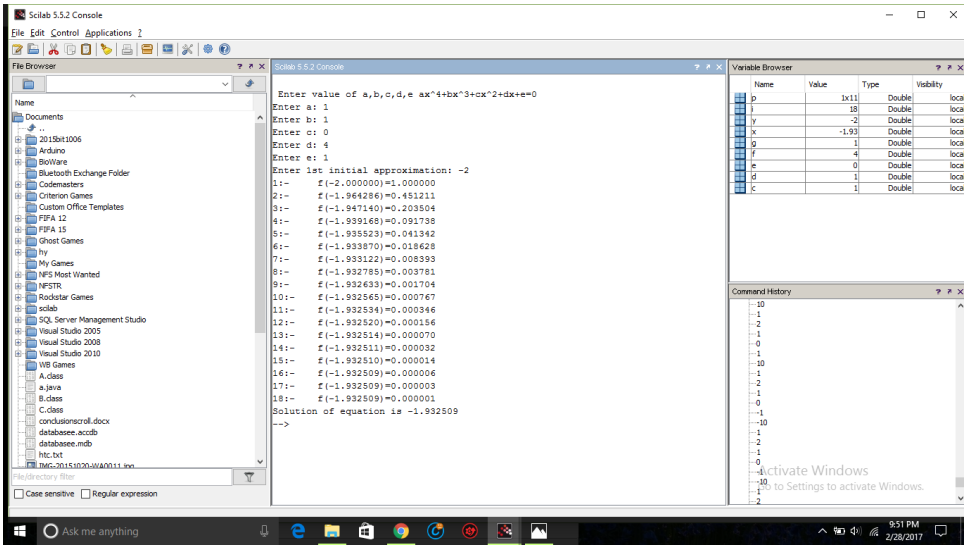

Figure 3.1: NewtonRaphson

```
10 //c= 0
11 //d= 4
12 //e= 1
13 //Enter the first approximation as
14 //x=-2
15 //such that f(p) is positive and f(q) is negative
16 //then x=(a+b)/2
17 clc
18 clear
19 disp("Enter value of a,b,c,d,e ax^4+bx^3+cx^2+dx+e=0
     ")
20 c=input("Enter a: ");
21 d=input("Enter b: ");
22 e=input("Enter c: ");
23 f=input("Enter d: ");
24 g=input("Enter e: ");
25 function y=fun(x)
26     y=c*x.^4+d*x.^3+e*x.^2+f*x+g;
27 endfunction
28 //deff["fun(int x)=(a*x^4)+(b*x^3)+(c*x^2)+(d*x)+e",
```

