

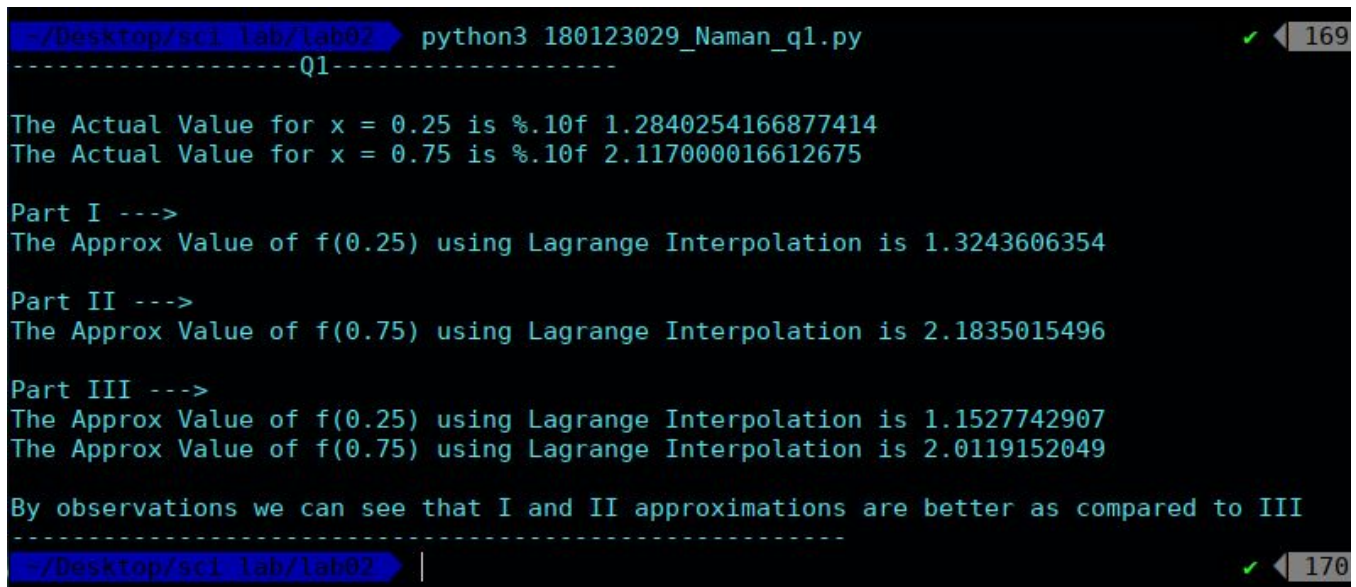
MA322 Scientific Computing lab: 02

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Ques.1

- To execute my .py file
Run `$python3 180123029_Naman_q1.py` on the terminal. The snapshot is given below



```
~/Desktop/sci_lab/lab02 python3 180123029_Naman_q1.py
-----Q1-----
The Actual Value for x = 0.25 is %.10f 1.2840254166877414
The Actual Value for x = 0.75 is %.10f 2.117000016612675

Part I --->
The Approx Value of f(0.25) using Lagrange Interpolation is 1.3243606354

Part II --->
The Approx Value of f(0.75) using Lagrange Interpolation is 2.1835015496

Part III --->
The Approx Value of f(0.25) using Lagrange Interpolation is 1.1527742907
The Approx Value of f(0.75) using Lagrange Interpolation is 2.0119152049

By observations we can see that I and II approximations are better as compared to III
-----
~/Desktop/sci_lab/lab02 |
```

- From **observations**, we can see that **Linear Approximation** is better than **Quadratic Approximation**. Generally, quadratic is better than linear approximations. But specific in this problem the **nature of the graph** is that it is **closer to the linear curve** as compared to the **quadratic curve**.
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Ques.2

- To execute my .py file
Run `$python3 180123029_Naman_q2.py` on the terminal. The snapshot is given below

```
~/Desktop/sci_lab/lab02 python3 180123029_Naman_q2.py ✓ 132
-----Q2-----

Part I --->
Chosen Interval = [8.3, 8.6]
The Approximate value of f(8.4) with degree 1 Lagrange Interpolation is 17.8783300000

Chosen Interval = [8.1, 8.3, 8.6]
The Approximate value of f(8.4) with degree 2 Lagrange Interpolation is 17.8771300000

Chosen Interval = [8.1, 8.3, 8.6, 8.7]
The Approximate value of f(8.4) with degree 3 Lagrange Interpolation is 17.8771425000

Part II --->
Chosen Interval = [-0.5, -0.25]
The Approximate value of f(-1/3) with degree 1 Lagrange Interpolation is 0.2150416667

Chosen Interval = [-0.5, -0.25, 0]
The Approximate value of f(-1/3) with degree 2 Lagrange Interpolation is 0.1698888889

Chosen Interval = [-0.75, -0.5, -0.25, 0]
The Approximate value of f(-1/3) with degree 3 Lagrange Interpolation is 0.1745185185

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~/Desktop/sci_lab/lab02 | ✓ 133
```

