

CS Systems Qualifying Exam 2014

Important Dates

- **April 27: Registration ends.** Registration instructions are below. When you register, you must declare the three exams you plan to take.
- **May 19: Exams.** Candidates will take exams during the week starting Monday May 20. For oral exams, students are responsible for scheduling an exam with the examiner. We will schedule the written exams.
- **May 27 Grading Complete.** Faculty members to email grades for all exams to Philip Levis.
- **May 29: Decision.** Faculty meet to decide on grades. All Systems Faculty are invited. Time TBD.
- **May 30: Announce.** Decisions emailed to students and advisers.

You should only take this exam if your adviser is a "Systems Faculty" member. Students without a Systems Faculty adviser may request to take the exam, but you need the permission of your adviser and Professor Philip Levis.

Exams

- [Architecture - Kunle Olukotun](#)
- [Compilers - Alex Aiken](#)
- [Databases - Hector Garcia-Molina](#)
- [Graphics - Marc Levoy](#)
- [Programming Languages - John Mitchell](#)
- [Human Computer Interaction - Michael Bernstein](#)
- [Networking - Sachin Katti](#)
- [Operating Systems - David Mazières](#)
- [Security - Dan Boneh](#)

Registration

Send an email to Alexis Wing <alexisw@cs.stanford.edu> indicating which of the three exams you wish to take.

Architecture Qualifying Exam

Details and Reading List

Examiner: Professor Kunle Olukotun

This qual will cover any ideas, topics and reading covered in the following courses:

- EE282: Computer Systems Architecture
- EE382A: Advanced Processor Architecture
- CS315A: Parallel Computer Architecture and Programming

You will be expected to be very conversant with the key ideas in computer architecture: Levels of abstraction (e.g. ISA→processor→RTL blocks→gates), pipelining, caching, prediction, virtualization and parallelism. As someone taking the architecture qual, you will be expected to have a fairly sophisticated knowledge of these topics.

Reading List

- Computer Architecture: A Quantitative Approach, 3rd Edition , Hennessy & Patterson.

Format

15-20 minute oral exam

Scheduling

Arrange with Darlene Hadding (darlene@cs.stanford.edu)

Compilers Qualifying Exam

Details and Reading List

Examiner: Professor Alex Aiken

Reading List

- Compilers: Principles, Techniques, & Tools (Second Edition), Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, Addison-Wesley, 2007.
Chapters: 2.1.-2.5, 4-10, 12
- Modern Compiler Implementation in Java, Andrew Appel with Jens Parlsberg
Chapters on Advanced Topics: 13-21

Example Questions

Format

Depending on the number of students who sign up, there will either be a 20 minute oral or 1 hour written exam

Scheduling

Email Alex (aiken@cs.stanford.edu) if you need more information.

Database Qualifying Exam

SYLLABUS FOR THE DATABASE PORTION OF THE PH.D. QUALIFYING EXAMINATION IN SYSTEMS

The Database portion of the Systems Qual is a one hour written exam. It is OPEN BOOK.

TOPICS

Data models and query languages. Database design, building database applications. File structures, indexing, and hashing methods. Query processing and optimization. Transactions, concurrency control and recovery, security and authorization, database performance. Material as covered in CS145 and CS245.

READING LIST

H. Garcia-Molina, J.D. Ullman, and J. Widom
Database Systems: The Complete Book (Second Edition)
Prentice-Hall, 2009
All chapters

[Previous Quals](#)

Graphics Qualifying Exam

Details and Reading List

Examiner: Marc Levoy

Knowledge of basic representations of surfaces and solids, scan-conversion algorithms, geometric transformations, viewing projections, visible-surface determination, and shading models, as covered in CS 148 and 248. Understanding of basic issues in input and display hardware, graphics software, and user interface design. Some knowledge in depth of either curve, surface, and solid modeling and geometric algorithms at the level of CS 348A, or of sampling, filtering, and local and global illumination methods at the level of CS 348B.