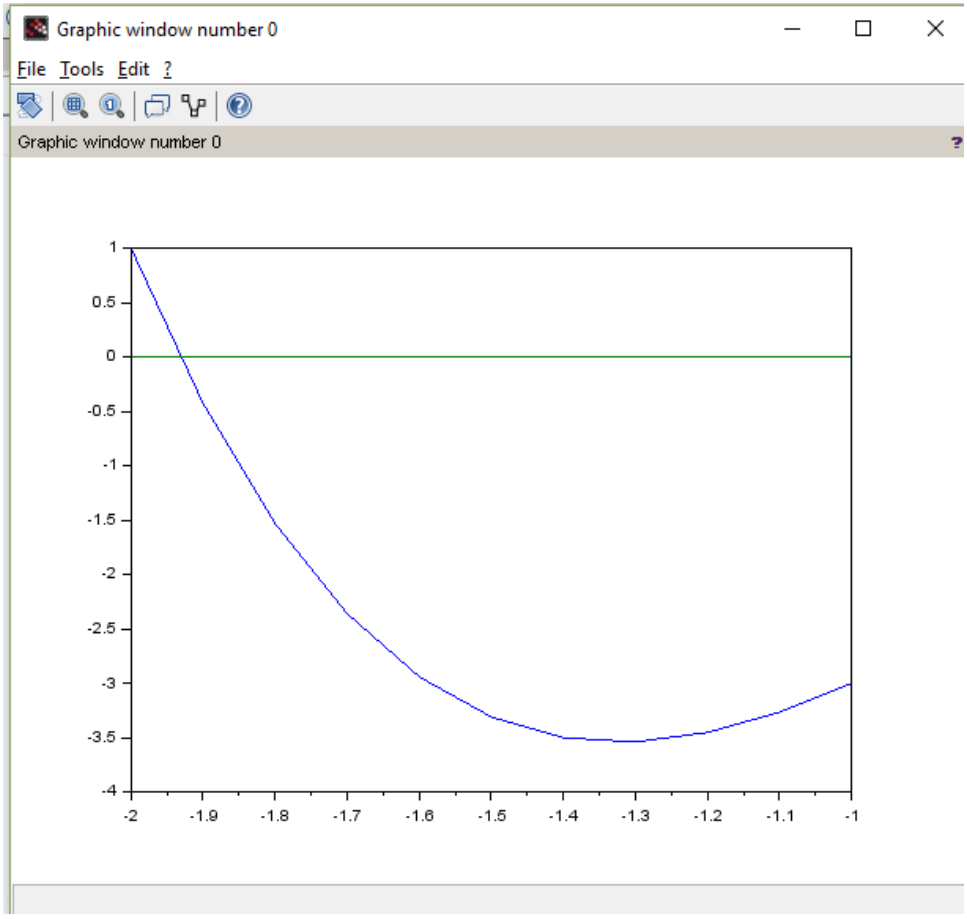

Figure 3.2: NewtonRaphson

```
    x];
x=input("Enter 1st initial approximation: ");
y=x;
i=0;
while(abs(fun(x))>.000001)
    i=1+i;
    mprintf('%d:-\tf(%f)=%f\n',i,x,fun(x))
    x=x-(fun(x)/numderivative(fun,x));
end
if(y<x) then
    p=[y:.1:x+1]
else
    p=[x:.1:y+1]
end
mprintf("Solution of equation is %f",x)
plot(p,fun(p),p,p*0)
```

Experiment: 4

To find out the root of the Algebraic and Transcendental equations using Method of Iteration.

Scilab code Solution 4.4 ITERATION

```
1  //Operating System - Windows 10
2  //SCILAB version 5.5.2
3  //Experiment No.4
4  //Objective: Root of algebraic and transcendental
       equations using iteration
5  //for example for solution of given equation
6  //x^3-5x+1=0
7  //Enter the initial approximation x=1
8  //then x=g(x)
9  clc
10 clear
11 function y=f(x)
12     y=x^3-5*x+1
```

