

EXPERIMENT-1

Q1

3. Students are required to write both the programs (IVT and Bisection) and implement it on the following examples.
 - (i) Use bisection method in computing of $\sqrt{29}$ with $\epsilon = 0.001$, $N = 10$, $h = 1$.
 - (ii) Determine the number of iterations necessary to solve $f(x) = x^3 + 4x^2 - 10 = 0$ with accuracy 10^{-3} using $a = 1$ and $b = 2$ and hence find the root with desired accuracy.

Ans1(i)

```

1 - clc%For clearing our command Window
2 - clear%For clearing our workspace
3 - f=@(x) x^2-29;
4 - N=10;
5 - h=1;
6
7 - for i=-N:h:N
8 -     if f(i)*f(i+h)<0
9 -         a=i;
10 -        b=i+h;
11 -    end
12 - end
13 - fprintf('initial guess\n a=%d\n',b);
14 - fprintf('b=%d\n',b);
15 - while (abs(a-b)>=0.001)
16 -     c=(a+b)/2;
17 -     if f(a)*f(c)<0
18 -         b=c;
19 -     else
20 -         a=c;
21 -     end
22 - end
23 - fprintf('root is %f\n',c);
24
25

```

Command Window

```

initial guess
a=6
b=6
root is 5.385742
fx >>

```

Workspace

Name	Value
a	5.3848
b	5.3857
c	5.3857
f	@(x)x^2-29
h	1
i	10
N	10

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CODE:

```
clc%For clearing our command Window
```

```
clear%For clearing our workspace
```

```
f=@(x)x^2-29;
```

```
N=10;
```

```
h=1;
```

```
for i=-N:h:N
```

```
    if f(i)*f(i+h)<0
```

```
        a=i;
```

```
        b=i+h;
```

```
    end
```

```
end
```

```
fprintf('initial guess\na=%d\n',b);
```

```
fprintf('b=%d\n',b);
```

```
while(abs(a-b)>=0.001)
```

```
    c=(a+b)/2;
```

```
    if f(a)*f(c)<0
```

```
        b=c;
```

```
    else
```

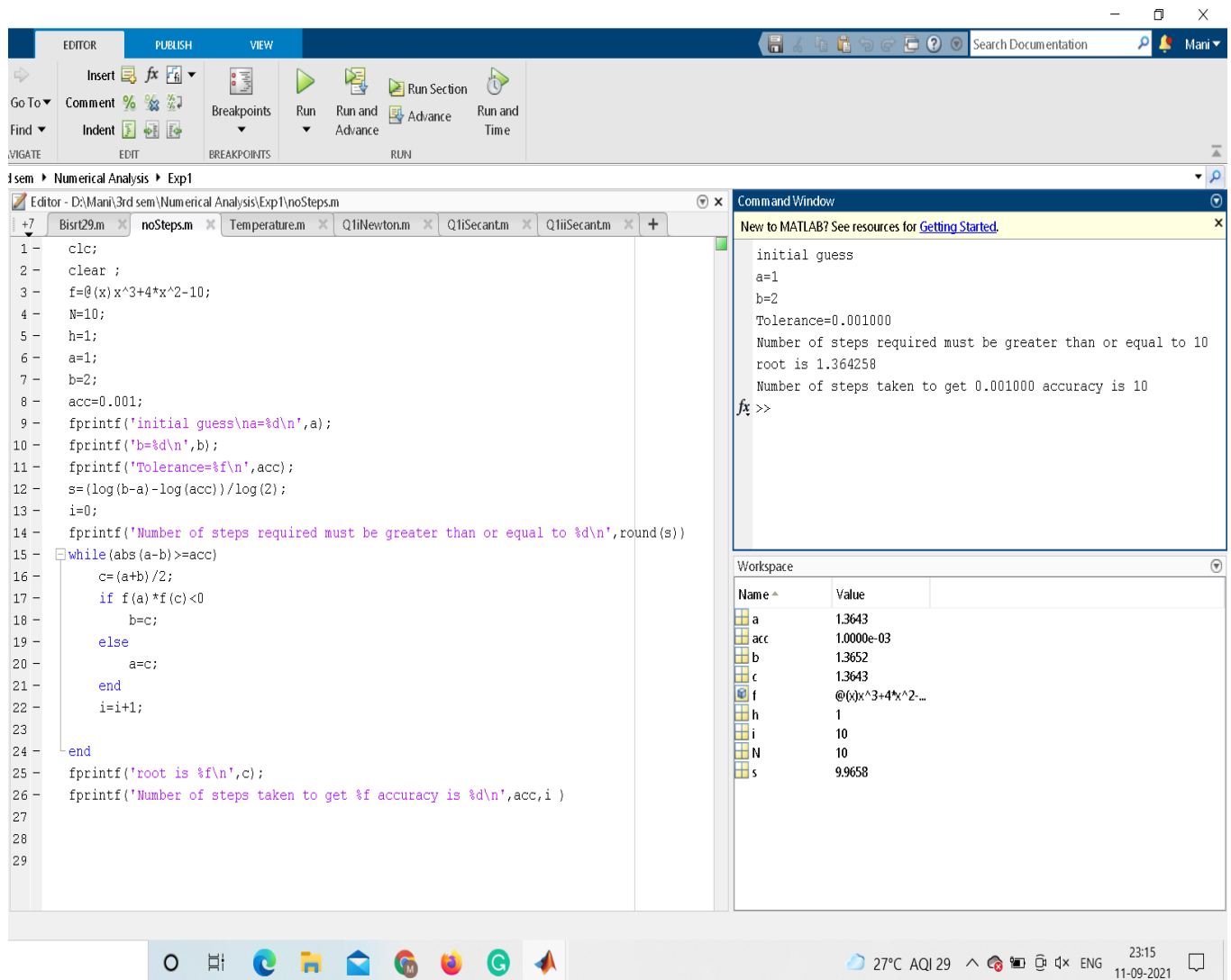
```
        a=c;
```

```
    end
```

```
end
```

```
fprintf('root is %f\n',c);
```

