

Raffi Khatchadourian

Ph.D. Candidate

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Objective

To develop techniques, methodologies, theories, and tools that alleviate the burden associated with correctly and efficiently evolving large and complex software systems.

Research Interests

Automated software evolution; Automated refactoring of legacy software; Information retrieval in the context of engineering software; Reasoning, verification, and specification of Aspect-Oriented software.

Education

Ph.D. Computer Science, *Ohio State University*, Expected June 2011.

Thesis: *Techniques for Automated Software Evolution*, Advisor: N. Soundarajan.

Major: Software Methodology; Minors: Distributed Software Systems, Mathematics.

Relevant coursework: Software Engineering, Programming Languages, Computer Architecture, Operating Systems, Analysis of Algorithms, Computability & Unsolvability, Distributed Computing, Mathematical Logic, Set Theory.

Awards: NSF East Asia and Pacific Summer Institutes (EAPSI) Award, CS&E Graduate Teaching Award.

M.S. Computer Science, *Ohio State University*, March 2010.

Visiting Graduate Student in Computing, *Lancaster University, UK*, 2008.

Advisor: A. Rashid

B.S. Computer Science (cum laude), *Monmouth University, NJ*, May 2004.

GPA: 3.63/4

Relevant coursework: Database Systems, Probability & Statistics, Operating Systems Analysis, Object-Oriented Software Development, File Management, Systems Administration, Software Engineering Concepts, Computer Networks, Computer Algorithms, Computer Architecture, Scientific Computing Applications, Problem Solving.

Activities & Awards: Outstanding Computer Science Student, ACM Student Chapter President and Re-establisher, Science Advisory Council Member, Lambda Sigma Tau Member, Kappa Mu Epsilon Member, Dean's list.

Journal Publications (peer-reviewed)

Raffi Khatchadourian, Phil Greenwood, Awais Rashid, and Guoqing Xu. Pointcut rejuvenation: Recovering pointcut expressions in evolving aspect-oriented software. *IEEE Transactions on Software Engineering*, 99(PrePrints), 2011. Regular paper. To appear.

Conference Publications (peer-reviewed; ordered chronologically)

Raffi Khatchadourian and Benjamin Muskalla. Enumeration refactoring: A tool for automatically converting java constants to enumerated types. In *Proceedings of the 25th International Conference on Automated Software Engineering (ASE '10)*, pages 181–182, Antwerp, Belgium, September 2010. IEEE/ACM. (18/45; 40% tool demonstration acceptance rate). See tinyurl.com/ase10enum.

Raffi Khatchadourian, Phil Greenwood, Awais Rashid, and Guoqing Xu. Pointcut rejuvenation: Recovering pointcut expressions in evolving aspect-oriented software. In *Proceedings of the 24th International Conference on Automated Software Engineering (ASE '09)*, pages 575–579, Auckland, New Zealand, November 2009. IEEE/ACM. (38+33/222; 32% acceptance rate). See tinyurl.com/ase09rejuv.

Raffi Khatchadourian and Awais Rashid. Rejuvenate pointcut: A tool for pointcut expression recovery in evolving aspect-oriented software. In *Proceedings of the 8th International Working Conference on Source Code Analysis and Manipulation (SCAM '08)*, pages 261–262, Beijing, China, September 2008. IEEE. See tinyurl.com/scam08.

Neelam Soundarajan, Raffi Khatchadourian, and Johan Dovland. Reasoning about the behavior of aspect-oriented programs. In J. Smith, editor, *Proceedings of the 11th IASTED International Conference on Software Engineering and Applications (SEA '07)*, Cambridge, MA, USA, November 2007. ACTA Press. See tinyurl.com/sea07.

Raffi Khatchadourian, Jason Sawin, and Atanas Rountev. Automated refactoring of legacy Java software to enumerated types. In *Proceedings of the 23rd International Conference on Software Maintenance (ICSM '07)*, pages 224–233, Paris, France, October 2007. IEEE. (46/214; 21% acceptance rate). See tinyurl.com/icsm07enum.

Workshop Publications (peer-reviewed; ordered chronologically)

Neelam Soundarajan and Raffi Khatchadourian. Specifying reusable aspects. In *Proceedings of the 5th Asian Workshop on Aspect-Oriented and Modular Software Development (AOAsia '09) at the 24th International Conference on Automated Software Engineering (ASE '09)*, Auckland, New Zealand, November 2009. See tinyurl.com/aoasia09.