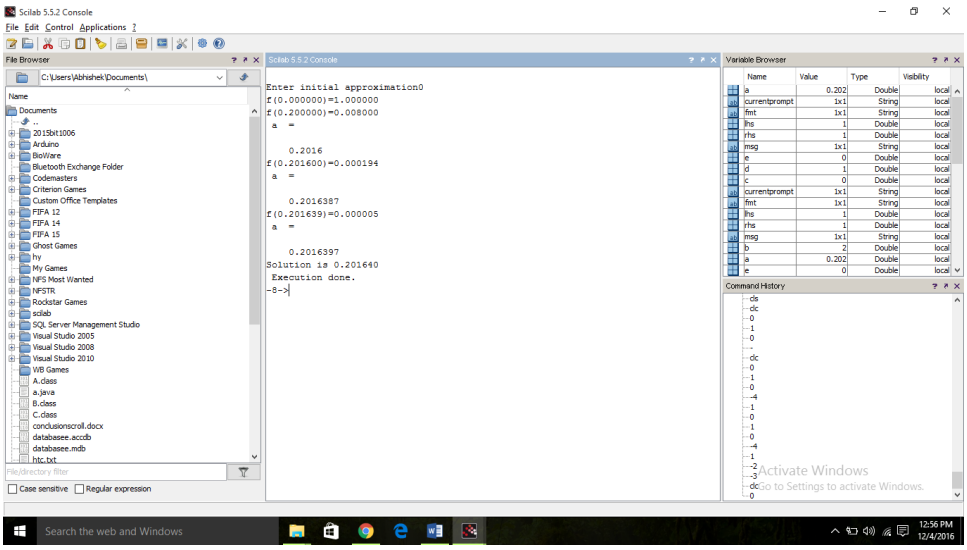

Figure 4.1: ITERATION

```
13 endfunction
14 function y=fi(x)
15     y=(x^3+1)/5
16 endfunction
17
18 a=input("Enter initial approximation ");
19 mprintf("f(%f)=%f\n",a,f(a))
20 a=fi(a);
21 while(abs(f(a))>.000001)
22     mprintf("f(%f)=%f\n",a,f(a))
23     a=fi(a)
24 end
25 mprintf("Solution is %f",a)
```

Experiment: 5

To implement Newton's Forward and Backward difference table.

Scilab code Solution 5.5 NewtonFwdAndBckwd

```
1 //Operating System - Windows 10
2 //SCILAB version 5.5.2
3 //Experiment No.5
4 //objective: newton's forward difference
     interpolation table and newton's backward
     interpolation table
5 //for example for forward difference select 1
6 //enter number of values 5
7 //matrix is formed of 5*5
8 //enter the value of x and y simultanously
9 //Enter the element x: 1
10 //Enter the element y: 6
11 //Enter the element x: 2
```

