Python Classes – Exercises Set 8

Vetrivel V

- Write the following using Python Classes
  - Create a child class from the previous matrix and name it as Square matrix
    - Finding trace
    - Finding determinant (only for 3x3)
      - Use recursion to compute for higher dimensions
    - Find the inverse of A

- Write the following using Python Classes
  - Create a vector class
    - Do all possible vector operations
    - Use Matrix class and vector class to define matrix vector product

- Write the following using Python Classes
  - Consider the interval $[-\pi, \pi]$. Get an integer input N from user. Using Python program compute and output N points with equal distance between adjacent points. Store the output in an array. That is, $x_0, x1_1, x_2, \ldots, x_{N-1}$ such that

$$x_i + 1 - x_i = x_1 - x_0 = dx, \forall i.$$

- Consider the following two function f and g
  - $f(x,n) = x^2 \cos nx$
  - $g(x,n) = x^2 \sin nx$
  - Use the matrix class created in Exercise 19. Compute the values of $f(x_i,n)$ and $g(x_i,n)$, where n can be any integer between 0 and 20, $x_i's$ are from Exercise 22. Store the values of $f(x_i,n)$ in a matrix $F_{N\times 21}$
  - Store the values of $g(x_i,n)$ in a matrix $G_{N\times 21}$

- Compute the following expression

$$a_0 = \frac{dx}{2\pi}\sum_{i=0}^{N-1} F_{i0}$$

$$a_n = \frac{dx}{\pi}\sum_{i=0}^{N-1} F_{in}, n = 1,2,\cdots,20$$

$$b_n = \frac{dx}{\pi}\sum_{i=0}^{N-1} G_{in}, n = 0,1,2,\cdots,20$$

Save $a = (a_0, a_1, \cdots, a_{20})$ and b $= (b_0, b_1, \cdots, b_{20})$ in files Avec.dat and bvec.dat

- Compute approximated Fourier Series,

$$h(x) = \sum_{n=0}^{20} a_n \cos nx + b_n \sin nx$$

Where $a_n's$ and $b_n's$ are from Exercise 24

- Verify that when $h(x) = x^2$

$$\pi^2 = h(\pi) \approx \frac{\pi^2}{3} + 4\sum_{n=1}^{20} \frac{1}{n^2}$$

- Plot the graph $h(x) = x^2$ in the interval $[-\pi, \pi]$
- Plot the graph $s(x)$ against x

$$s(x) = \sum_{n=0}^{k} a_n \cos nx + b_n \sin nx$$

End of Python Classes