Ques.3

- To execute my .py file
Run **\$python3 180123029_Naman_q3.py** on the terminal. The snapshot is given below

```
~/Desktop/sci_lab/lab02 python3 180123029_Naman_q3.py
-----Q3-----

The Actual Value of f(0.9) is 0.444858
The Expected value of f(0.9) using degree 2 Lagrange Interpolation is 0.487982
The Max Absolute Error is 0.043124
The Max Relative Error is 9.693942%

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~/Desktop/sci_lab/lab02 |
```

Ques.4

- To execute my .py file
Run **\$python3 180123029_Naman_q4.py** on the terminal. The snapshot is given below

```

~/Desktop/sci lab/lab02 python3 180123029_Naman_q4.py
-----Q4-----
The Actual Value of f(1.09) is 0.2826
The Expected value of f(1.09) using degree 3 Lagrange Interpolation is 0.2826
The Max Absolute Error is 0.0000
The Max Relative Error is 0.0027%
-----
~/Desktop/sci lab/lab02 |

```

Ques.5

- To execute my .py file
Run `$python3 180123029_Naman_q5.py` on the terminal. The snapshot is given below

```

~/Desktop/sci lab/lab02 python3 180123029_Naman_q5.py
-----Q5-----
Actaul Value for z = 0.00 is 0.00 ,Lagrange : -0.00 ,Monomial : -0.00 ,Newton : -0.00
Actaul Value for z = 0.01 is 0.01 ,Lagrange : 0.01 ,Monomial : 0.01 ,Newton : 0.01
Actaul Value for z = 0.02 is 0.02 ,Lagrange : 0.02 ,Monomial : 0.02 ,Newton : 0.02
Actaul Value for z = 0.03 is 0.03 ,Lagrange : 0.03 ,Monomial : 0.03 ,Newton : 0.03
Actaul Value for z = 0.04 is 0.05 ,Lagrange : 0.05 ,Monomial : 0.05 ,Newton : 0.05
Actaul Value for z = 0.05 is 0.06 ,Lagrange : 0.06 ,Monomial : 0.06 ,Newton : 0.06
Actaul Value for z = 0.06 is 0.07 ,Lagrange : 0.07 ,Monomial : 0.07 ,Newton : 0.07
Actaul Value for z = 0.07 is 0.08 ,Lagrange : 0.08 ,Monomial : 0.08 ,Newton : 0.08
Actaul Value for z = 0.08 is 0.09 ,Lagrange : 0.09 ,Monomial : 0.09 ,Newton : 0.09
Actaul Value for z = 0.09 is 0.10 ,Lagrange : 0.10 ,Monomial : 0.10 ,Newton : 0.10
Actaul Value for z = 0.10 is 0.11 ,Lagrange : 0.11 ,Monomial : 0.11 ,Newton : 0.11
Actaul Value for z = 0.11 is 0.12 ,Lagrange : 0.13 ,Monomial : 0.13 ,Newton : 0.13
Actaul Value for z = 0.12 is 0.13 ,Lagrange : 0.14 ,Monomial : 0.14 ,Newton : 0.14
Actaul Value for z = 0.13 is 0.15 ,Lagrange : 0.15 ,Monomial : 0.15 ,Newton : 0.15
Actaul Value for z = 0.14 is 0.16 ,Lagrange : 0.16 ,Monomial : 0.16 ,Newton : 0.16
Actaul Value for z = 0.15 is 0.17 ,Lagrange : 0.17 ,Monomial : 0.17 ,Newton : 0.17
Actaul Value for z = 0.16 is 0.18 ,Lagrange : 0.18 ,Monomial : 0.18 ,Newton : 0.18
Actaul Value for z = 0.17 is 0.19 ,Lagrange : 0.19 ,Monomial : 0.19 ,Newton : 0.19
Actaul Value for z = 0.18 is 0.20 ,Lagrange : 0.20 ,Monomial : 0.20 ,Newton : 0.20
Actaul Value for z = 0.19 is 0.21 ,Lagrange : 0.21 ,Monomial : 0.21 ,Newton : 0.21
Actaul Value for z = 0.20 is 0.22 ,Lagrange : 0.23 ,Monomial : 0.23 ,Newton : 0.23
Actaul Value for z = 0.21 is 0.23 ,Lagrange : 0.24 ,Monomial : 0.24 ,Newton : 0.24