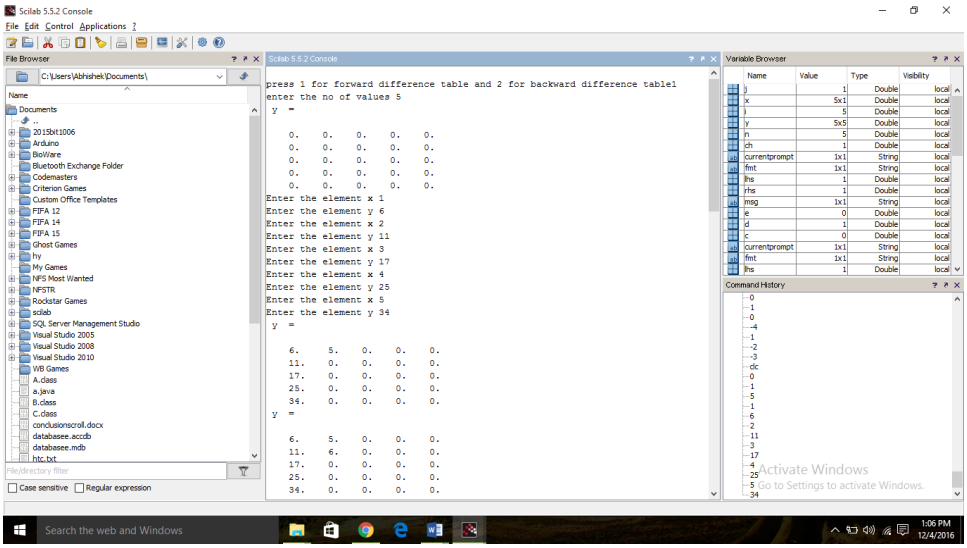

Figure 5.1: NewtonFwdAndBckwd

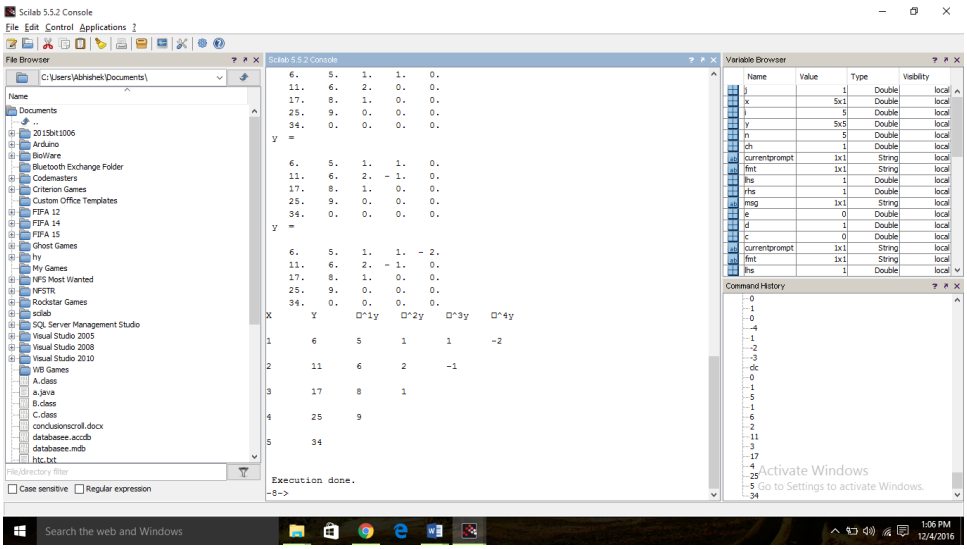

Figure 5.2: NewtonFwdAndBckwd

```
12 //Enter the element y: 11
13 //Enter the element x: 3
14 //Enter the element y: 17
15 //Enter the element x: 4
16 //Enter the element y: 25
17 //Enter the element x: 5
18 //Enter the element y: 34
19 clc
20 clear
21 ch=input("press 1 for forward interpolation table
      and 2 for backward interpolation table");
22 if(ch==1) then
23 n=input("enter the no of values ");
24 y=zeros(n,n)
25 for i=1:n
26     x(i)=input("Enter the element x ");
27     y(i,1)=input("Enter the element y ");
28 end
29 for i=2:n
30     for j=1:n-i+1
31         y(j,i)=y(j+1,i-1)-y(j,i-1)
32     end
33 end
34 mprintf("X\tY\t")
35 for i=1:n-1
36     mprintf("%cˆ%dy\t",char(30),i)
37 end
38 disp("")
39 for i=1:n
40     mprintf("%d\t",x(i))
41     for j=1:n-i+1
42         mprintf("%d\t",y(i,j))
43     end
44     disp("")
45 end
46 else
47     n=input("enter the no of values ");
48 y=zeros(n,n)
```

```
for i=1:n
    x(i)=input("Enter the element x ");
    y(i,1)=input("Enter the element y ");
end
for i=2:n
    for j=1:n-i+1
        y(j,i)=y(j+1,i-1)-y(j,i-1)
    end
end
mprintf("X\tY\t")
for i=1:n-1
    mprintf("%c^%dy\t",char(31),i)
end
disp("")
for i=1:n
    mprintf("%d\t",x(i))
    for j=1:n-i+1
        mprintf("%d\t",y(i,j))
    end
    disp("")
end
end
```

Experiment: 6

To implement Langrange's Interpolation formula

Scilab code Solution 6.6 Lagrange Interpolation

```
1  //Operating System - Windows 10
2  //SCILAB version 5.5.2
3  //Experiment No.6
4  //Objective:Lagrange's Interpolation formula
5  //for example Enter the number of terms in table as
6  //n=2
7  //enter the values of x and y as
8  //x= 1
9  //y= 1
10 //x=  6
11 //y= 36
12 //Enter the value of x to calculate y as
13 //a=5
14 clc
15 clear
16 n=input("Enter the no of terms in the table  :-")
17 for i=1:n
```

