

### First computer lab.

1. Write a program that computes the machine epsilon.
2. Implement Kahan summation algorithm and discuss its accuracy with examples.
3. Write a program that switches the rounding mode of your computer.
4. Consider the infinite series

$$\zeta(s) = \sum_{k \geq 1} \frac{1}{k^s}.$$

Compute rigorous lower and upper bounds of  $\zeta(s)$  for  $s = 2, 3, 4, 5, 6$ . Are your results tight?

5. Compute rigorous lower and upper bounds of the integrals

$$\int_0^1 e^{\sin(x^2)} dx;$$
$$\int_1^\infty \sin(x^2) x^{-3} dx.$$

6. How many times does the function

$$\sin(x) \cos(x) + \frac{1}{2} - (x+1) \sin\left(\left(x + \frac{1}{2}\right)^2\right) + \exp(-x)$$

vanish in the interval  $[0, 2]$ ?