Scientific Computing Lab 02

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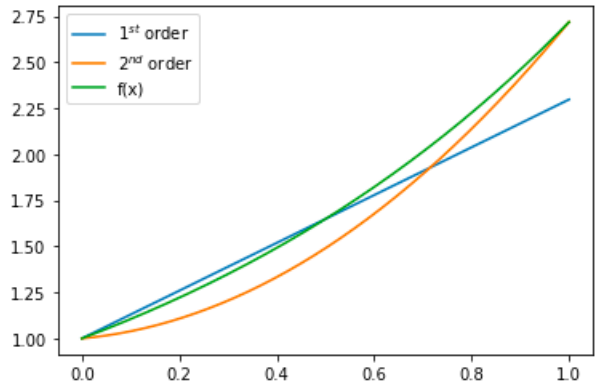
Problem 1:

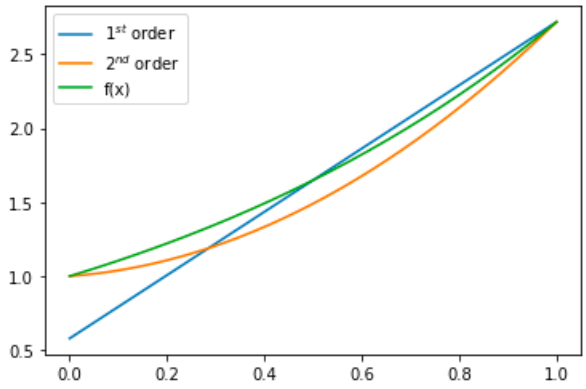
Output:

```
Part (i):
For x0 = 0 and x1 = 0.5, we have approximation = 1.324360635350064 while f(0.25) =
1.2840254166877414
Absolute Error = 0.0403352186623227

 Part (ii):
For x0 = 0.5 and x1 = 1, we have approximation = 2.183501549579587 while f(0.75) =
2.117000016612675
Absolute Error = 0.06650153296691208

 Part (iii):
For x0 = 0, x1=1 and x2 = 2, we have approximation = 1.1527742906760838 while f(0.25) =
1.2840254166877414
Absolute Error = 0.13125112601165756
For x0 = 0, x1=1 and x2 = 2, we have approximation = 2.0119152049056064 while f(0.75) =
2.117000016612675
Absolute Error = 0.1050848117070684
```





Graphs are with respect part(iii)

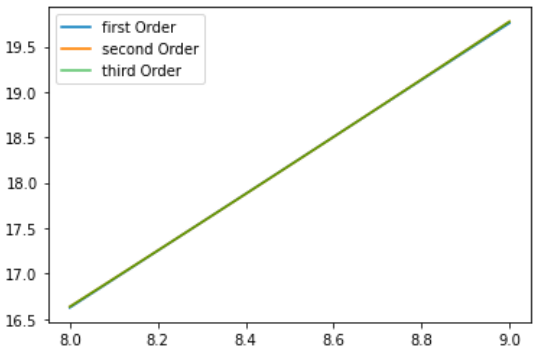
(iv) Observation: We see that 1st order approximation is bette. As, it is evident from graph that proximity to the root is much better in case of 1st order approximation.

Problem 2:

Output:

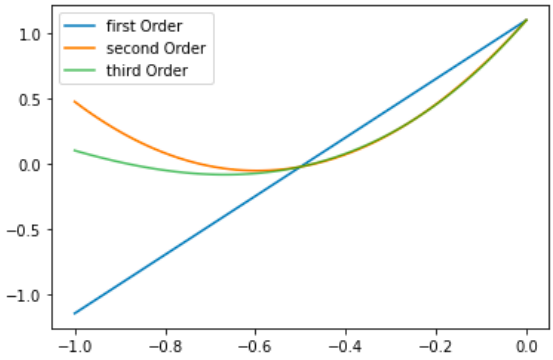
```
Part (i):


all the plot is overlapping:
```




```
firstOrder with endpoints 8.3,8.6 : approx = 17.87833
secondOrder with endpoints 8.1,8.3,8.6 : approx = 17.877129999999998
thirdOrder with endpoints 8.1,8.3,8.6,8.7 : approx = 17.8771425
```

