Report for Coding Assignment-7

Computational Methods & Applications

Topic-Partial Differential Equations and Finding Zeros

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Q.1) Explanation:

Finite difference method has been used to find the 1-d heat equation solution with given conditions.

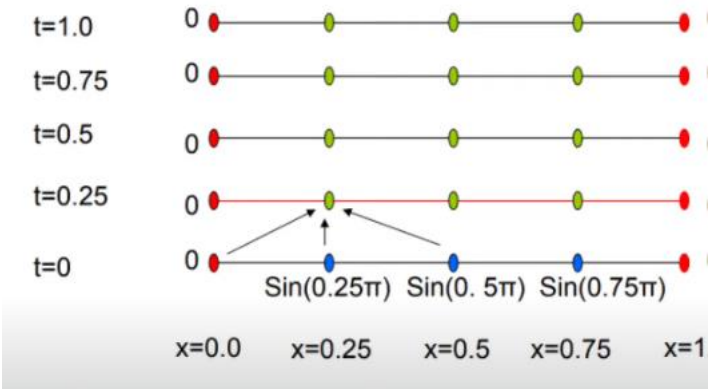
The temperature value at i-unit distance and j unit time is:

$U_{i,j} = \lambda U_{i-1,j-1} + (1-2\lambda)U_{i,j-1} + \lambda U_{i+1,j-1}$.

Where i = 0(h)1 and j= 0(k)1 as $x \in [0, 1]$ and we have taken $t \in [0, 1]$.

$\lambda = k/h^2$.

h is spatial step size, k is time step size.



Here h = 0.25, k= 0.25 and initial condition is Sin(πx)

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Q.2) Explanation:

Finite difference method has been used to find the 2-d heat equation solution with given conditions and source function.

Q.3)Output:

```
answer=nth_root(n=2,a=-4,eps=0.01)

print(answer)
```

Result:

```
('cannot find the', 2, '-th root of', -4, 'as', -4, 'is negative')
```

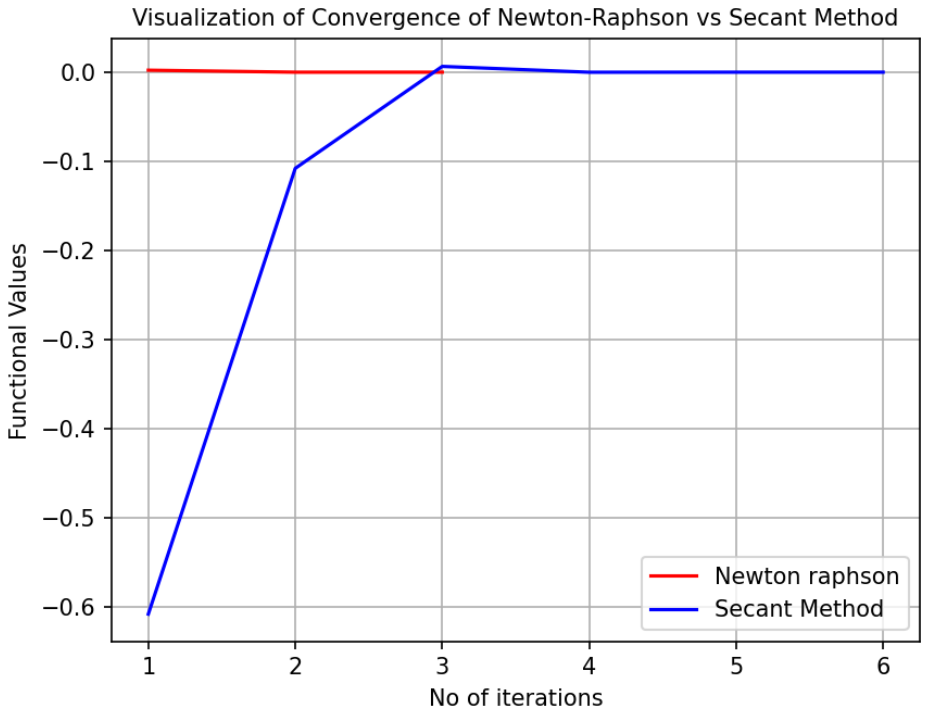
```
answer=nth_root(n=2,a=5,eps=0.01)
print(answer)
```

Result:

```
The 2-th root of 5 with 0.01 tolerance is 2.236328125
```

Q.4)Output:

Here we have taken $f(x) = x^2 + \sin(x) - 2$.



Q.5) The formula has been used here is :

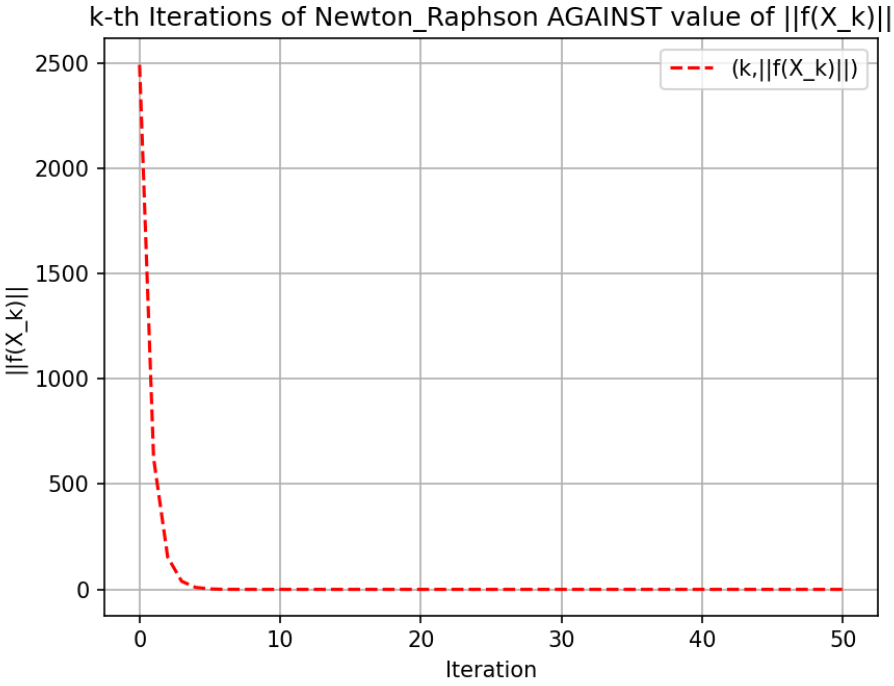
If $F : \mathbb{R}^k \to \mathbb{R}^k$ multivariate vector-valued function, then the iteration is given by

$$x_{k+1} = x_k - J(x_k)^{-1} F(x_k)$$

where $J(x_k)$ is the **Jacobian matrix** of F.

Output:

```
The root of the function is [ 0.83328161  0.03533462 -0.49854928]
```



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Q.6)Output:

```
q = Polynomial()

q.printRoots([1, 3, 5, 7, 9])
```

Output:

```
The approximated roots_list are :
7.00000000000004
5.000000000000032
2.9999999999999893
1.0
8.999999999999961
All roots are with in an error 10^-3
```

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Q.7)Input:

```
function=lambda x: np.tan(x)
a=-np.pi / 2                #interval [a,b]
b=4 * np.pi / 3
All_Roots(function,a,b )
```

Output:

```
All roots are with in an error 10^-3
Roots in the interval[ -1.5707963267948966 4.1887902047863905 ] are :
 [-3.1415926536]
```

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