Phil Greenwood, Awais Rashid, and Raffi Khatchadourian. Contributing factors to pointcut fragility. In *Proceedings of the 3rd International Workshop on Assessment of Contemporary Modularization Techniques (ACoM '09) at the 24th ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA '09)*, pages 19–24, Orlando, Florida, USA, October 2009. ACM. See tinyurl.com/wacom09.

Raffi Khatchadourian, Phil Greenwood, and Awais Rashid. On the assessment of pointcut design in evolving aspect-oriented software. In *Proceedings of the 2nd International Workshop on Assessment of Contemporary Modularization Techniques (ACoM '08) at the 23rd ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA '08)*, pages 9–10, Nashville, Tennessee, USA, October 2008. Lancaster University, ACM. See tinyurl.com/wacom08.

Raffi Khatchadourian, Johan Dovland, and Neelam Soundarajan. Enforcing behavioral constraints in evolving aspect-oriented programs. In *Proceedings of the 7th International Workshop on Foundations of Aspect-Oriented Languages (FOAL '08) at the 7th International Conference on Aspect-Oriented Software Development (AOSD '08)*, pages 19–28, Brussels, Belgium, April 2008. ACM. See tinyurl.com/foal08.

Raffi Khatchadourian and Neelam Soundarajan. Rely-guarantee approach to reasoning about aspect-oriented programs. In *Proceedings of the 5th International Workshop on Software Engineering Properties of Languages and Aspect Technologies (SPLAT '07) at the 6th International Conference on Aspect-Oriented Software Development (AOSD '07)*, Vancouver, British Columbia, Canada, March 2007. ACM. See tinyurl.com/splat07.

Technical Reports

Raffi Khatchadourian, Phil Greenwood, Awais Rashid, and Guoqing Xu. Pointcut rejuvenation: Recovering pointcut expressions in evolving aspect-oriented software. Technical Report COMP-001-2008, Revised March 2009, May 2009, Lancaster University, Lancaster, UK, August 2008. See tinyurl.com/rejuvpctr.

Raffi Khatchadourian, Jason Sawin, and Atanas Rountev. Automated refactoring of legacy Java software to enumerated types. Technical Report OSU-CISRC-4/07-TR26, Ohio State University, April 2007. See tinyurl.com/enumtr.

Project Deliverables

Jean-Claude Royer, Joost Noppen, Nicolas Anquetil, Andreas Rummler, Ralf Mitschke, André Sousa, Uira Kulesza, Raffi Khatchadourian, Phil Greenwood, Awais Rashid, and Ismênia Galvao. Software support for the traceability framework, including extension of current configuration management and product line evolution model. Technical Report AMPLE D4.2, Aspect-Oriented, Model-Driven Product Line Engineering, October 2008. See bit.ly/ample_d42.

Raffi Khatchadourian, Ruzanna Chitchyan, Phil Greenwood, Awais Rashid, Juan A. Valenzuela, Luis M. Fernández, Mónica Pinto, Lidia Fuentes, Andrew Jackson, and Siobhán Clarke. Overall aspect-oriented analysis and design approach. Technical Report AOSD-Europe Deliverable D132, AOSD-Europe-ULANC-49, European Network of Excellence on Aspect-Oriented Software Development, September 2008. See tinyurl.com/aosd-d132.

Mónica Pinto, Lidia Fuentes, Ruzanna Chitchyan, Awais Rashid, Andrew Jackson, Siobhán Clarke, Boris Shishkov, Bedir Tekinerdogan, Mehmet Aksit, Phil Greenwood, and Raffi Khatchadourian. Traceability framework: From requirements through architecture and design. Technical Report AOSD-Europe Deliverable D126, AOSD-Europe-ULANC-43, European Network of Excellence on Aspect-Oriented Software Development, July 2008. See tinyurl.com/aosd-d126.

Safoora Omer Rashid, Ruzanna Chitchyan, Awais Rashid, Raffi Khatchadourian, and Phil Greenwood. Approach for change impact analysis of aspectual requirements. Technical Report AOSD-Europe Deliverable D110, AOSD-Europe-ULANC-40, European Network of Excellence on Aspect-Oriented Software Development, January 2008. See tinyurl.com/aosd-d110.