Part (ii)




```
firstOrder with endpoints -0.5,0 : approx = 0.35050000000000003
secondOrder with endpoints -0.5,-0.25,0 : approx = 0.1698888888888889
thirdOrder with endpoints -0.75,-0.5,-0.25,0 : approx = 0.17451851851851857
```

Problem 3:

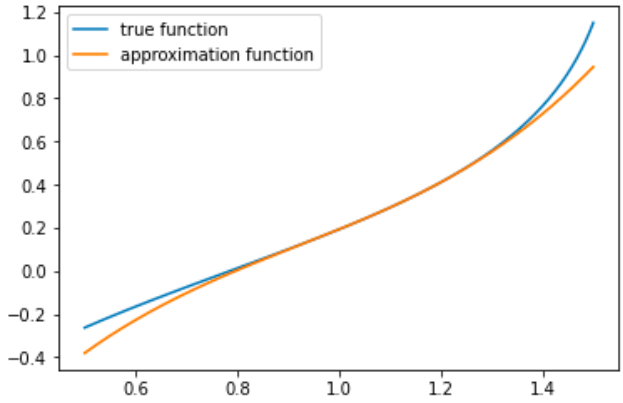
Output:

```
second Polynomial approximation for f(0.9) = 0.487982
true value f(0.9) = 0.444858
absolute error = 0.043124
```

Problem 4:

Output:

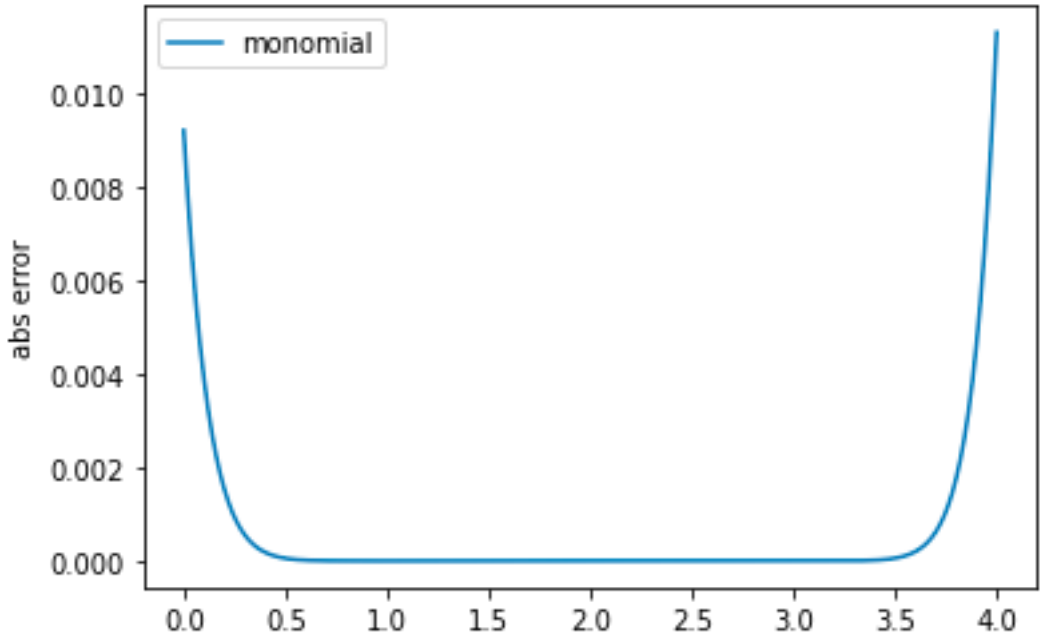
```
approximation of f(1.09) = 0.2826
```