Reading List

- Typical references for the material in 248, 348A, and 348B, are the online course notes, where available
- For 148: P. Shirley,, Fundamentals of Computer Graphics, 2nd Edition, A. K. Peters, 2006
- For 248: E. Angel, Interactive Computer Graphics (5th ed.)
- For 348A: G. Farin, Curves and Surfaces for Computer Aided Geometric Design Academic Press, (2nd edition)
- For 348B: M. Pharr and G. Humphreys, Physically-Based Rendering. Morgan-Kaufman

Format

30 minute oral exam.

Scheduling

Email Marc directly (levoy@cs.stanford.edu).

Programming Language Qualifying Exam

Details and Reading List

Examiner: Professor John Mitchell

Knowledge of the principles and central concepts in programming language, as covered in CS 242. Students taking the Systems Qual in programming languages are expected to have a professional-level conversational competency in the main design and implementation topics associated with programming languages, applied to languages and situations you know and those you may not.. Some sophistication beyond the preparation provided by CS242, typically gained by practical experience and preparation for software systems research, is expected.

Reading List

- J.C. Mitchell, Concepts in Programming Languages, Cambridge Univ Press, 2002.

Format

20-30 min oral exam.

Scheduling

Human Computer Interaction Qualifying Exam

Details and Reading List

Examiner: Michael Bernstein

The qualifying exam will be a half-hour oral with Professor Bernstein. The exam will expect: 1) a deep understanding of the human-computer interaction design process, technology, and experimental design and analysis covered in CS 147 and CS 247, and 2) fluency with readings from [CS376: Research Topics in Human-Computer Interaction](#). Don't focus on memorizing paper details, but on understanding the concepts behind the papers and being able to apply them in discussing HCI examples and issues.

Format

30 minute oral exam

Networking Qualifying Exam

Details and Reading List

Examiner: Professor Sachin Katti

This is the official web page for the 2013 Networking Qual (part of the CS Systems Quals). It is the only official web page describing the exam. Below are some tips on how to prepare, and a couple of example questions (taken from the CS244 Final in 2009).

Before you start preparing for the Networking Qualifying Exam, make sure you are broadly familiar with the concepts taught in CS144, and the textbook: **Kurose and Ross**, *Computer Networks: A Top-down Approach*. Prentice-Hall, 5th edition. You won't be tested on the specifics in the textbook; so if you have taken an equivalent class at your undergraduate school with a similar textbook (e.g. Peterson and Davie) you should have the sufficient foundation to start preparing for the exam.

The Networking Qualifying Exam has the **same** reading list as CS244 -- a discussion-based graduate networking class offered once per year. In the Qual exam we'll be looking for signs that: (1) You understand the key concepts and principles in the papers, (2) You are able to critically review the key ideas, and (3) You are able draw meaningful conclusions from the work; for example, that you can suggest improvements and areas for further study. The exam **won't** be testing your ability to regurgitate details, header formats and other minutiae.

You can find the Quals/CS244 reading list on or after April 2nd here:

<http://www.stanford.edu/class/cs244/2013/> (Note you are NOT required to read the papers marked optional in the reading list)

Example Questions

1. Internet mobility

- Mobile IP allows users to move from one part of the network to another, while keeping the same IP address. Describe how Mobile IP works.
- Describe some of the shortcomings of Mobile IP, and suggest some ways to mitigate the problems.

2. If you can't beat them, join them.

3. It has been proposed that internet service providers (ISPs) could reduce costs by installing P2P "supernodes" in their networks. These nodes would download and mirror the most popular files of P2P networks. P2P users of the ISPs would primarily download content from these nodes inside the ISP's network. The result for the ISP would be that most of the traffic that is generated by downloading this content would stay inside the ISP's network, and the ISP would not have to pay transfer cost to carriers or

other ISPs.

4. Assume these ISP operated P2P? nodes become widespread. How would you modify BitTorrent? to take maximum advantage of this development?
5. Is it a good idea?

Format

The exam is a 30 minute oral exam.

Scheduling

Email Professor Katti (skatti@cs.stanford.edu) and cc his admin Crystle Palafox (palafox@stanford.edu) to schedule a time for the exam.

Operating Systems Qualifying Exam

Details and Reading List

Examiner: David Mazières

Reading List

- Contact David Mazières for details

Format

Contact David Mazières for details

Scheduling

Security Qualifying Exam

<http://seclab.stanford.edu/SecurityQual.html>