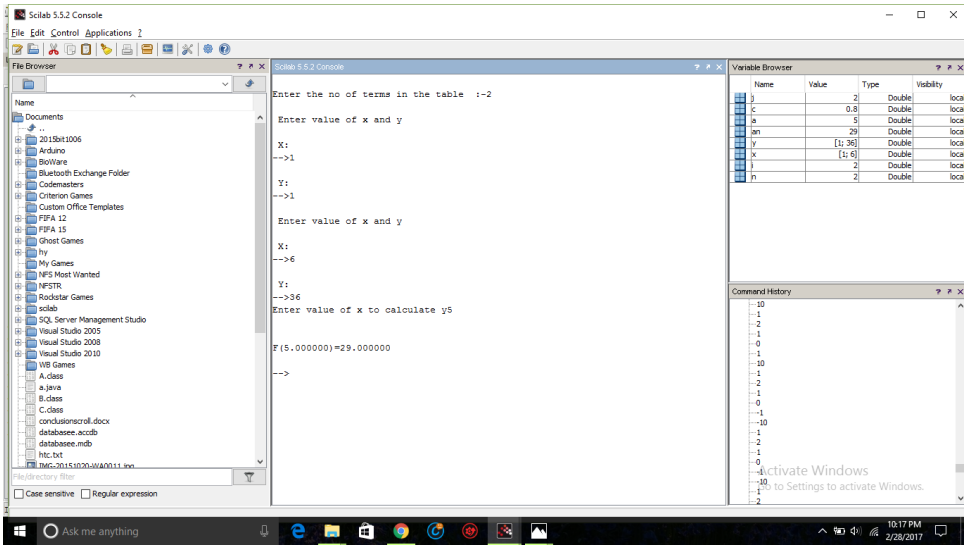

Figure 6.1: Lagrange Interpolation

```
18      disp("Enter value of x and y")
19      disp("X: ")
20      x(i)=mscanf("%f")
21      disp("Y: ")
22      y(i)=mscanf("%f")
23  end
24  an=0;
25  a=input("Enter value of x to calculate y")
26  for i=1:n
27      c=1;
28      for j=1:n
29          if(i~=j)
30              c=c*(a-x(j))/(x(i)-x(j))
31          end
32      end
33      an=an+c*y(i)
34  end
35  mprintf("\n\nF(%f)=%f\n",a,an)
```

Experiment: 7

To implement Numerical Integration using Trapezoidal, Simpson 1/3 and Simpson 3/8 rule.

Scilab code Solution 7.7 Trapezoidal Simpsons

```
1 //Operating System - Windows 10
2 //SCILAB version 5.5.2
3 //Experiment No.7
4 //Objective:to impliment numerical integration using
      trapezoidal,simpson 1/3 and simpson 3/8 rule
5 //For Example for trapezoidal press 1
6 //Enter the Start limit as
7 //a= -1
8 //Enter the End limit as
9 //b=2
10 //Enter the number of Intervals as
```