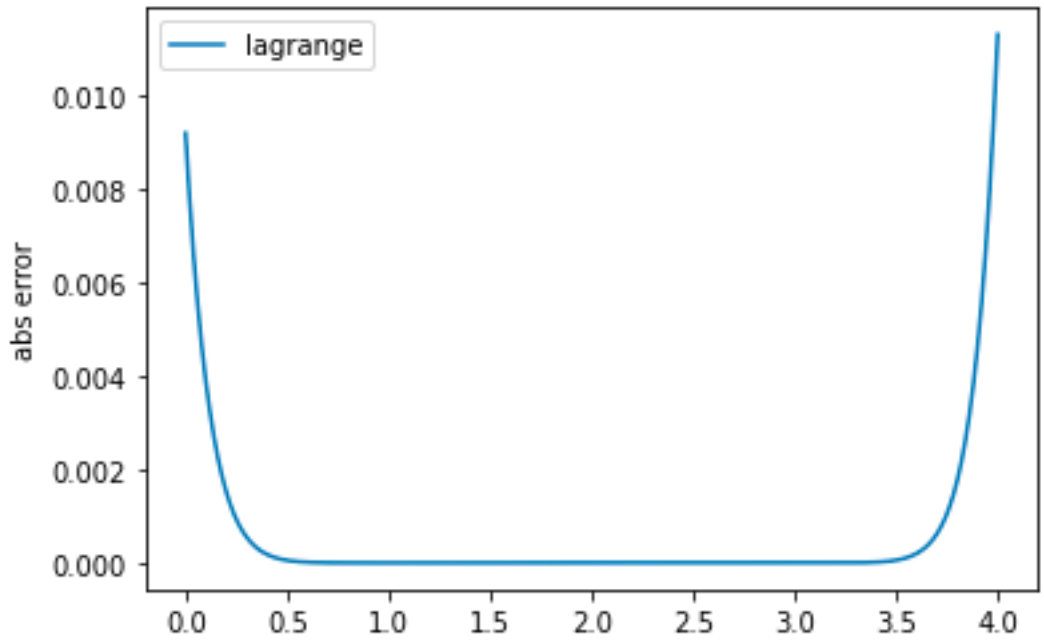

```
error in approximation of f(1.09) = 7.714e-06
max error as bound in the interval [0.5,1.5] = 0.2044
average absolute error in the interval [0.5,1.5] = 0.027
```

Problem 5:

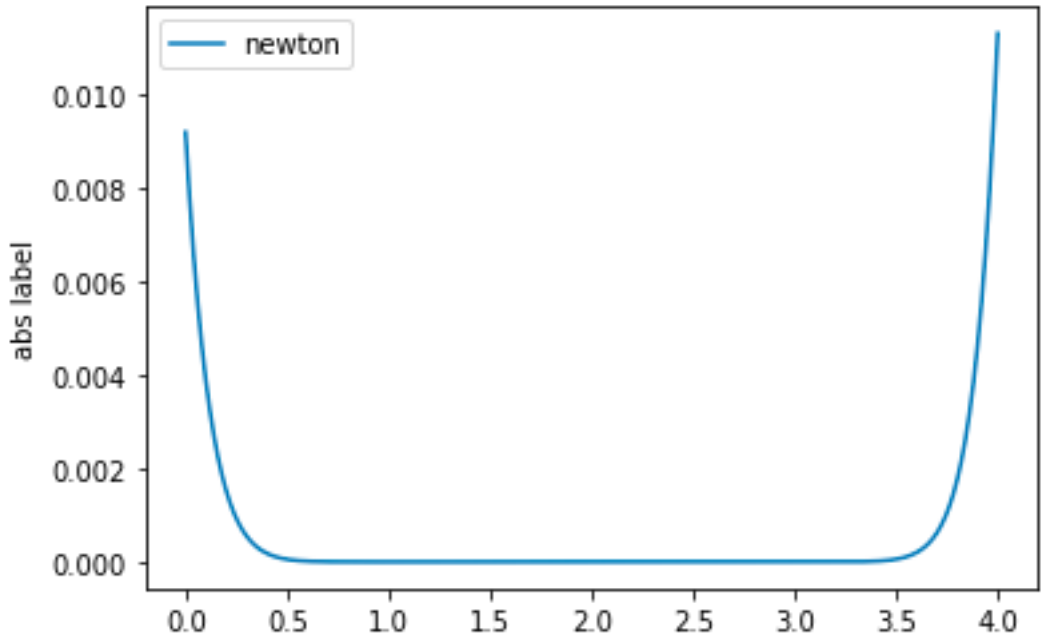
```
Part (i): Monomial basis
max abs error = 0.011281917623777504
```



```
Part (ii): Lagrange basis
max abs error = 0.011291485679479907
```




```
Part (iii): Newton basis
max abs error = 0.011291604217375628
```



Observation:

We see that error go wild beyond 3.5 and before 0.5 so, yes we don't recommend to interpolate beyond [1,3]

Also, in terms of absolute error Monomial Basis is best , Lagrange better and Newton worse!