ASSIGNMENT-2

21MAT204

MIS-3

Professor-Dr. Soman/Dr.Neethu Mohan

1. Compute the value of Cos(pi/4) by taylor series expansion upto 10 terms. Use ‘For Loop’ in MATLAB.

Ans. We will use the general formulae of COSINE derived from taylor series and put that in a for loop as an iterative function that will give us iterations upto 10 terms.

$$\cos x = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} x^{2n} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \cdots \qquad \text{for all } x$$

```
clc;
clear;
close all;
i = input('Please give number for the total number of terms in the taylor series: ');
x = input('Please give the input: ');
cosfunc = 0;
for n = 0:i
    cosfunc = cosfunc + ((-1)^n)*(x^(2*n))/factorial(2*n);

end

disp((cosfunc))

```

Output:

Command Window

```
Please give number for the total number of terms in the taylor series: 10
Please give the input: pi/4
    0.7071
```

2. Compute the value of Sin(pi/4) by taylor series expansion upto 10 terms. Use 'WHILE Loop' in MATLAB.

Ans. We will use the general formulae of SINE derived from taylor series and put that in a while loop(conditional loop) as an iterative function that will give us iterations upto 10 terms.

$$\sin x = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots \quad \text{for all } x$$

```
clc;
clear;
close all;
i = input('Please give number for the total number of terms in the taylor series: ');
x = input('Please give the input: ');
sinfunc = 0;
n=0;
while n < i
    sinfunc = sinfunc + ((-1)^n)*(x^(2*n+1))/factorial((2*n)+1);
    n = n+1;

end

disp((sinfunc))
```

Output:

```
Command Window
Please give number for the total number of terms in the taylor series: 10
Please give the input: pi/4
    0.7071
```

3. Compute the value of exp(2) by taylor series expansion upto 10 terms. Use 'For Loop' in MATLAB.

Ans. We will use the general formulae of EXPONENTIAL derived from taylor series and put that in a for loop as an iterative function that will give us iterations upto 10 terms.

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

```
clc;
clear;
close all;
i = input('Please give number for the total number of terms in the taylor series: ');
x = input('Please give the input: ');
expfunc = 0;
for n = 0:i
    expfunc = expfunc + (x^(n))/factorial(n);

end

disp((expfunc))
```

Output:

```
Command Window
Please give number for the total number of terms in the taylor series: 10
Please give the input: 2
    7.3890
```

4. Compute the value of exp(-2) by taylor series expansion upto 10 terms. Use ‘WHILE Loop’ in MATLAB.

Ans. We will use the general formulae of EXPONENTIAL derived from taylor series and put that in a while loop(conditional loop) as an iterative function that will give us iterations upto 10 terms.

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

```
clc;
clear;
close all;
i = input('Please give number for the total number of terms in the taylor series: ');
x = input('Please give the input: ');
expfunc = 0;
n=0;
while n < i
    expfunc = expfunc + (x^(n))/factorial(n);
    n = n+1;

end

disp((expfunc))

```

Output:

Command Window

```
Please give number for the total number of terms in the taylor series: 10
Please give the input: -2
    0.1351
```

5. Compute Cos(pi/4), Sin(pi/4), e^2,e^{-2} by taylor series using 10 iterations each by writing a single formula in Microsoft excel cell and dragging it.

Ans.

Using a single formula from taylor series to get series for other functions is hectic task so we will instead go for formulae already derived for the functions and get the value of each function at a point x with fixed number of iterations.

Cos(pi/4)

Cos				
				x
iteration		function		0.785398
0		1		
1		=((-1)^(B7)*(F4^(2*(B7)))/FACT(2*(B7)))		
2		0.015854		
3		-0.000326		
4		3.59E-06		
5		-2.46E-08		
6		1.15E-10		
7		-3.9E-13		
8		1E-15		
9		-2.02E-18		
10		3.28E-21		
Cos(pi/4)		0.707107		

Sin(pi/4)

Sin				x
				0.785398
iteration		function		
0		=((-1)^(B26)*(F4^(2*(B26)+1)))/FACT(2*(B26)+1)		
1		-0.080746		
2		0.00249		
3		-3.66E-05		
4		3.13E-07		
5		-1.76E-09		
6		6.95E-12		
7		-2.04E-14		
8		4.63E-17		
9		-8.35E-20		
10		1.23E-22		
Sin(pi/4)		0.707107		

e^2

Exp				
				x
iteration		function		2
0		= (((M4)^(I6))/FACT(I6))		
1		2		
2		2		
3		1.333333		
4		0.666667		
5		0.266667		
6		0.088889		
7		0.025397		
8		0.006349		
9		0.001411		
10		0.000282		
Expo(2)		7.388995		

e^{-2}

Exp				x
				-2
iteration		function		
0		1		
1		= (((M22)^(I27))/FACT(I27))		
2		2		
3		-1.333333		
4		0.666667		
5		-0.266667		
6		0.088889		
7		-0.025397		
8		0.006349		
9		-0.001411		
10		0.000282		
Expo(-2)		0.135379		

6. Find square root and cube root of 1000 using iterative formula also known as Newton-Raphson's method.

Ans.

Newton Raphson Formula:

$$x_n = x_{n-1} - \frac{f(x)}{f'(x)}$$

Firstly, we will choose appropriate function and then iterate it over and over to get the approximate value after some iterations.

In case of square root, the function can be
$f(x) = x^2 - 1000$
$f'(x) = 2x$
$x_o = 1$

SquareRoot		
iteration		function
0		1
1		=D46-(((D46)^2-1000)/(2*D46))
2		251.249
3		127.6146
4		67.72533
5		41.24543
6		32.74527
7		31.64202
8		31.62278
9		31.62278
10		31.62278

In case of cube root, the function can be

$f(x) = x^3 - 1000$

$f'(x) = 3x^2$

$x_o = 1$

CubeRoot

Iteration		function
0		1
1		=K46-(((K46)^3-1000)/(3*((K46)^2)))
2		222.6697
3		148.4532
4		98.9839
5		66.02329
6		44.09199
7		29.56612
8		20.09207
9		14.22043
10		11.12865
11		10.1106
12		10.00121
13		10
14		10
15		10