

Programming in Real Bioinformatics

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Outline

- 1 Five Programming Languages?
- 2 Software Development Process
- 3 Final Examination

Next

1 Five Programming Languages?

2 Software Development Process

3 Final Examination

Why do we need five programming languages?

Why do we have to learn languages?

- 廣東話
- 普通话
- 客家话
- 上海话
- English
 - England, Scotland, Wales, North Ireland
 - United States
 - Hong Kong
- Hinglish
- ...

Programming Languages

- C: Embedded device, high performance system software
- C++: Embedded device, large-scale software, GUI applications
- Java: Large-scale system, Enterprise systems, cross-platform applications
- Perl: Text processing, biological sequence processing, CGI-programming
- Python: System administration, desktop applications, web development
- R: Data analysis and visualization
- Objective-C: applications on iOS and Mac OS
- Swift: a future programming languages for Apple products
- Go: Google's system programming languages
- Ruby, Scala, Julia, JavaScript, LaTeX ...

The
Pragmatic
Programmers

Seven Languages in Seven Weeks

A Pragmatic
Guide to
Learning
Programming
Languages

Bruce A. Tate

Edited by Jacquelyn Carter



香港中文大學

The Chinese University of Hong Kong

Seven More Languages in Seven Weeks

Languages That Are
Shaping the Future



Bruce A. Tate, Fred Daoud,
Ian Dees, and Jack Moffitt

Foreword by José Valim

Edited by Jacquelyn Carter



香港中文大學

The Chinese University of Hong Kong



Seven Databases in Seven Weeks

A Guide to Modern Databases
and the NoSQL Movement



Eric Redmond
and Jim R. Wilson

Series editor: Bruce A. Tate
Development editor: Jacquelyn Carter



Seven Concurrency Models in Seven Weeks

When Threads Unravel



Paul Butcher

Series editor: Bruce A. Tate
Development editor: Jacquelyn Carter



Seven Web Frameworks in Seven Weeks

Adventures in Better Web Apps



Jack Moffitt
and Fred Daoud

Series editor: Bruce A. Tate
Development editor: Jacquelyn Carter

Interaction between Programming Languages

- C-based: C, C++, Go, R, Perl, Python ...
- Virtual Machine based:
 - JVM: Java, Scala, JPython, Perl 6 ...
 - CLI: C++/CLI, C#, IronPython, F#, VB.NET, PowerShell ...
- Interface: web service, file, database, container ...

- Java and R: rJava
- Perl and R: RSPerl
- Python and R: rpy2
- C/C++ and R: Rcpp
- C and Perl: perl.h
- Java and C/C++: JNI

Example: Integration of R and C++
see rcpp directory.

Next

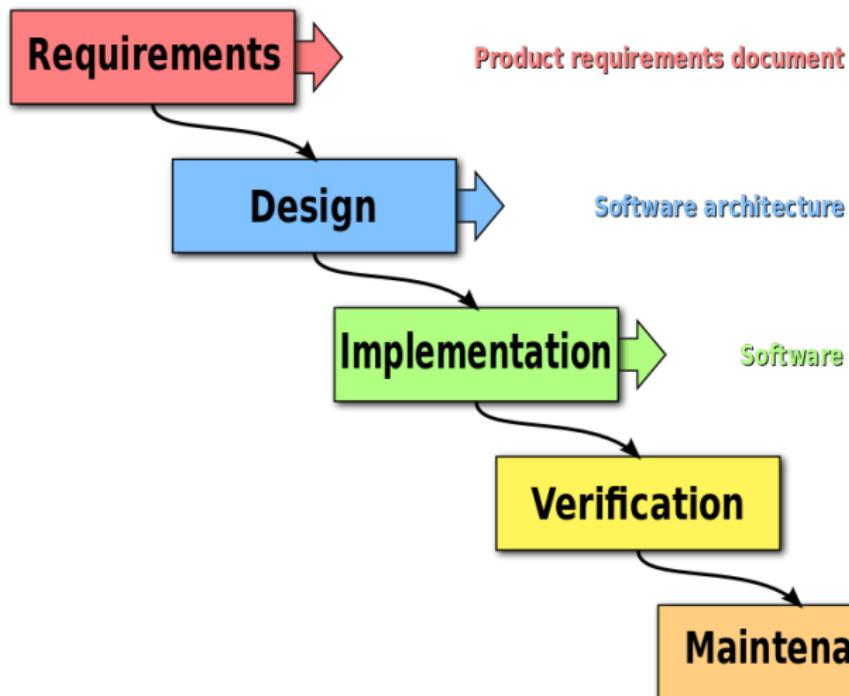
1 Five Programming Languages?

