Scientific Computing Lab MA – 322 Lab – 5

Name – Rasesh Srivastava

Roll Number – 210123072

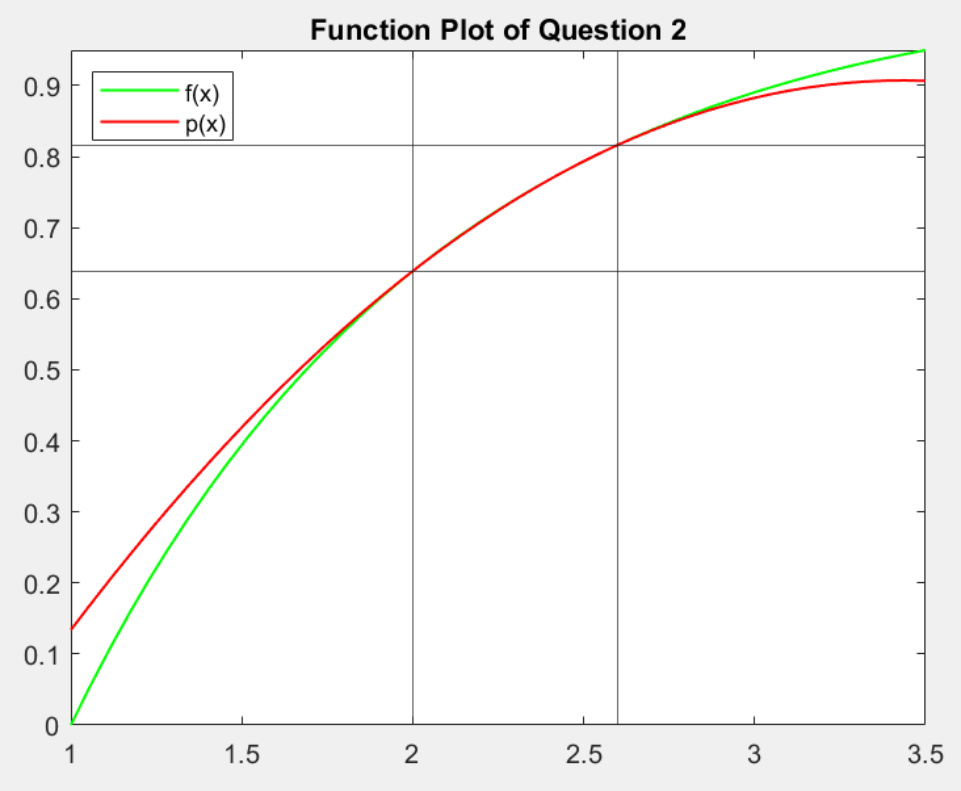
Branch – Mathematics and Computing

1)

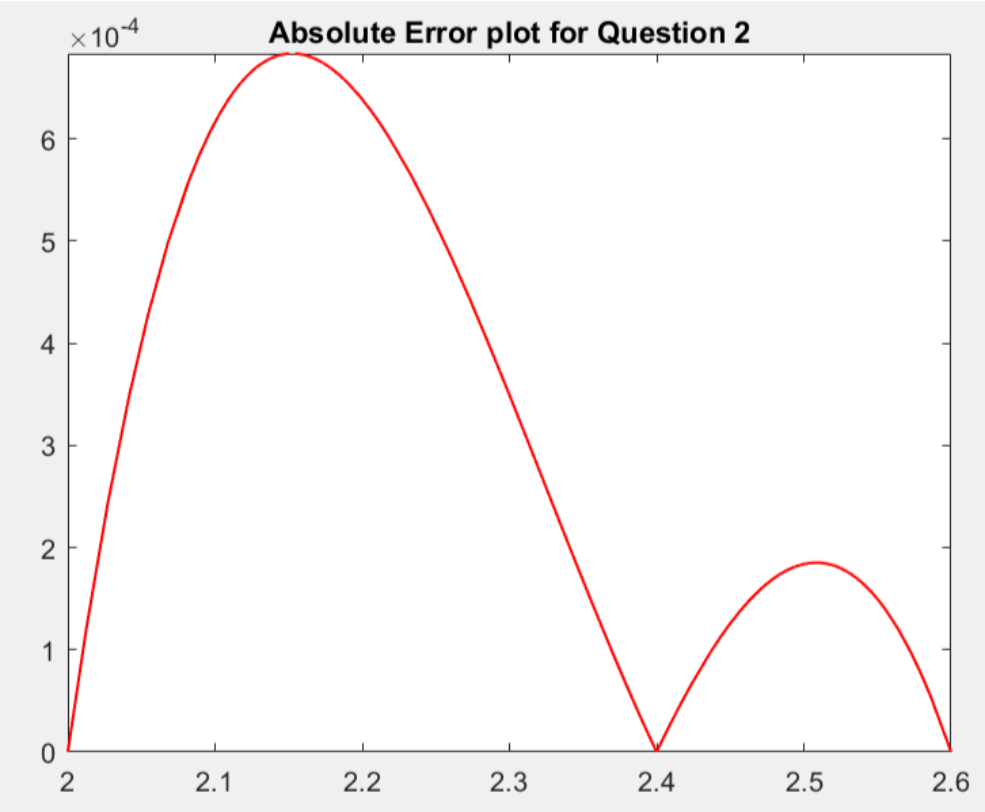
```
Question 1
Using Newton forward-difference formula
The Forward Difference Table is:
1.00000     0.22140     0.04902     0.01086     0.00238
1.22140     0.27042     0.05988     0.01324     0.00000
1.49182     0.33030     0.07312     0.00000     0.00000
1.82212     0.40342     0.00000     0.00000     0.00000
2.22554     0.00000     0.00000     0.00000     0.00000

The approximate value of f(0.05) = 1.0512587988

Using Newton backward-difference formula
The Backward Difference Table is:
1.00000     0.00000     0.00000     0.00000     0.00000
1.22140     0.22140     0.00000     0.00000     0.00000
1.49182     0.27042     0.04902     0.00000     0.00000
1.82212     0.33030     0.05988     0.01086     0.00000
2.22554     0.40342     0.07312     0.01324     0.00238

The approximate value of f(0.65) = 1.9155505176
```