Research Experience

June 2006 – March
2011

Ohio State University, *Graduate Research*, Advisor: N. Soundarajan.

Research in formal program reasoning, verification, and specification of Aspect-Oriented (AO) software. Past work has involved adaptation of approaches to reasoning about concurrent programs and how they may be applied to the AO paradigm. Specifically, adaptation of a rely-guarantee approach for specifying AO software has been explored, as well as axiomatic, trace-based specifications for combining the execution behavior of aspects and with that of the base-code to arrive at an overall system behavioral specification. Future work regarding this avenue encompasses proof of soundness, applicability to AO languages such as AspectJ, and possible tool-supported verification. Current work focuses on developing formal reasoning techniques for verifying properties of reusable aspects.

June 2010 –
September 2010

University of Tokyo, Japan, *Visiting Researcher – Programming Principles and Practices (PPP) Group*, *Department of Graphics and Computer Science*, Supervisor: H. Masuhara.

Research in program change prediction and code completion techniques for Aspect-Oriented software in the context of Integrated Development Environments (IDEs). Work currently in progress.

June 2009 –
September 2009

Ohio State University, *Graduate Research Associate – Program Analysis and Testing of Object-Oriented Software (PRESTO) Group*, *Department of Computer Science & Engineering*, Advisor: A. Rountev.

Research in summary-based, intra-procedural points-to analysis for Java programs. Ongoing work involves augmenting the Soot Java byte-code analysis and optimization framework (see www.sable.mcgill.ca/soot) to support summary-based (cached) byte-code analysis for increased performance of common analyzes, such as points-to analysis, involving reusable software libraries and frameworks. Future work entails formalization of the approach, thorough empirical evaluation, and possible integration with the Soot framework for public distribution.

January 2008 –
September 2008

Lancaster University, UK, *Visiting Graduate Research Associate – Aspect-Oriented Software Engineering Group*, *Computing Department*, Supervisor: A. Rashid, Mentor: P. Greenwood.

Collaborative research on traceability in Aspect-Oriented (AO) analysis and design in the context of two European Commission Framework 6 projects, namely, AOSD-Europe: European Network of Excellence on AOSD and AMPLE: Aspect-Oriented, Model-Driven Product Line Engineering. Main research focus centered on the application of software artifact traceability to support automated source code evolution of AO software, thus enabling developers to correctly maintain AO software as requirements are altered. Other work entailed development of an analysis and design framework that supports end-to-end traceability of a variety of software engineering artifacts that include AO concepts. Furthermore, reasoning techniques are have been devised to elicit and verify new trace information as software evolves.

September 2006 –
September 2007

Ohio State University, *Graduate Research – Program Analysis and Testing of Object-Oriented Software (PRESTO) Group*, *Department of Computer Science & Engineering*, Advisor: A. Rountev.

Research in source code refactoring of Java programs through static analysis/type inferencing to reduce manual software maintenance efforts. Projects include an automated source-to-source transformation of Java software that utilizes legacy enumeration patterns to instead utilize the Enum construct introduced in Java 1.5. Implementation realized as an Eclipse IDE plug-in with planned release with the standard distribution of Eclipse. Current work comprises augmentation of the approach to encompass grouping heuristics, analysis of reference types, etc. Also exploring issues in aspect mining and usage in regards to persistence and distribution. Future research involves refactoring of XML-based source code metadata to Java 1.5 annotations.

Autumn 2006

Ohio State University, *Graduate Research Associate – EASE Laboratory*, *Department of Electrical & Computer Engineering*, , Advisor: F. Khan.

Joint collaboration between Computer Science and Engineering, Electrical Engineering, and Mechanical Engineering departments. Position included a research appointment at the Electrical and Applied Software Engineering Laboratory (EASE Labs). Developed new ECE/CSE 668 course to model a Challenge-X (see <http://tinyurl.com/challengex>) hybrid SUV automobile in a component-based software architecture.

