Numerical Computing Lab 1
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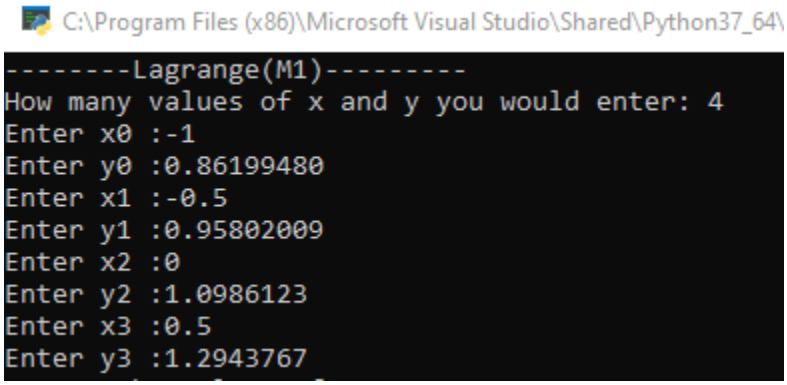
These are some of the questions from our course book in order to help understand the working of our program. The screenshots show input format and outputs for some problems. All methods are coded in different files and will run separately.
Selected methods for Lab 1: M1, M2 and M3.

Ex 3.1:

Q 6(d): Third degree polynomial using lagrange(M1):

$f(0.25)$ if $f(-1) = 0.86199480$, $f(-0.5) = 0.95802009$, $f(0) = 1.0986123$, $f(0.5) = 1.2943767$

Input: Number of coordinates and their values are input with value of x to be found.



Answer: Input values of x and y are listed. The final equation is output with subsequent powers of x along with the answer of y required at given x value.

```
-------The values of x are-------
[-1.0, -0.5, 0.0, 0.5]
-------The values of y are-------
[0.8619948, 0.95802009, 1.0986123, 1.2943767]
Enter the value of x to find y for: 0.25
The simplified lagrange equation is:
                    3                          2
0.01414035999999996x  + 0.1103443799999999x  + 0.33282152x + 1.0986123
The answer of y is: 1.1889351
Press any key to continue . . .
```

Ex 3.3:

Example 1: Divided difference table (M2):

Example 1 Complete the divided difference table for the data used in Example 1 of Section 3.2, and reproduced in Table 3.10, and construct the interpolating polynomial that uses all this data.

Table 3.10

x	$f(x)$
1.0	0.7651977
1.3	0.6200860
1.6	0.4554022
1.9	0.2818186
2.2	0.1103623

Solution The first divided difference involving x_0 and x_1 is

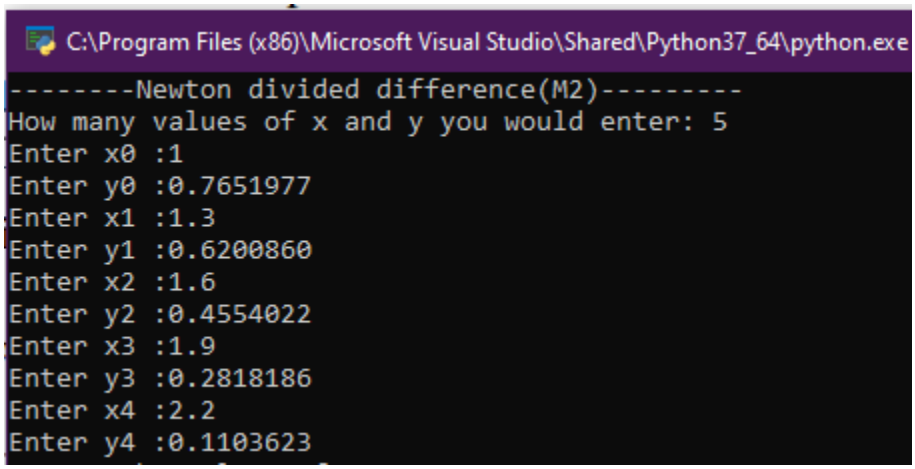
$$f[x_0, x_1] = \frac{f[x_1] - f[x_0]}{x_1 - x_0} = \frac{0.6200860 - 0.7651977}{1.3 - 1.0} = -0.4837057.$$

The remaining first divided differences are found in a similar manner and are shown in the fourth column in Table 3.11.

