

## Finding People and Information

- Henrik Nilsson  
Room A08, Computer Science Building  
e-mail: [nhn@cs.nott.ac.uk](mailto:nhn@cs.nott.ac.uk)  
tel: 0115 846 6506
- Main module web page (both G54FOP & G54FPP):  
[www.cs.nott.ac.uk/~nhn/G54FOP](http://www.cs.nott.ac.uk/~nhn/G54FOP)

# G54FOP/FPP 2012/13

## Mathematical Foundations of Programming & Mini-Project

### Lecture 1-A

*Administrative Details and Introduction*

Henrik Nilsson

University of Nottingham, UK

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A - p.1/13

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A - p.2/13

## Contacting Me

- I will be available immediately after each lecture for course-related matters.
- E-mail.
- Make an appointment if necessary.

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A - p.3/13

## Aims of G54FOP

- To provide a sound basis in a range of topics in the foundations of programming languages, including aspects of recent and current research. Specifically:
  - Basic lambda calculus
  - Operational semantics
  - Denotational semantics
  - Types and type systems
  - Domain theory

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A - p.4/13

## G54FPP: Optional Mini-Project

- Can only be taken together with G54FOP
- Aim is to provide G54FOP students with the opportunity to deepen their understanding by an in-depth study of a specific topic related to G54FOP.
- Non-exclusive list of suggested topics available via the module web page; additional topics or amended versions can be discussed.

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A – p.5/13

## Organization (1)

- **G54FOP:** Two lectures per week:
  - Thursdays, 11–12, B12, AMEN
  - Fridays, 11–12, B12, AMEN
- **G54FPP:**
  - Written report on a research article/topic.
  - Report deadline: Friday 3 May, 17:00 (CW submission)
  - Presentation (20 + 5 minutes).
  - Presentations towards end of spring semester (2 per lecture); spare G54FOP slots or specially scheduled.

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A – p.6/13

## Organization (2)

- **Assessment:**
  - **G54FOP:**
    - Unseen 2-hour written examination: 100 %
  - **G54FPP:**
    - Written 10-page (3000–4000 words) report: 60 %
    - Presentation: 30 %
    - Participation in class discussions during presentations: 10 %

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A – p.7/13

## Organization (3)

- **Resit assessment:**
  - **G54FOP:** Unseen 2-hour written examination (like first sit)
  - **G54FPP:** Extended, 20-page (7000–8000 words) report.

G54FOP/FPP 2012/13 Mathematical Foundations of Programming & Mini-Project Lecture 1-A – p.8/13

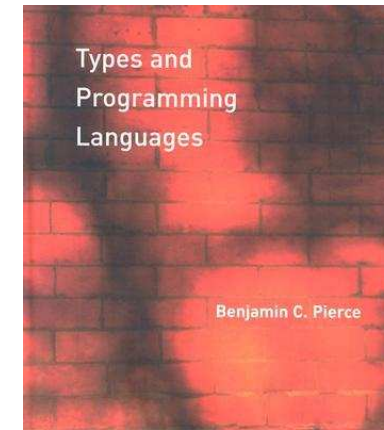
## Literature

- Your own notes from the lectures!
- The lectures will draw from:  
Benjamin C. Pierce. *Types and Programming Languages*, MIT Press, 2002.

A good reference for large parts of the module.

- Other texts on lambda calculus, semantics, etc. I'll make some suggestions as we go along.

## Literature (2)



## Content (1)

- Mathematical preliminaries: formal languages, grammars, induction, inference rules, ...
- Semantics:
  - Operational
  - Denotational
- Lambda calculus
- Type theory
  - Simply-typed lambda calculus
  - Recursive types?
  - Polymorphism (System F)

## Content (2)

With G54FOP as a basis, G54FPP allows you to for example study topics like the following:

- Program analysis
  - Type reconstruction
  - Type and effects systems
  - Abstract interpretation
  - Data-flow analysis
- Program logics and correctness
  - Hoare logic
  - Calculation of programs from specifications

## Your background?

- Discrete mathematics, sets, logic?
- Formal languages, grammars, abstract syntax?
- Mathematical induction?
- Structural induction?
- Functional programming? Haskell?
- Semantics?
- Type theory?