

MA322 Scientific Computing lab: 04

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

Ques.1

```
~/Desktop/src/lab/lab04 python3 180123029_NamanGoyal.py
-----Q1-----

Part I ----->
Approx Value of the Integral using MidPoint Method: 0.7404804897
Approx Value of the Integral using Trapezoidal Method: 0.3926990817
Approx Value of the Integral using Simpson Method: 0.6245533537

Part II ----->
Approx Value of the Integral using MidPoint Method: 0.6283185307
Approx Value of the Integral using Trapezoidal Method: 1.7453292520
Approx Value of the Integral using Simpson Method: 1.0006554378

Part III ----->
Approx Value of the Integral using MidPoint Method: 0.7788007831
Approx Value of the Integral using Trapezoidal Method: 0.6839397206
Approx Value of the Integral using Simpson Method: 0.7471804289
-----
```

- The values corresponding to the MidPoint, Trapezoidal, Simpson are given above in the snapshot.
-

Ques.2

```
-----Q2-----

Part I ----->
Approx Value of Integral using Trapezoidal Method: 7.5000000000

Part II ----->
Approx Value of Integral using Simpson Method: 7.1666666667
-----
```

- In this case, the value of c can be taken to be 1.5 because $a = 1$, $b = 2$, and hence the midpoint would be 1.5.
-

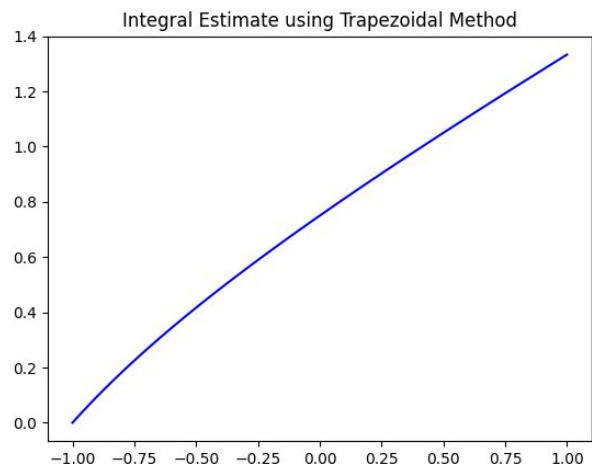
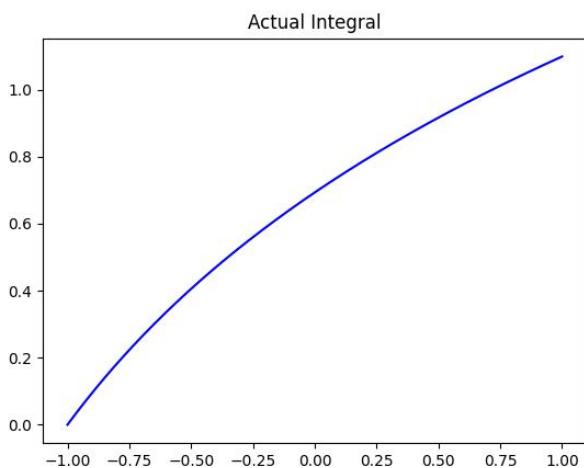
Ques.3

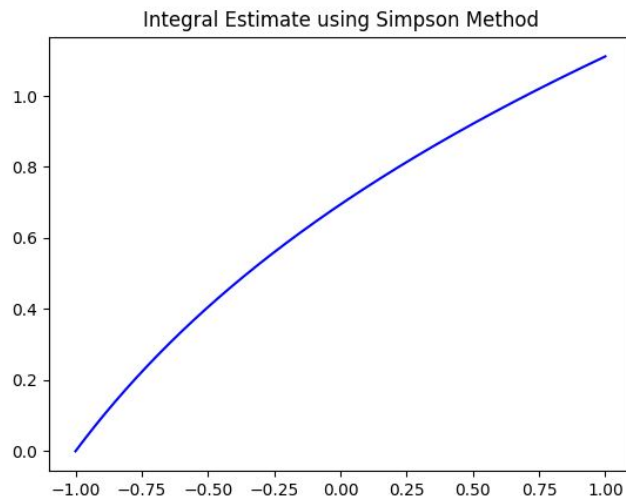
```
-----Q3-----  
Approx Value of Integral using Composite Simpson Method: 0.5235987756  
Approx Value of Integral using Composite Trapezoid Method: 0.5235987756  
-----
```