2 Software Development Process

- Waterfall
- Agile Software Development
- Reference

3 Final Examination

Waterfall



Case: Fibonacci Sequence Generator

- Requirements: What is the input? Web based or Command line application?
- Design: technology stack, architecture, user experience ...
- Implementation: only coding? Construction
- Verification: testing, alpha, beta
- Maintenance:

Agile Software Development

Agile Software Development

Agile software development is a group of software development methods in which requirements and solutions evolve through collaboration between self-organizing, cross-functional teams. It promotes adaptive planning, evolutionary development, early delivery, continuous improvement and encourages rapid and flexible response to change.

12 principles of agile software development

- Customer satisfaction by rapid delivery of useful software
- Welcome changing requirements, even late in development
- Working software is delivered frequently (weeks rather than months)
- Close, daily cooperation between business people and developers
- Projects are built around motivated individuals, who should be trusted
- Face-to-face conversation is the best form of communication (co-location)
- Working software is the principal measure of progress
- Sustainable development, able to maintain a constant pace
- Continuous attention to technical excellence and good design
- Simplicity—the art of maximizing the amount of work not done—is essential
- Self-organizing teams
- Regular adaptation to changing circumstances

Why do we need agile software development?

- Stock trading system, military, bank ...
- Desktop softwares ship as floppy disk, CD or DVD ...
- Internet helps us update our software every minutes ...

Agile Methods

- Extreme Programming
- Test Driven Programming
- Scrum
- ...

Agile Practices

- Pair programming
- test-driven
- story-driven modeling
- Iterative and incremental development
- Cross-functional team
- Refactoring
- ...

Practice: Pair Programming

Pair Programming

An agile software development technique in which two programmers work together at one workstation

- Driver: writes codes
- Observer: reviews each line of code as it is typed in.

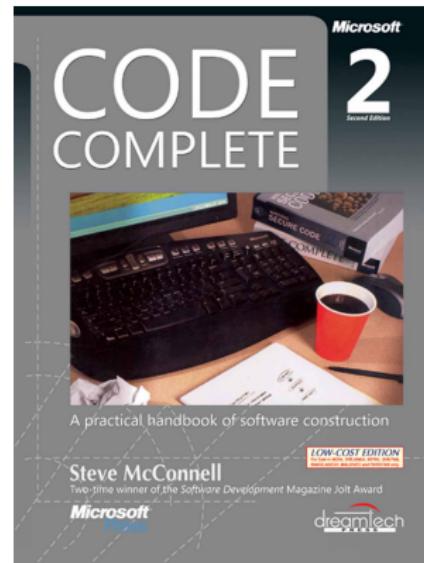
Practice: Pair Programming

Fibonacci Sequence Generator

- Input from command line argument
- Output to screen
- What will happen if the input is less than 1?
- What will happen if the input is more than 2000?
- Who is driver? Who is observer?

Reference

- Code Complete, Second Edition
- <http://www.cc2e.com/>



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Scope

- Basic knowledge of the five programming language
- How to choose a programming language for your work
- Basic knowledge of software engineering

Question Sample

Is it possible to implement object-oriented programming using Perl?

- Yes
- No

Question Sample

Which one is not a OOP system in R?

- S3
- S4
- ROOP
- RC

Question Sample

Assume that your customer needs a website to provide genome annotation service. Choose a programming language for this work and explain the reason.

Tips

- Don't leave blank on your answer sheet.
- Review the slides of this course before exam.
- Finish all assignments as required.

Thanks!