ACM/IEEE Computer Science 2013 Exemplar-Fest

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ABSTRACT

Beginning with the publication of Curriculum 68, ACM and IEEE-Computer Society have sponsored various efforts to establish international curricular guidelines for undergraduate programs in computing. Work on the next volume, Computer Science 2013 is well underway, with the Ironman draft out shortly before SIGCSE 2013. The Ironman draft includes course and curricular exemplars, which should serve as a rich resource for those trying to meet the curriculum standards. This special session highlights the exemplar section of the Ironman report through a description of its purpose, presentation of several exemplars, and an invitation to the SIGCSE community to participate by submitting exemplars and providing feedback on what they would find useful in this section of the CS 2013 final report.

Categories and Subject Descriptors

K.3.2 [**Computers and Education**]: Computer and Information Science Education

General Terms

Design

Keywords

Computing Curricula 2013; CS 2013; Curriculum Exemplars

1. INTRODUCTION

Beginning over 40 years ago with the publication of Curriculum 68[1], the major professional societies in computing – ACM and IEEE-Computer Society – have sponsored various efforts to establish international curricular guidelines for undergraduate programs in computing. As the field has grown and diversified, so too have the recommendations for curricula. There are now guidelines for Computer Engineering, Information Systems, Information Technology, and Software Engineering in addition to Computer Science. These volumes are updated regularly with the aim of keeping computing curricula modern and relevant.

Work on the next volume, Computer Science 2013 (CS 2013), is well underway. The first draft, known as the Strawman report [2], was made available in February 2012; the next draft, known as the Ironman report, will be available shortly before SIGCSE 2013. New to the Ironman draft will be course and curricular exemplars. These will be descriptions of existing, fielded courses and curricula from a wide variety of institutions. The exemplar section of the Ironman draft will explicitly identify how the exemplars intersect the CS 2013 Body of Knowledge in diverse ways. The CS 2013 Steering Committee recognizes that there are many successful ways to teach computer science. Including exemplars will provide a rich resource for those trying to meet the curriculum standards.

This special session will focus on course exemplars. The goals of the session are to

- Highlight the exemplar section of the CS 2013 Ironman report.
- Illustrate a range of ways in which the Body of Knowledge can be translated into successful courses. Demonstrate that the organizational units in the Body of Knowledge (i.e., Knowledge Areas) need not be in one-to-one correspondence with courses.
- Provide the audience with an opportunity to give feedback on the range and types of exemplars in the Ironman draft, as well as the opportunity to suggest additional types of exemplars for the final CS 2013 document.

Four faculty will present exemplar courses from their institutions. Two were invited to participate before this special session was proposed for SIGCSE 2013; an additional two were selected after a call for exemplars was sent out to the SIGCSE community. The CS 2013 Ironman report will include many more exemplars, and authors of several of those will be available to talk to SIGCSE attendees informally at the end of the session. We will distribute a list of those authors, along with brief descriptions of their courses, before the session.

2. OUTLINE AND PRESENTERS

Andrea Danyluk, a member of the CS 2013 Steering Committee, will begin by giving a very brief overview of the "Course Exemplar" chapter of the CS 2013 Ironman report. This will be followed by presentations of the exemplars.

2.1 Henry Walker: A Three-Course Introductory Sequence

Henry Walker will present Grinnell College's three-course introductory sequence. The CS program at Grinnell follows a multi-paradigm approach in its introductory curriculum. Since each course emphasizes problem solving following a specified paradigm, students gain practice by tackling a range of problems. Toward that end, the first two courses utilize application themes to generate interest in interdisciplinary connections of computer science. The following outlines the main elements of this approach:

- Functional Problem Solving (CS1)
  - Primary Paradigm: Functional problem solving
  - Supporting language: Scheme
  - Application area: image processing, media scripting
- Imperative Problem Solving and Data Structures (CS2)
  - Primary Paradigm: Imperative problem solving
  - Supporting language: C (no objects as in C++)
  - Application area: robotics
- Algorithms and Object-Oriented Design (CS3)
  - Primary Paradigm: Object-oriented problem solving
  - Supporting language: Java
  - Application areas: large-scale problems

These three courses cover topics and learning outcomes selected from 12 of the 18 Knowledge Areas in the CS 2013 Strawman Body of Knowledge.