Ques.4

```
-----Q4-----  
Approx Value of Integral using Trapezoidal Method: 1.3333333333  
Approx Value of Integral using Simpson Method: 1.1111111111  
-----
```

- The plots obtained of Trapezoidal and Simpson comparison are shown below:





- We can see that Simpson one is closer to Actual as compared to Trapezoidal.
-

Ques.5

-----Q5-----

Part I ----->
Composite Trapezoidal:
n: 46
h: 0.0434782609
Approx Value: 0.4054705778

Part II ----->
Composite Simpson:
n: 6
h: 0.3333333333
Approx value: 0.4054663746

Part III ----->
Composite Midpoint:
n: 65
h: 0.0307692308
Approx Value: 0.4054633502

- The values of n & h for different Methods are shown in the above snapshot.
-

Ques.6

```
-----Q6-----  
  
Part I ----->  
      h/2          T(h/2)          L(T)  
1.5000000000      0.9173076923      0.5094339623  
0.7500000000      1.0970043616      0.1638067045  
0.3750000000      1.1384585664      0.0364125722  
0.1875000000      1.1481180340      0.0084133053  
0.0937500000      1.1505008862      0.0020711433  
0.0468750000      1.1510947524      0.0005159143  
0.0234375000      1.1512431055      0.0001288634  
0.0117187500      1.1512801867      0.0000322087  
0.0058593750      1.1512894566      0.0000080517  
0.0029296875      1.1512917740      0.0000020129  
0.0014648438      1.1512923534      0.0000005032  
Number of Functional Evaluations: 2049
```

```
Part II ----->  
      h/2          T(h/2)          L(T)  
0.4750000000      5.8922619048      0.6928982726  
0.2375000000      4.0836933187      0.4428757120  
0.1187500000      3.3570758478      0.2164435669  
0.0593750000      3.1017719812      0.0823090376  
0.0296875000      3.0241335026      0.0256729667  
0.0148437500      3.0029962433      0.0070387232  
0.0074218750      2.9975598200      0.0018136163  
0.0037109375      2.9961899090      0.0004572177  
0.0018554687      2.9958467297      0.0001145517  
0.0009277344      2.9957608905      0.0000286535  
0.0004638672      2.9957394280      0.0000071644  
0.0002319336      2.9957340622      0.0000017912  
0.0001159668      2.9957327207      0.0000004478  
Number of Functional Evaluations: 8193
```



```

Part III ----->
For m = 0.500000
      h/2          T(h/2)          L(T)
0.7853981634      1.8549591311      0.0221890424
0.3926990817      1.8540752278      0.0004767354
0.1963495408      1.8540746773      0.0000002969
Number of Functional Evaluations: 9

For m = 0.800000
      h/2          T(h/2)          L(T)
0.7853981634      2.2847455921      0.1124222561
0.3926990817      2.2576215270      0.0120144430
0.1963495408      2.2572054615      0.0001843277
0.0981747704      2.2572053268      0.0000000596
Number of Functional Evaluations: 17

For m = 0.950000
      h/2          T(h/2)          L(T)
0.7853981634      3.2328552103      0.3294147895
0.3926990817      2.9426673463      0.0986138866
0.1963495408      2.9089732769      0.0115828047
0.0981747704      2.9083375614      0.0002185838
0.0490873852      2.9083372484      0.0000001076
Number of Functional Evaluations: 33
-----

```

- The table and total no of functional evaluations are shown in the above snapshot.

Ques.7

```

-----Q7-----
Approx Value of Integral using Composite Trapezoidal (with Inexact Function Evaluations): 0.254975
Error (with inexact function evaluations): 0.009637
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~/Desktop/sci Lab/Lab04

```

- Some proofs are attached with the submission file also after then the code is written.