Mathematics 1 and 2

Day 1, July 5, 3:30-4:30pm
Day 2, July 6, 3:30-4:30pm

An introduction to inequalities

Abstract:

Inequalities are useful in science. For example, one can quantify several phenomena in a mathematical way via inequality. As an example, consider a sequence $(a_k)_{k=1}^{\infty}$ defined by $a_k = (-1)^k$, namely

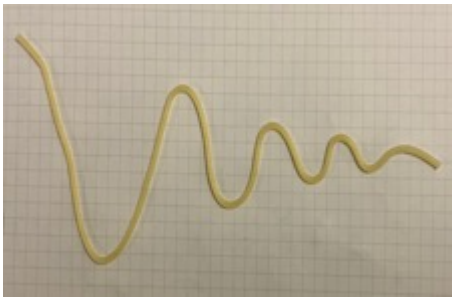
$$a_1 = -1, \quad a_2 = +1, \quad a_3 = -1, \quad a_4 = +1, \quad \ldots.$$

This sequence is an elemental example of "oscillation" phenomenon (plot and visualise this sequence!). Let us quantify it by taking an average. For comparison, consider two types of average :

$$S_K = \frac{1}{K}\sum_{k=1}^{K} a_k, \qquad M_K = \frac{1}{K}\sum_{k=1}^{K} |a_k|, \qquad (K = 1,2,3 \ldots) .$$

Take say $K = 100$ and compare $|S_{100}|$ and M_{100}. Then one eventually finds an inequality: $|S_{100}| = \frac{1}{100} \ll M_{100} = 1$ and the smallness of $|S_{100}|$ reflects an effect of the "oscillation" of $(a_k)_{k=1}^{\infty}$.

This simple example tells us that *one can measure an oscillation phenomenon via an inequality of its average*. I will exhibit few examples of inequalities and explain how they are influencing in several fields of mathematics.



Speaker: *Prof. Shohei Nakamura*

OSAKA UNIVERSITY
School of Science
Graduate School of Science