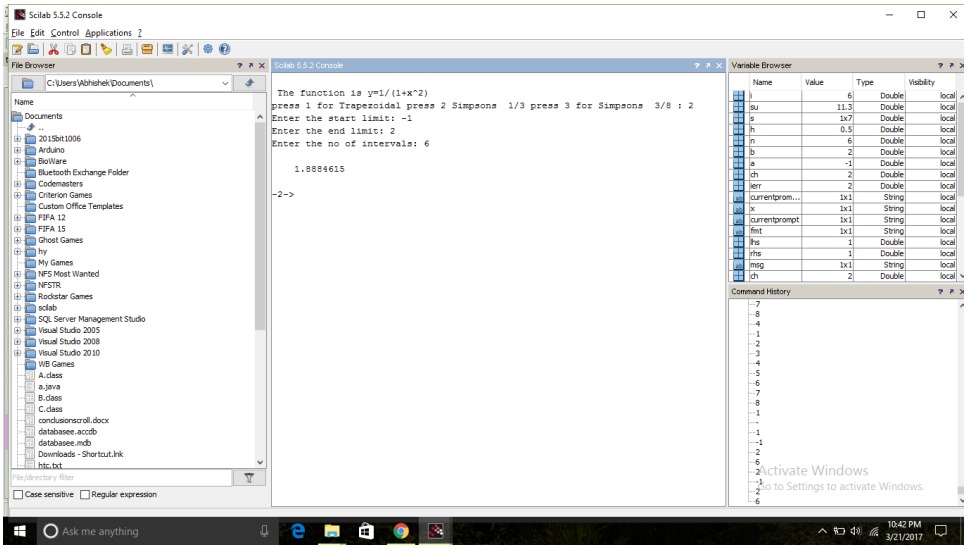

Figure 7.1: Trapezoidal Simpsons

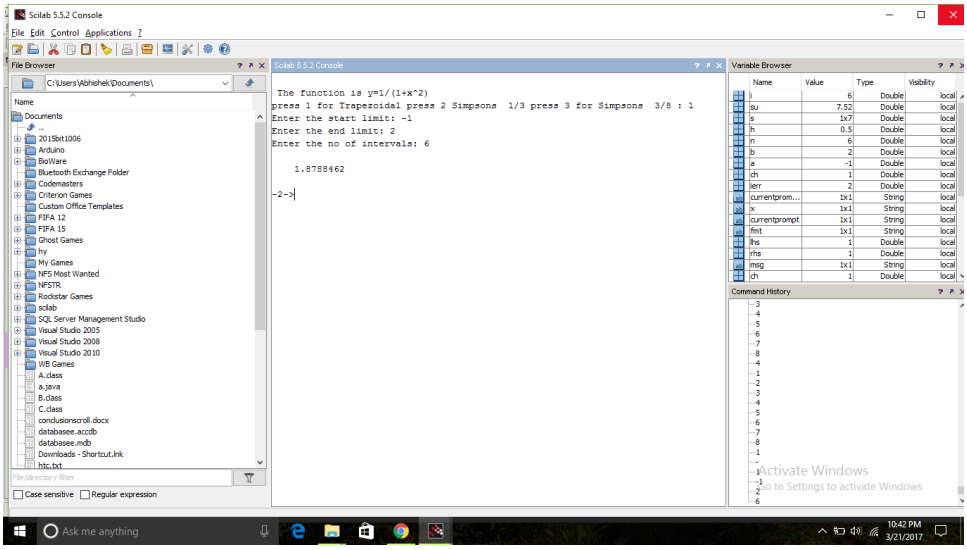

Figure 7.2: Trapezoidal Simpsons

```
11 //n=6
12 //For Example for simpsons 1/3 rule press 2
13 ////Enter the Start limit as
14 //a= -1
15 //Enter the End limit as
16 //b=2
17 //Enter the number of Intervals as
18 //n=6
19 //For Example for simpsons 3/8 rule press 3
20 ////Enter the Start limit as
21 //a= -1
22 //Enter the End limit as
23 //b=2
24 //Enter the number of Intervals as
25 //n=6
26 clc
27 clear
28 function y=f(x)
29     y=1/(1+x^2)
30 endfunction
31 disp("The function is y=1/(1+x^2)")
32 ch=input("press 1 for Trapezoidal press 2 Simpsons
      1/3 press 3 for Simpsons  3/8 : ")
33 if(ch==1) then
34 a=input("Enter the start limit: ")
35 b=input("Enter the end limit: ")
36 n=input("Enter the no of intervals: ")
37 h=(b-a)/n
38 s=[a:h:b]
39 su=0
40 for i=2:length(s)-1
41     su=su+2*f(s(i))
42 end
43 su=su+f(s(1))+f(s(length(s)))
44 ans=h*su/2
45 disp(ans)
46 //Simpson's 1/3
47 elseif(ch==2) then
```

```
function y=f(x)
    y=1/(1+x^2)
endfunction
a=input("Enter the start limit: ")
b=input("Enter the end limit: ")
n=input("Enter the no of intervals: ")
h=(b-a)/n
s=[a:h:b]
su=0
for i=2:length(s)-1
    if(modulo(i-1,2)==0)
        su=su+2*f(s(i))
    else
        su=su+4*f(s(i))
end
end
su=su+f(s(1))+f(s(length(s)))
ans=h*su/3
disp(ans)
//Simpson's 3/8
elseif(ch==3) then
function y=f(x)
    y=1/(1+x^2)
endfunction
a=input("Enter the start limit: ")
b=input("Enter the end limit: ")
n=input("Enter the no of intervals: ")
h=(b-a)/n
s=[a:h:b]
su=0
for i=2:length(s)-1
    if(modulo(i-1,3)==0)
        su=su+2*f(s(i))
    else
        su=su+3*f(s(i))
end
end
su=su+f(s(1))+f(s(length(s)))
```

```
86 ans=3*h*su/8
87 disp(ans)
88 end
```

