Surveys in Mathematical Sciences IV (Fall 2013)

Teacher: Jacques Garrigue

Course Subject

Part 2 of the course is "Computability and lambda-calculus".

Purpose

What does it mean to be "computable"? This question first appeared in mathematical logic. Mathematicians, trying to fullfil the Hilbert Project of finding theorems according to rules, discovered problems whose solution could not be automated. To explain this, in 1936, Turing, Kleene and Church gave different definitions of computability, and proved the existence of non-computable functions. Immediately after they proved that those 3 completely different definitions were actually equivalent.

In this lecture we will learn the basics of computability, and the corresponding computational models. In particular we will emphasize Church's lambda-calculus, as it plays an important role in computer science.

Evaluation

Evaluation will be based on a report.
If you wish, you can send it by mail to `garrigue@math.nagoya-u.ac.jp`.

References

We will not use no textbook, but the following books may be of interest to those wishing to know more.

- 高橋 正子, "計算論 計算可能性とラムダ計算", 近代科学社, 1991.
- Neil D. Jones, *Computability and Complexity from a Programming Perspective*. MIT Press, 1995.
- Henk Barendregt, "The lambda-calculus : its syntax and semantics", North-Holland, 1981.

Course Plan

The course shall progress as indicated below

1st lecture (11/5) Turing Machine and Computability

2nd lecture (11/12) Universal Turing Machine and undecidable problems

3rd lecture (11/19) Lambda-calculus and Turing completeness

4th lecture (11/26) Recursive functions

Office Hour

Every Thursday   12:45〜13:45   Math. Bld., Room 405.

Course URL

Course material and other information can be found at the course URL:
   `http://www.math.nagoya-u.ac.jp/~garrigue/lecture/`