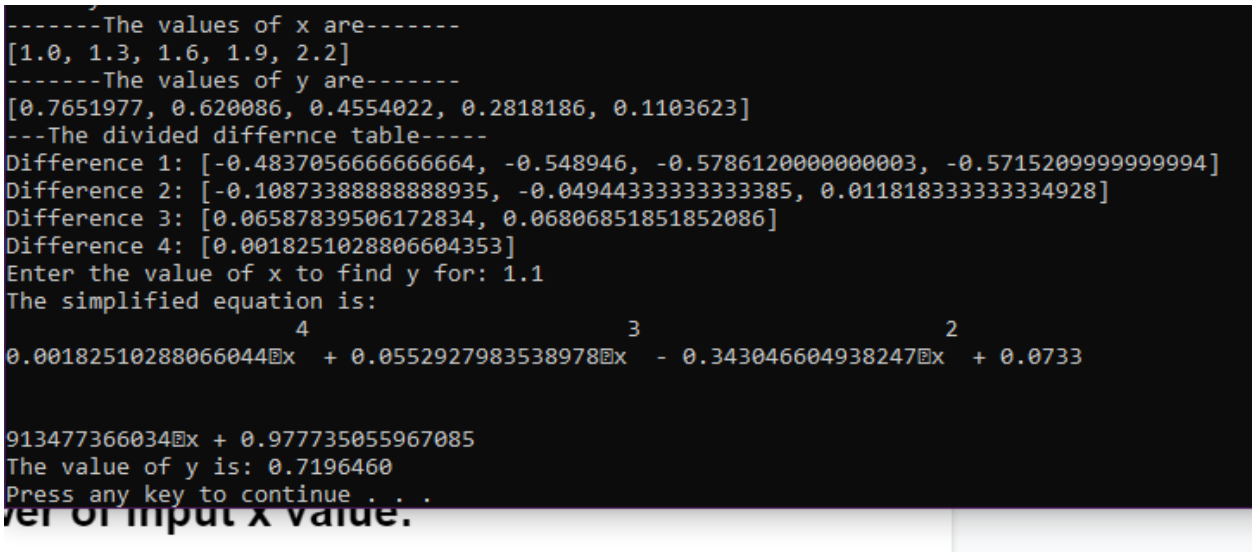
Table 3.11

i	x_i	$f[x_i]$	$f[x_{i-1}, x_i]$	$f[x_{i-2}, x_{i-1}, x_i]$	$f[x_{i-3}, \ldots, x_i]$	$f[x_{i-4}, \ldots, x_i]$
0	1.0	0.7651977				
			−0.4837057			
1	1.3	0.6200860		−0.1087339		
			−0.5489460		0.0658784	
2	1.6	0.4554022		−0.0494433		0.0018251
			−0.5786120		0.0680685	
3	1.9	0.2818186		0.0118183		
			−0.5715210			
4	2.2	0.1103623				

Input: 5 coordinates:



Answer: Divided Difference table with polynomial and answer of input x value:



Ex 3.3:

Q3(d): Newton's forward difference table(M3), with polynomial and required x value.

$f(0.25)$ if $f(0.1) = -0.62049958$, $f(0.2) = -0.28398668$, $f(0.3) = 0.00660095$, $f(0.4) = 0.24842440$

Input:

```
C:\Program Files (x86)\Microsoft Visual Studio\Shared\Python37_64\python.exe
Code to calculate the newton forward difference
How many numbers of x and y you would enter: 4
Enter x0 :0.1
Enter y0 :-0.62049958
Enter x1 :0.2
Enter y1 :-0.28398668
Enter x2 :0.3
Enter y2 :0.00660095
Enter x3 :0.4
Enter y3 :0.24842440
```

Answers:

Difference table with 3rd degree polynomial and required value output.

```
-------The values of x are-------
[0.1, 0.2, 0.3, 0.4]
-------The values of y are-------
[-0.62049958, -0.28398668, 0.00660095, 0.2484244]
---The difference table-----
Difference 1: [0.3365129, 0.29058763, 0.24182345]
Difference 2: [-0.04592527, -0.04876418]
Difference 3: [-0.00283891]
Enter the value of x to find y: 0.25
The simplfied equation is:
                     3              2
- 0.473151666666667x  - 2.0123725x  + 4.00196136666667x - 1.00009884
The value of y is: -0.1327748
Press any key to continue . . .
```

Q3(d): Newton's forward difference table(M3), with polynomial and required x value.

Input:

```
C:\Program Files (x86)\Microsoft Visual Studio\Shared\Python37_64\python.exe
Code to calculate the newton backward difference
How many numbers of x and y you would enter: 4
Enter x0 :0.1
Enter y0 :-0.62049958
Enter x1 :0.2
Enter y1 :-0.28398668
Enter x2 :0.3
Enter y2 :0.0066095
Enter x3 :0.4
Enter y3 :0.248442440
```

Answers:

Difference table with 3rd degree polynomial and required value output.

```
-------The values of x are-------
[0.1, 0.2, 0.3, 0.4]
-------The values of y are-------
[-0.62049958, -0.28398668, 0.0066095, 0.24844244]
---The difference table-----
Difference 1: [0.3365129, 0.29059618, 0.24183294]
Difference 2: [-0.04591672, -0.04876324]
Difference 3: [-0.00284652]
Enter the value of x to find y: 0.25
The simplfied equation is:
          3             2
- 0.47442□x  - 2.011184□x  + 4.0016936□x - 1.00008268
The value of y is: -0.1327711
Press any key to continue . . .
```

=> Note that the answer of f(0.25) is almost the same for forward and backward difference methods for this example.