Henry Walker is a Professor of Computer Science at Grinnell College. He has served as Chair of SIGCSE, is a regular columnist on "Classroom Issues" for the *SIGCSE Bulletin*, and was designated an ACM "Distinguished Educator" in 2009. He will receive the SIGCSE Award for Lifetime Service to the Computer Science Education Community at this conference.

2.2 Ruth Anderson: Multithreading and Data Structures

Ruth Anderson will describe a required data structures course that comes after CS2 and discrete structures and that integrates a 3-week introduction to multithreading[3]. This University of Washington course emphasizes a distinction between utilizing parallelism to speed up computations and managing concurrency to ensure correct access to shared resources. It approaches multithreading with the same mix of algorithms, programming, and asymptotic analysis that makes the data structures course such a keystone in the curriculum. This course covers topics and learning outcomes from 4 of the 18 Knowledge Areas in the Strawman Body of Knowledge.

Ruth Anderson is a Lecturer in the Department of Computer Science and Engineering at the University of Washington. She is a regular SIGCSE conference contributor, including former workshops co-chair.

2.3 Elizabeth Hawthorne: Discrete Math at a Community College

Union County College is a comprehensive community college in Cranford, NJ offering associate degree programs in computer science/engineering and in mathematics. Both programs were designed to transfer into respective baccalaureate degree programs throughout the New York metropolitan region and require a sophomore level course in discrete mathematics, MAT 267. The presentation of this course exemplar will highlight not only the topics and student learning outcomes, which adhere closely to the CS 2013 guidelines, but also the assessment of student learning.

The course is the work of Cynthia Roemer and Jean Lane. Dr. Cynthia Roemer chairs the Mathematics department and Professor Jean Lane coordinates the Mathematics program at Union County College. As department chair, Cynthia directs the assessment of all mathematics courses for institutional accreditation. As program coordinator, Jean developed the discrete mathematics course based on the 1991 ACM/IEEE-CS computer science guidelines and has kept it current in accordance with ACM/IEEE-CS curricular revisions (CS2001, CS2013). Elizabeth Hawthorne, a member of the CS 2013 Steering Committee, will present the exemplar.

2.4 Christa Chewar: Information Assurance

Christa Chewar will discuss how Information Assurance topics are infused throughout the computer science curriculum at the United States Military Academy (West Point). Coverage of information-assurance fundamentals begins in the CS0 and CS1 courses, where students are exposed to topics such as personal and global cyber threats, while developing problem solving and programming skills with exercises in steganography, ciphering, and "Facebook scraping." Students have several choices of more advanced coursework to fulfill their networking and information assurance and security requirements, including courses in Digital Forensics and Exploitation. However, the most popular option is the Cyber Security course. Serving both the IT and CS programs, this course focuses on offensive and defensive information operations, with a culminating week-long "Cyber Defense Exercise" that challenges students to protect a production network from external intrusions.

Christa Chewar has served as an Assistant Professor at West Point for five years, and is currently the curriculum coordinator for the CS and IT programs.

2.5 Audience Participation

Three members of the CS 2013 Steering Committee – Andrea Danyluk, Steve Roach (CS 2013 Co-Chair), and Elizabeth Hawthorne – will invite the audience to provide feedback on the range of exemplars in the Ironman draft, with an eye to fleshing out the set of exemplars for the final report.

As described above, authors of exemplars in the Ironman will be invited to the front of the room so that session attendees may speak with them as well as with session presenters.

3. REFERENCES

[1] ACM Curriculum Committee on Computer Science. Curriculum 68: Recommendations for academic programs in computer science. *Comm. ACM*, 11(3):151–197, Mar 1968.

[2] ACM/IEEE-CS Joint Task Force on Computer Science Curricula. Computer science curricula 2013 strawman draft, February 2012.

[3] D. Grossman and R. E. Anderson. Introducing parallelism and concurrency in the data structures course. In *SIGCSE'12*, pages 505–510, 2012.