Ans1(ii)



The MATLAB Editor window displays the following script:

```
1 clc;
2 clear ;
3 f=@(x) x^3+4*x^2-10;
4 N=10;
5 h=1;
6 a=1;
7 b=2;
8 acc=0.001;
9 fprintf('initial guess\na=%d\n',a);
10 fprintf('b=%d\n',b);
11 fprintf('Tolerance=%f\n',acc);
12 s=(log(b-a)-log(acc))/log(2);
13 i=0;
14 fprintf('Number of steps required must be greater than or equal to %d\n',round(s))
15 while (abs(a-b)>=acc)
16     c=(a+b)/2;
17     if f(a)*f(c)<0
18         b=c;
19     else
20         a=c;
21     end
22     i=i+1;
23 end
24 fprintf('root is %f\n',c);
25 fprintf('Number of steps taken to get %f accuracy is %d\n',acc,i )
26
27
28
29
```

The Command Window shows the output of the script:

```
initial guess
a=1
b=2
Tolerance=0.001000
Number of steps required must be greater than or equal to 10
root is 1.364258
Number of steps taken to get 0.001000 accuracy is 10
fx >>
```

The Workspace window shows the values of the variables:

Name	Value
a	1.3643
acc	1.0000e-03
b	1.3652
c	1.3643
f	@(x)x^3+4*x^2-10
h	1
i	10
N	10
s	9.9658

CODE:

```
clc;

clear ;

f=@(x)x^3+4*x^2-10;

N=10;

h=1;

a=1;

b=2;

acc=0.001;

fprintf('initial guess\ na=%d\n',a);

fprintf('b=%d\n',b);

fprintf('Tolerance=%f\n',acc);

s=(log(b-a)-log(acc))/log(2);

i=0;

fprintf('Number of steps required must be greater than or equal to %d\n',round(s))

while(abs(a-b)>=acc)

    c=(a+b)/2;

    if f(a)*f(c)<0

        b=c;

    else

        a=c;

    end

    i=i+1;

end

fprintf('root is %f\n',c);

fprintf('Number of steps taken to get %f accuracy is %d\n',acc,i )
```

Q2

4. Thermistors are temperature-measuring devices based on the principle that the thermistor material exhibits a change in electrical resistance with a change in temperature.

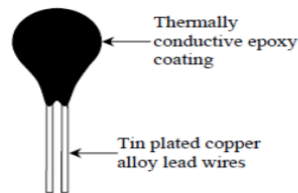


Figure 1 A typical thermistor.

By measuring the resistance of the thermistor material, one can then determine the temperature. For a 10K3A Betatherm thermistor, the relationship between the resistance R of the thermistor and the temperature is given by

$$\frac{1}{T} = 1.129241 \times 10^{-3} + 2.341077 \times 10^{-4} \ln(R) + 8.775468 \times 10^{-8} \{\ln(R)\}^3$$

where T is in Kelvin and R is in ohms. Use the bisection method to find the resistance R at 18.99°C .

Ans2

The screenshot shows the MATLAB environment with the following components:

- Editor:** Contains a script named `Temperature.m` implementing the bisection method. The script defines a function `f = @(x) 1.129241*10^-3 + 2.341077*(10^-4)*2.303*log(x) + 8.775468*10^-8*(2.303*log(x))^3 - (1/292.14);` and uses the bisection method to find the root of `f` within the interval `[1, 1000]` with a tolerance of `1.0000e-03`.
- Command Window:** Displays the output of the script:


```
The root is 61.301758 (i.e. Value of Resistance in ohm)
Number of iterations is 10
>>
```
- Workspace:** Shows the values of variables defined in the script:

Name	Value
a	61.3018
b	61.3027
c	61.3018
count	10
f	@(x)1.129241*10...
h	1
i	1000
n	1000
tol	1.0000e-03

CODE:

```
clc
clear
f=@(x)1.129241*10^-3+2.341077*(10^-4)*2.303*log(x)+8.775468*10^-8*(2.303*log(x))^3-(1/292.14);
h=1;
tol=0.001;
n=1000;
%ivt
for i=-n:h:n
    if f(i)*f(i+h)<0
        a=i;
        b=i+h;
    end
end
count=0;
%logic of bisection
while abs(a-b)>=tol
    c=(a+b)/2;
    if f(a)*f(c)<0
        b=c;
    elseif f(c)==0
        break;
    else
        a=c;
    end
    count=count+1;
end

fprintf('The root is %f (i.e. Value of Resistance in ohm)',c);
fprintf('\nNumber of iterations is %d\n',count);
```