Experiment: 8

To implement Least Square Method for curve fitting

Scilab code Solution 8.8 Curve Fitting

```
1 //Operating System - Windows 10
2 //SCILAB version 5.5.2
3 //Experiment No.8
4 //fitting a curve by least square method
5 //For example for fitting a curve enter the number
     of terms as
6 //n=4
7 //Enter x : 1
8 //Enter y : 2
9 //Enter x : 3
10 //Enter y : 4
11 //Enter x : 5
12 //Enter y : 5
13 //Enter x : 9
14 //Enter y : 10
15
16 clc
17 clear
18 n=input("Enter no of terms  : ")
```

```
for i=1:n
    x(i)=input("Enter x : ")
    y(i)=input("Enter y : ")
end
x0=0
y0=0
x2=0
xy=0
for i=1:n
    x0=x0+x(i)
    y0=y0+log10(y(i))
    x2=x2+x(i)^2
    xy=xy+x(i)*log10(y(i))
end
p=[x0:.1:x2]
q=[y0:.1:xy]
b=((xy/x0)-(y0/n))/((x2/x0)-(x0/n))
a=(xy-b*x2)/x0
A=10^a
B=b/log10(exp(1))
p=[x(1):.1:x(n)]
y=A*exp(B*p)
mprintf("A=%f\nB=%f\nIs the solution of the equation
    y=A*e^Bx",A,B)
plot(p,y)
```