```

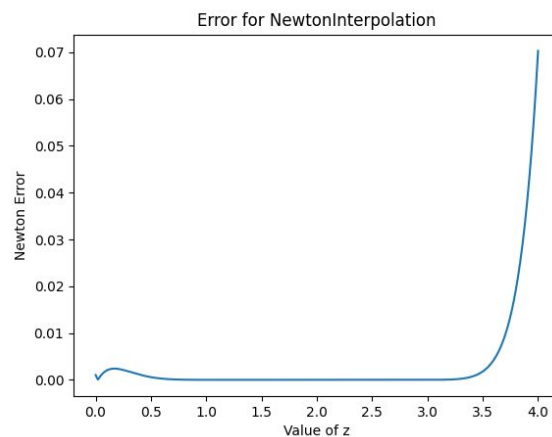
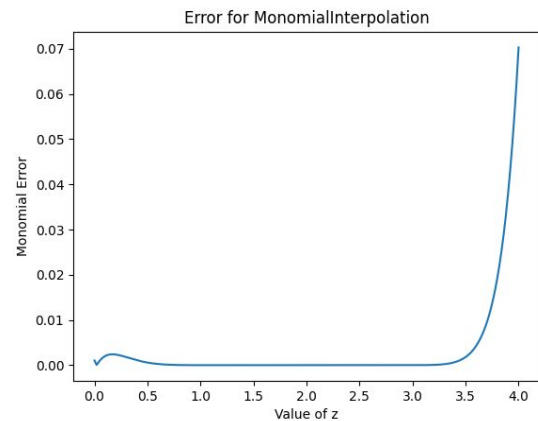
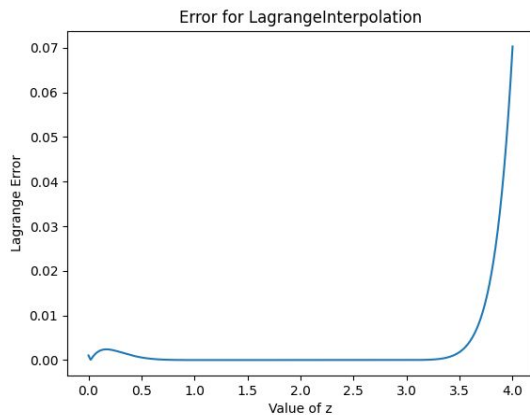


```

Actaul Value for z = 3.79 is 1.00 ,Lagrange : 0.98 ,Monomial : 0.98 ,Newton : 0.98
Actaul Value for z = 3.80 is 1.00 ,Lagrange : 0.98 ,Monomial : 0.98 ,Newton : 0.98
Actaul Value for z = 3.81 is 1.00 ,Lagrange : 0.98 ,Monomial : 0.98 ,Newton : 0.98
Actaul Value for z = 3.82 is 1.00 ,Lagrange : 0.98 ,Monomial : 0.98 ,Newton : 0.98
Actaul Value for z = 3.83 is 1.00 ,Lagrange : 0.98 ,Monomial : 0.98 ,Newton : 0.98
Actaul Value for z = 3.84 is 1.00 ,Lagrange : 0.97 ,Monomial : 0.97 ,Newton : 0.97
Actaul Value for z = 3.85 is 1.00 ,Lagrange : 0.97 ,Monomial : 0.97 ,Newton : 0.97
Actaul Value for z = 3.86 is 1.00 ,Lagrange : 0.97 ,Monomial : 0.97 ,Newton : 0.97
Actaul Value for z = 3.87 is 1.00 ,Lagrange : 0.97 ,Monomial : 0.97 ,Newton : 0.97
Actaul Value for z = 3.88 is 1.00 ,Lagrange : 0.97 ,Monomial : 0.97 ,Newton : 0.97
Actaul Value for z = 3.89 is 1.00 ,Lagrange : 0.96 ,Monomial : 0.96 ,Newton : 0.96
Actaul Value for z = 3.90 is 1.00 ,Lagrange : 0.96 ,Monomial : 0.96 ,Newton : 0.96
Actaul Value for z = 3.91 is 1.00 ,Lagrange : 0.96 ,Monomial : 0.96 ,Newton : 0.96
Actaul Value for z = 3.92 is 1.00 ,Lagrange : 0.96 ,Monomial : 0.96 ,Newton : 0.96
Actaul Value for z = 3.93 is 1.00 ,Lagrange : 0.95 ,Monomial : 0.95 ,Newton : 0.95
Actaul Value for z = 3.94 is 1.00 ,Lagrange : 0.95 ,Monomial : 0.95 ,Newton : 0.95
Actaul Value for z = 3.95 is 1.00 ,Lagrange : 0.95 ,Monomial : 0.95 ,Newton : 0.95
Actaul Value for z = 3.96 is 1.00 ,Lagrange : 0.94 ,Monomial : 0.94 ,Newton : 0.94
Actaul Value for z = 3.97 is 1.00 ,Lagrange : 0.94 ,Monomial : 0.94 ,Newton : 0.94
Actaul Value for z = 3.98 is 1.00 ,Lagrange : 0.94 ,Monomial : 0.94 ,Newton : 0.94
Actaul Value for z = 3.99 is 1.00 ,Lagrange : 0.93 ,Monomial : 0.93 ,Newton : 0.93
Actaul Value for z = 4.00 is 1.00 ,Lagrange : 0.93 ,Monomial : 0.93 ,Newton : 0.93
-----
~/Desktop/sci lab/lab02

```

- The Error Graphs obtained are shown below:



- Based on the results, I **don't** recommend to **approximate erf** using **Polynomial Interpolation** as the error is more outside the points [1,3].
- The error between curves obtained are shown below:

