

# Curry-Howard seminar S1 2018

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<b>Subject</b>	Logic, categories, programs
<b>When</b>	Thursdays 3pm
<b>Where</b>	Room 107 Peter Hall

The Curry-Howard seminar has as its theme the growing field of connections between logic, category theory and the theory of computation, sometimes referred to as the Curry-Howard correspondence (or by the slogan “formulas-as-types, proofs-as-programs”). In the first semester of the seminar we proved the correspondence between intuitionistic logic, the simply-typed lambda calculus (i.e. functional programs), and Cartesian closed categories (the left hand column below). This semester is about the right hand column:

$$\begin{array}{ccc} \{\text{intuitionistic logic}\} & \hookrightarrow & \{\text{higher-order logic}\} \\ \cong \Big| & & \cong \Big| \\ \{\text{functional programs}\} & \hookrightarrow & \{\text{programs} + \text{equations}\} \\ \cong \Big| & & \cong \Big| \\ \{\text{Cartesian closed categories}\} & \hookrightarrow & \{\text{topoi}\} \end{array}$$

The idea of organising mathematical foundations around adjoint functors is due to Lawvere and is realised concretely in the theory of topoi. In this vein, the primary aim of the seminar this semester is to study the following question:

Q. How can we use adjoint functors and topoi to organise mathematical knowledge?

For this we will work our way through Mac Lane & Moerdijk’s book “Sheaves in Geometry and Logic”. A secondary research aim is to extend the known differentiable structure of the left hand column, given by differential lambda calculus, to the right hand column:

Q. What is differential higher-order logic?