

Parallel Functional Programming

Stephen A. Edwards

Columbia University

Fall 2023



Instructor



Prof. Stephen A. Edwards

sedwards@cs.columbia.edu

<http://www.cs.columbia.edu/~sedwards/>

462 Computer Science Building

Email me for appointments, or just come by

Haskell

```
primes = filterPrime [2..]
  where filterPrime (p:xs) =
        p : filterPrime [x | x <- xs, x `mod` p /= 0]
```

Sieve of Eratosthenes

Purely Functional · Declarative · Lazy · Statically Type-Inferred · Parallel

Sequential Haskell in the first half · Parallel in the second half

Prerequisites

Data structures (COMS W3134, W3137, or equivalent)

- ▶ You must be fluent in at least one programming language



- ▶ You must dream about lists and trees



- ▶ You do **not** need prior experience in a *functional* programming language; that's what this course is for

Assignments and Grading

70 % Homework assignments

30 % Final Project (alone or in pairs)

This is a coding[†] class

The homework must be your own code

The project may be done alone or in pair

[†]More precisely, mostly debugging,
with a little bit of bugging



Collaboration

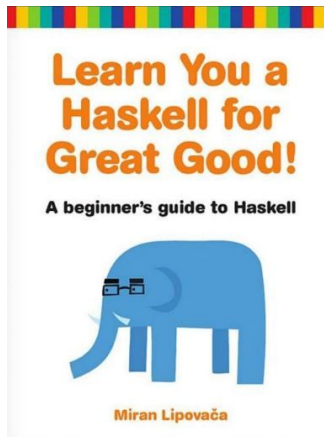
You may seek outside help, including from other students, on homework, but

- ▶ **You must write all** of your own code. No copying or copying-with-modification of any code. No looking at other student's code as reference as you write your own.
- ▶ You must **cite** all people and resources you consulted. For example, you might add a comment like

```
{- I collaborated with Haskell Curry, Jim Backus, Alonzo Church,  
  and Grace Hopper on this assignment, and consulted  
http://hackage.haskell.org/package/base-4.12.0.0/docs/Data-List.html  
https://stackoverflow.com/questions/211216  
http://www.cis.upenn.edu/~cis194/fall16/policies.html  
-}
```

See also <http://www.cs.columbia.edu/education/honesty/>

Recommended Texts



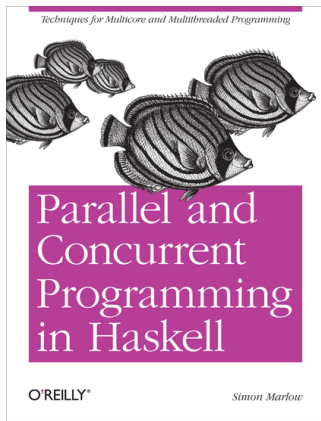
Miran Lipovača.

Learn You a Haskell for Great Good!
No Starch Press, 2001.

<http://learnyouahaskell.com/>

Excellent introductory text. We will be following it for roughly the first half of the class.

Recommended Texts

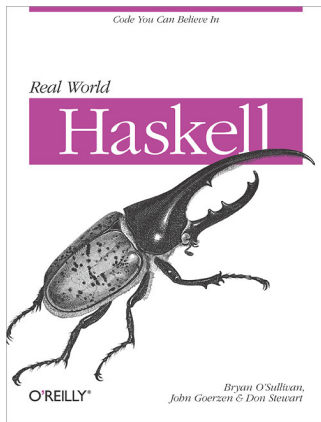


Simon Marlow.
Parallel and Concurrent Programming in Haskell.
O'Reilly, 2013.

<https://simonmar.github.io/pages/pcph.html>

Like its title says. Assumes a reasonable understanding of Haskell. We will be following it for the second half of the class.

Recommended Texts

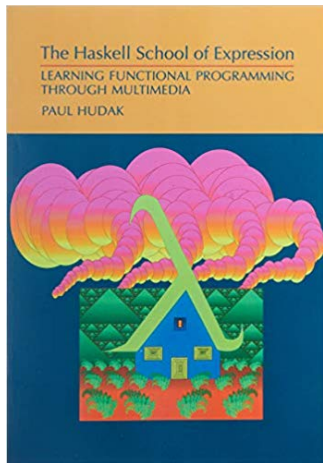


Bryan O'Sullivan, Don Stewart, and John Goerzen.
Real World Haskell.
O'Reilly, 2009.

<http://book.realworldhaskell.org/>

Also an introductory text on Haskell that starts at the beginning, it quickly focuses on practical, real-world aspects of writing Haskell programs, such as elaborate I/O, and interfacing with external libraries.

Recommended Texts



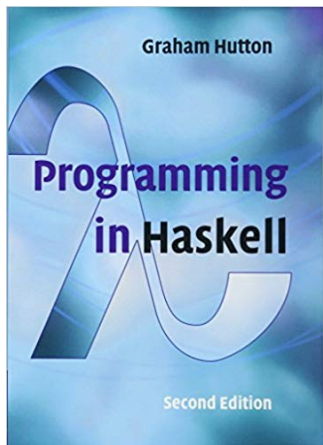
Paul Hudak.

The Haskell School of Expression.
Cambridge University Press, 2000.

<http://www.cs.yale.edu/homes/hudak/SOE/>

An idiosyncratic approach to learning Haskell based on multimedia (graphics, animation, and sound) ultimately leading to domain-specific languages.

Recommended Texts

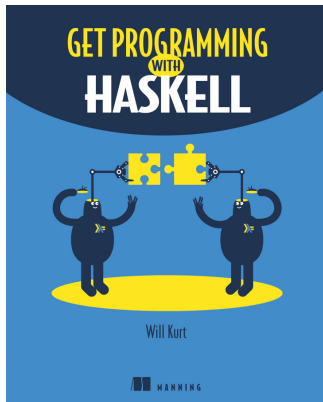


Graham Hutton.
Programming in Haskell.
Second Edition, Cambridge University Press, 2016.

<http://www.cs.nott.ac.uk/~pszgmh/pih.html>

Another introductory Haskell text, this one written by a professor from the University of Nottingham

Recommended Texts



Will Kurt.
Get Programming with Haskell.
Manning, 2018.

[https://www.manning.com/books/
get-programming-with-haskell](https://www.manning.com/books/get-programming-with-haskell)

Another introductory Haskell text, written more like a textbook