Teaching Experience

- Au05, Wi06, Sp06, Su06, Wi07, Au07, Wi09, Sp09, Wi10, Sp10, Au10, Wi11 **Graduate Teaching Associate Lecturer (Instructor of Record)**, *CS&E 230: Introduction to C++ Programming*, Department of Computer Science & Engineering, Ohio State University. Introduction to programming in C++ and Object-Oriented programming; encapsulation using classes, inheritance, etc.; data structures, introduction to search and sorting algorithms, complexity, Object-Oriented design. Duties include lecturing, lesson planning, exam design, online course content administration, weekly office hours, and instructional video and audio production.
- Sp07, Au08, Au09 **Graduate Teaching Associate Lecturer (Instructor of Record)**, *CS&E 202: Introduction to Programming and Algorithms for Engineers and Scientists*, Department of Computer Science & Engineering, Ohio State University. Introduction to computer programming and to problem solving techniques using computer programs with applications in engineering and the physical sciences; algorithm development; programming lab experience. Duties included lecturing, lab instruction, online course content administration, weekly office hours, and instructional video production.
- Spring 2008 **Invited Lecturer**, *Seminar in L^AT_EX Typography*, Department of Graduate Studies, Lancaster University, Lancaster, UK. One-day seminar to introduce L^AT_EX typography for scientific publications. Content included simple document construction, image/figure scaling and placement, and general thesis writing. Material was also comprised of automated table of contents management, indexes, bibliography, etc.
- 2003 – 2004 **Mathematics Tutor**, *Mathematics Learning Center*, Department of Mathematics, Monmouth University, West Long Branch, NJ. Tutored college-level courses such as College Algebra, Probability and Statistics, Discrete Math, Pre-calculus, and Calculus for Business and Finance.

Industrial Experience

- April 2011 – **Apple Inc., Cupertino, CA**, *RF Systems Integration Engineer*, Supervisor: Brian Joseph.
- May 2007 – September 2007 **Bell Laboratories, Alcatel-Lucent, Murray Hill, NJ**, *Research Intern*, Supervisor: R. Hull, Mentor: K. Namjoshi. Research in Session Data Types (SDTs). Entailed program language design for shared experience, multi-media, multi-protocol, event-driven applications. Contributions include novel Application Programmer Interface (API) based on hierarchical finite automata and a research prototype implementation. Potential future work includes formal specification, validation, and verification of SDT client software.
- February 2004 – September 2005 **New Jersey Office of Information Technology, Trenton, NJ**, *Software Development Specialist*. Developed J2EE architecture and infrastructure for the New Jersey Insurance Surcharge System, a multi-level client, high-volume transactional system. Created object-oriented design and stored procedures in an Oracle RDBMS.
- June 2003 – February 2004 **Integrated Medical Care, Toms River, NJ**, *UNIX Systems Administrator*. Created and administered network devoted to web authoring. Administered and configured local web servers, Java application containers, source code repository, RDBMS (MySQL), and windows clients using samba.

Grants and Awards

- 2009,2010 ACM SIGSOFT CAPS Program Travel Grant Recipient (\$2,300 US).
- 2010 Japan Society for the Promotion of Science (JSPS) Summer Program Fellowship Recipient (¥692,500).
- 2010 National Science Foundation (NSF) East Asia and Pacific Summer Institutes (EAPSI) Award Recipient (\$5,000 US).
- 2010 Ohio State University Department of Computer Science & Engineering Graduate Teaching Award Recipient (\$500 US).

- 2010 Ohio State University Graduate Associate Teaching Award Nominee.
- 2008,2009 Lancaster University Faculty of Science & Technology Travel Grant Recipient (£300).
- 2007,2008(2),2009 ACM SIGPLAN Professional Activities Committee (PAC) Travel Grant Recipient (\$1,142 US).
- 2008 European Network of Excellence on Aspect-Oriented Software Development Student Grant Recipient (€300).
- 2007 Visiting Studentship in Aspect-Oriented Software Analysis and Design, Computing Department, Lancaster University, UK (£8,000).
- 2004 Monmouth University Outstanding Undergraduate Computer Science Student Award Recipient.