2)

```
Question 2
Using Lagrange interpolation method
Required bound for the absolute error = 0.00068350
that is, maximum possible error = 0.00068350 on the interval [x0, x2]
```



The function plots are drawn by plotting f(x) and p(x). These show that p(x) successfully interpolates f(x) in the interval [2, 2.6].



The error plot is drawn by plotting |p(x) – f(x)|

3)

a)

```
Question 3 part a
Using Lagrange interpolation method
Approximate value of f(0.43) = 2.360604734080
```

b)

```
Question 3 part b
Using Lagrange interpolation method
Approximate value of f(0.90) = 0.441985002500
```

4)

```
Newton's divided difference table is:

T =
```

6×6 table

DividedDiff1	DividedDiff2	DividedDiff3	DividedDiff4	DividedDiff5	DividedDiff6
1.5133e+05	2799.7	-20.09	0.5465	-0.011204	0.00091217
1.7932e+05	2397.9	-3.695	0.098333	0.034404	0
2.033e+05	2324	-0.745	1.4745	0	0
2.2654e+05	2309.1	43.49	0	0	0
2.4963e+05	3178.9	0	0	0	0
2.8142e+05	0	0	0	0	0

```
Approximate population in the year 1940 = 102397

Approximate population in the year 1975 = 215043

Approximate population in the year 2020 = 513443
```

5)

Initially,

```
Question 5
Lagrange's interpolation method for Question 5
Approximate value of f(0.20) = -5.778589587302

Newton's divided difference interpolation method for Question 5
Newton's divided difference table is:

T =
```

5×5 table

DividedDiff1	DividedDiff2	DividedDiff3	DividedDiff4	DividedDiff5
-6	1.0517	0.5725	0.215	0.063016
-5.8948	1.2234	0.7015	0.27802	0
-5.6501	1.5742	0.95171	0	0
-5.1779	2.2404	0	0	0
-4.2817	0	0	0	0

```
Approximate value of f(0.2) = -5.778589587302
```

```
After adding f(1.1) = -3.99583
Lagrange's interpolation method for Question 5
Approximate value of f(0.20) = -5.778598649351

Newton's divided difference interpolation method for Question 5
Newton's divided difference table is:

T =
```

6×6 table

DividedDiff1	DividedDiff2	DividedDiff3	DividedDiff4	DividedDiff5	DividedDiff6
-6	1.0517	0.5725	0.215	0.063016	0.014159
-5.8948	1.2234	0.7015	0.27802	0.078591	0
-5.6501	1.5742	0.95171	0.35661	0	0
-5.1779	2.2404	1.237	0	0	0
-4.2817	2.8589	0	0	0	0
-3.9958	0	0	0	0	0

```
Approximate value of f(0.2) = -5.778598649351
```

We can observe that both the methods are giving exact same answer for both the tables since the interpolating polynomial p(x) formed by both the methods is completely the same, only the method of calculating the interpolating polynomial is different. Both Lagrange and Newton divided-difference methods are just different representations of each other.

After adding f (1.1) = −3.99583 to the table, the solution is changed but the change is of the order of10^{-5} which is negligible, that is, we almost get the same answer.