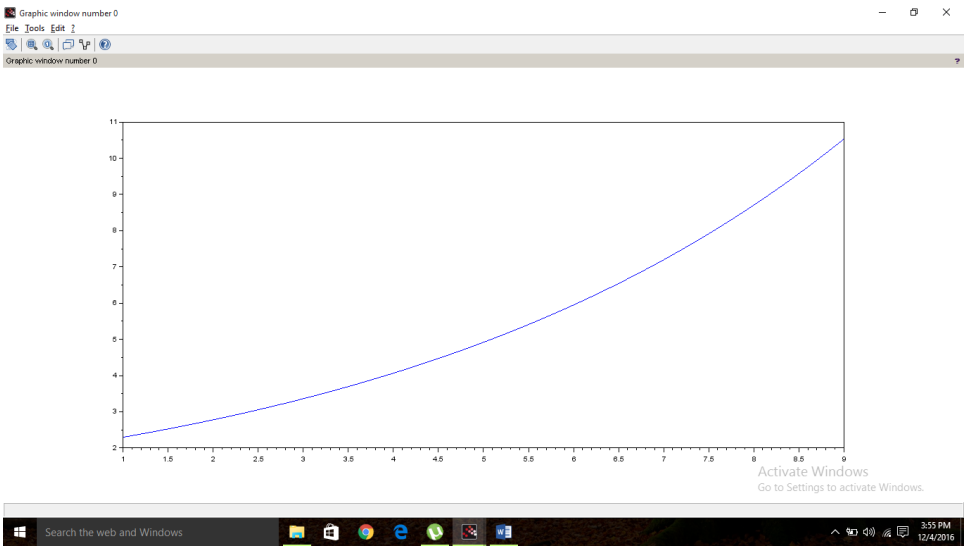

Figure 8.1: Curve Fitting

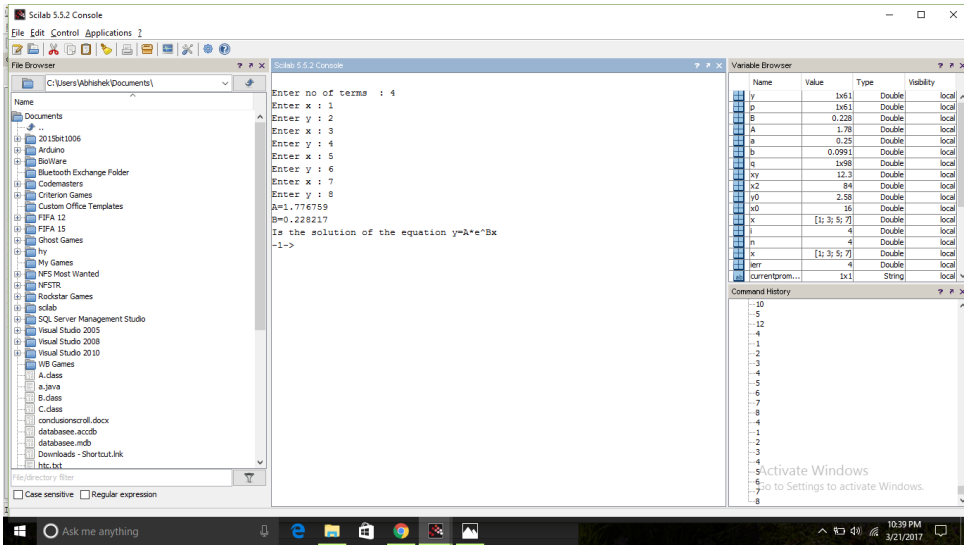

Figure 8.2: Curve Fitting

Experiment: 9

To estimate regression equation from sampled data and regression coefficient

Scilab code Solution 9.9 REGRESSION

```
1 //Operating System - Windows 10
2 //SCILAB version 5.5.2
3 //Experiment No.9
4 //to estimate regression equation from sampled data
     and regression coefficient
5 //Enter number of terms as
6 //n=4
7 //Enter x : 2
8 //Enter y : 3
9 //Enter x : 3
10 //Enter y : 7
11 //Enter x : 4
12 //Enter y : 10
13 //Enter x : 5
14 //Enter y : 12
```

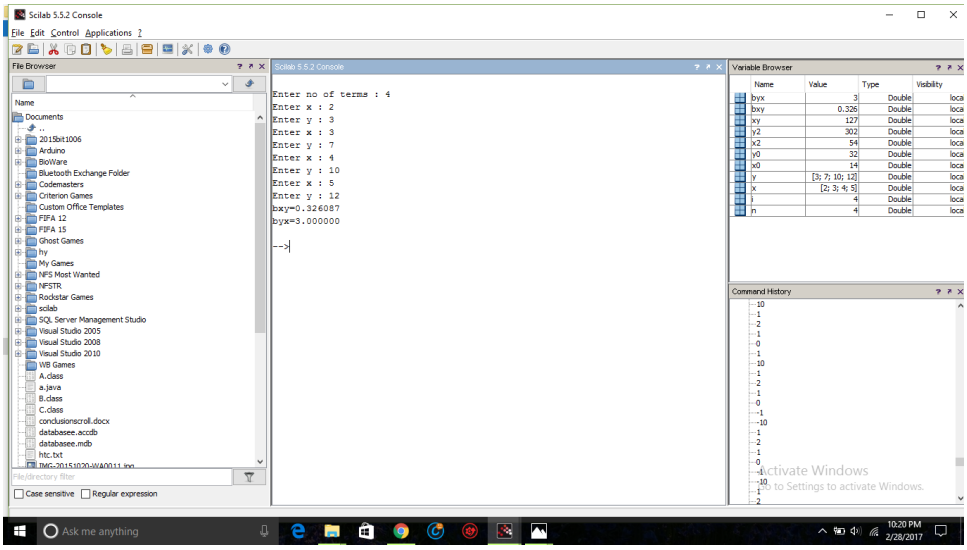

Figure 9.1: REGRESSION

```
15
16 clc
17 clear
18 n=input("Enter no of terms : ")
19 for i=1:n
20     x(i)=input("Enter x : ")
21     y(i)=input("Enter y : ")
22 end
23 x0=0
24 y0=0
25 x2=0
26 y2=0
27 xy=0
28 for i=1:n
29     x0=x0+x(i)
30     y0=y0+y(i)
31     x2=x2+x(i)^2
32     y2=y2+y(i)^2
33     xy=xy+x(i)*y(i)
34 end
```

```
35 bxy=(n*xy-x0*y0)/(n*y2-y0^2)
36 byx=(n*xy-x0*y0)/(n*x2-x0^2)
37 mprintf("bxy=%f\nbyx=%f\n",bxy,byx)
```