Presentations

- November 2010 **Johns Hopkins University Applied Physics Laboratory (JHU APL), Columbia, Maryland.**
Presentation on "Techniques for Automated Evolution of Aspect-Oriented Software."
- September 2010 **25th IEEE/ACM International Conference on Automated Software Engineering (ASE), Antwerp, Belgium.**
Tool demonstration, presentation, and poster on "Enumeration Refactoring: A Tool for Automatically Converting Java Constants to Enumerated Types." See slidesha.re/enum-tool.
- August 2010 **Chiba Shigeru Programming Languages and Operating Systems Research Group, Department of Mathematical and Computing Sciences, Graduate School of Information Science and Engineering, Tokyo Institute of Technology, Tokyo, Japan.**
Presentation on "Future Endeavors in Automated Refactoring of Legacy Java Software to Enumerated Types." See slidesha.re/enum-future
- July 2010 **Principles of Software Languages (POSL) Research Group, Kyushu University, Fukuoka City, Japan.**
Presentation on "Fraglight: Shedding Light on Broken Pointcuts in Aspect-Oriented Software."
- July 2010 **Computing System Research Group, Graduate School of Arts and Sciences, University of Tokyo, Tokyo, Japan.**
Presentation on "Pointcut Rejuvenation: Recovering Pointcut Expressions in Evolving Aspect-Oriented Software." See slidesha.re/rejuvpc
- June 2010 **Japan Society for the Promotion of Science (JSPS) Summer Program Research Proposal Session, The Graduate University for Advanced Studies (Sokendai), Hayama, Japan.**
Poster on "Fraglight: Shedding Light on Broken Pointcuts in Aspect-Oriented Software."
- November 2009 **24th IEEE/ACM International Conference on Automated Software Engineering (ASE), Auckland, New Zealand.**
Poster on "Pointcut Rejuvenation: Recovering Pointcut Expressions in Evolving Aspect-Oriented Software."
- November 2009 **5th Asian Workshop on Aspect-Oriented and Modular Software Development (AOAsia) at the 24th International Conference on Automated Software Engineering (ASE), Auckland, New Zealand.**
Presentation on "Specifying Reusable Aspects." See slidesha.re/reuse-aop.
- March 2009 **8th International Conference on Aspect-Oriented Software Development (AOSD), Charlottesville, VA.**
Invited tool demonstration of "Rejuvenate Pointcut: A Tool for Pointcut Expression Recovery in Evolving Aspect-Oriented Software." See slidesha.re/aosd09
- March 2009 **8th International Conference on Aspect-Oriented Software Development (AOSD), Charlottesville, VA.**
Poster on "Enforcing Behavioral Constraints in Evolving Aspect-Oriented Programs."

- October 2008 **2nd International Workshop on Assessment of Contemporary Modularization Techniques (ACoM) at the 23rd ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA)**, *Nashville, Tennessee*.
Presentation on "On the Assessment of Pointcut Design in Evolving Aspect-Oriented Software." See slidesha.re/pc-des.
- September 2008 **8th IEEE International Working Conference on Source Code Analysis and Manipulation (SCAM)**, *Beijing, China*.
Tool demonstration on "Rejuvenate Pointcut: A Tool for Pointcut Expression Recovery in Evolving Aspect-Oriented Software." See slidesha.re/rejuvpc-tool.
- April 2008 **7th International Conference on Aspect-Oriented Software Development (AOSD)**, *Brussels, Belgium*.
Poster on "Pointcut Rejuvenation: Recovering Pointcut Expressions in Evolving Aspect-Oriented Software."
- April 2008 **7th International Workshop on Foundations of Aspect-Oriented Languages (FOAL) at the 7th International Conference on Aspect-Oriented Software Development (AOSD)**, *Brussels, Belgium*.
Presentation on "Enforcing Behavioral Constraints in Evolving Aspect-Oriented Programs." See slidesha.re/aop-beh.
- March 2008 **Computing Department, Lancaster University, Lancaster, UK**.
Computing's Advanced Knowledge Extension Seminars (CAKES) presentation on "Rely, Guarantee, Enrich: An Approach to Modular Reasoning About Aspect-Oriented Programs."
- October 2007 **23rd IEEE International Conference on Software Maintenance (ICSM)**, *Paris, France*.
Presentation on "Automated Refactoring of Legacy Java Software to Enumerated Types." See slidesha.re/enum-refact.
- August 2007 **Bell Laboratories, Alcatel-Lucent, Murray Hill, NJ**.
Summer intern presentation on an "Overview of a Session Data Type (SDT) Framework Research Prototype."
- July 2007 **2nd European Summer School on Aspect-Oriented Software Development**, *Department of Informatics and Information Science (DISI), University of Genoa, Italy*.
Led group discussion and displayed a poster on current progress of "Modular Reasoning about Aspect-Oriented Programs: A Rely-Guarantee Approach."
- April 2007 **Ohio Graduate Student Symposium on Computer and Information Science & Engineering (OGSS-CISE)**, *University of Cincinnati, Cincinnati, OH, USA*.
Presentation on "Modular Reasoning about Aspect-Oriented Programs: A Rely-Guarantee Approach." See slidesha.re/ogss-cise
- March 2007 **5th International Workshop on Software Engineering Properties of Languages and Aspect Technologies (SPLAT) at the 6th International Conference on Aspect-Oriented Software Development (AOSD)**, *Vancouver, BC, Canada*.
Presentation on "Rely-Guarantee Approach to Reasoning about Aspect-Oriented Programs." See slidesha.re/rg-aop.

