

## IDC 101 : Introduction to computation

### Lab Exercise 6

*Note* : Use function construct to solve all the problems given below.

1) Compute the value of the following function

$$f(x) = (\sin x + \cos x)^2$$

for  $x \in [-2\pi, 2\pi]$ . Plot the result using matplotlib.

2) Create an empty list. Fill the list with 10 real numbers. These numbers should be taken as user input. Write a function which will compute the largest and smallest number in the array. The entire array must be passed on to the function.

3) For the problem (2) given above, write a function that will compute the number of positive and negative numbers in the array. The entire array must be passed on to the function.

4) Write a function to compute the following summation :

$$S = \sum_{k=1}^{\infty} \frac{2k^2 - 1}{k(4k^2 - 1)^2}$$

Decide for yourself the criteria for terminating the infinite summation. For comparison, the exact result is  $S = 2 \ln 2$ . Let  $S_N$  represent the finite sum with  $k = 1, 2, \dots, N$ . Compute  $S_N$  and plot  $|S - S_N|$  as a function of  $N$ . What can you infer about the rate of convergence.

5) Compute the following finite sum :

$$S_N = \sum_{k=1}^N \frac{k^2 + k - 1}{(k + 2)!}$$

for values of  $N=5$  and  $N=9$ .

Use function twice; once for computing each term of the summation and factorial should be computed using another function call. For comparison purposes, the exact result of this summation is

$$S_N = \frac{1}{2} - \frac{N + 1}{(N + 2)!}$$

Compute the difference between your computed result and this exact answer.