Professional Activities

- 2011- Web master for the Aspect-Oriented Software Development research website. See aosd.net.
- 2011 Ohio State University Department of Computer Science & Engineering Annual Awards Selection Committee member.
- 2011 Organizing committee member (Web Chair) for the European Conference on Object-Oriented Programming (ECOOP). See 2011.ecoop.org.
- 2010 Student volunteer at the ACM SIGPLAN/SIGSOFT International Conference on Systems, Programming, Languages, and Applications (SPLASH, formerly OOPSLA), Reno, Nevada, USA.
- 2008,2009,2010 Secondary reviewer for the IEEE/ACM International Conference on Automated Software Engineering (ASE).
- 2008,2009,2010 Secondary reviewer for the European Conference on Object-Oriented Programming (ECOOP).

- 2009,2010 Secondary reviewer for the International Conference on Aspect-Oriented Software Development (AOSD).
- 2009,2010 Google Summer of Code Proposed Project Mentor.
- 2007,2009 Student volunteer at the International Conference on Aspect-Oriented Software Development (AOSD), Vancouver, BC, Canada (2007), Charlottesville, VA, USA (2009).
- 2007,2009 Spring school participant at the International Conference of Aspect-Oriented Software Development (AOSD), Vancouver, BC, Canada (2007), Charlottesville, VA, USA (2009).
- 2008 Secondary reviewer for the 2nd Workshop on Assessment of Contemporary Modularization Techniques (ACoM) at the 23rd ACM SIGPLAN International Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA).
- 2007 Textbook reviewer for "Programming with C++ Brief Edition, " D.S. Malik, Cengage Learning, Boston, MA.
- 2007 Participant at the 2nd European Summer School on Aspect-Oriented Software Development, Genoa, Italy.
- 2007 Program committee member for the 2nd Ohio Graduate Student Symposium on Computer and Information Science & Engineering (OGSS-CISE).
- 2007 Secondary reviewer for the 29th International Conference on Software Engineering (ICSE).
- 2004 President and re-establisher, Monmouth University ACM Student Chapter.

Open Source Software

- 2008 – REJUVENATE POINTCUT.
AspectJ source code refactoring plugin for the Eclipse open source Integrated Development Environment, providing tool support for pointcut expression recovery in evolving Aspect-Oriented software. *See code.google.com/p/rejuvenate-pc.*
- 2007 – CONVERT CONSTANTS TO ENUM.
Java source code refactoring plugin for the Eclipse open source Integrated Development Environment. Planned for release in the standard distribution of Eclipse. *See code.google.com/p/constants-to-enum-eclipse-plugin.*

Professional Affiliations

- ACM Student Member, Association for Computing Machinery.
- SIGPLAN Student Member, ACM Special Interest Group for Programming Languages.
- SIGSOFT Student Member, ACM Special Interest Group on Software Engineering.
- IEEE-CS Student Member, IEEE Computer Society.
- ACM/IEEE Professional Member, ACM/IEEE Princeton, NJ Chapter.

Computer Skills

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|---|---|
| <ul style="list-style-type: none"> programming JAVA S/EE, AspectJ, C#, C++ building ant, make OS Linux, UNIX, Mac OS X | <ul style="list-style-type: none"> scripting PHP, Bash, Perl rules JBoss Drools, Prolog administration Apache, Samba, iptables |
|---|---|

IDE Eclipse, Visual Studio .NET, Vim
web HTML, CSS, JSF, JBoss Seam, Drupal

typography \LaTeX
database Postgresql, MySQL, Oracle

Languages

English **Native**
Spanish **Elementary**
Armenian **Conversational**
Japanese **Beginning**

1-year college course, 2-year high school course.