

Computing Curricula 2013: Computer Science – Update on the Strawman Report from the ACM/IEEE-CS Task Force

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1. SUMMARY

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.

In the Fall of 2010, work on the next volume in the series, Computer Science 2013 (CS2013), began. Considerable work on the new volume has already been completed and a first draft of the CS2013 report (known as the Strawman report) will be complete by the beginning of 2012. This panel seeks to update and engage the SIGCSE community in providing feedback on the Strawman report, which will be available shortly prior to the SIGCSE conference.

The rapid evolution and expansion of the computing field and the growing number of topics in computer science has made regular revision of curricular recommendations necessary. The integration of computing with other disciplines creates additional opportunities for defining innovative computing curricula. Balancing this topical growth with the need to keep recommendations realistic and

implementable in the context of undergraduate education is particularly challenging. As a result, it is important to engage the broader computer science education community in a dialog to better understand new opportunities, local needs, and novel successful models of computing curriculum.

The last complete Computer Science curricular volume was released in 2001 [3] and was followed by a review effort that concluded in 2008 [2]. While the review helped to update some of the knowledge units in the 2001 volume, it was not aimed at producing an entirely new curricular volume and deferred some of the more significant questions that arose at the time. The Computer Science 2013 effort seeks to provide a new volume reflecting the current state of the field. In particular, it highlights promising future directions through revisiting and redefining the knowledge areas in CS, rethinking the essentials necessary for a CS curriculum, and identifying working exemplars of courses and curricula along these lines.

The high-level themes on which the CS2013 effort is based include:

- *The “Big Tent” view of CS* – As CS expands to include more multi-disciplinary work and new programs of the form “Computational X” are developed, it is important to embrace an outward looking view in computing that sees CS as a discipline actively seeking to work with and integrate into other disciplines.
- *Managing the size of the curriculum* – Although the field of Computer Science continues to grow unabated, it is simply not feasible to proportionately expand the size of the curriculum. As a result, CS2013 seeks to re-evaluate what are considered essential topics in computing so as to make room for new topics without requiring more total instructional hours than the prior CC2001 guidelines. The circumscription of curriculum size is necessary to promote more flexible models for curricula without losing the essence of a rigorous CS education.
- *Actual course exemplars as opposed to stylized course guidance* – CS2001 took on the significant challenge of providing descriptions of stylized courses incorporating the knowledge units defined in that report. While this was a valiant effort, it was felt in retrospect that such course guidance did not have much impact on actual course design. As a result, CS2013 plans to take a different approach: identifying existing

successful courses and curricula as fielded exemplars of how relevant knowledge units can be addressed in actual programs. This bears similarity to the report by CRA-E [4], although that report focused on preparing students for research careers.

- *Institutional needs* – CS2013 aims to provide curricular models suitable in a broad range of contexts, understanding that curricula exist in the context of specific institutional needs, goals, and resource constraints. As a result, CS2013 allows for explicit flexibility in curricular structure through a *tiered* set of core topics, where a small set of Tier 1 topics are considered essential for all CS programs, but individual programs have flexibility with regard to their coverage of Tier 2 topics.

Work so far on the CS 2013 effort has primarily focused on updating the Body of Knowledge in computer science, organized around 18 Knowledge Areas, outlined below:

- Algorithms and Complexity (AL)
- Architecture and Organization (AR)
- Computational Science (CN)
- Discrete Structures (DS)
- Graphics and Visual Computing (GV)
- Human-Computer Interaction (HC)
- Information Assurance and Security (IAS)
- Information Management (IM)
- Intelligent Systems (IS)
- Networking and Communications (NC)
- Operating Systems (OS)
- Platform-Based Development (PBD)
- Parallel and Distributed Computing (PD)
- Programming Languages (PL)
- Software Development Fundamentals (SDF)
- Software Engineering (SE)
- System Fundamentals (SF)
- Social and Professional Issues (SP)

In a departure from previous curricular efforts, CS2013 reorganizes coverage of introductory programming in an area now called Software Development Fundamentals (previously called Programming Fundamentals), and defines a new area called Systems Fundamentals that captures cross-cutting systems-level concepts. Additionally, specific developments in the field in the past decade (such as the pervasiveness of parallel computing and the need for better understanding computer security) have given rise to the development of knowledge areas in Parallel and Distributed Computing, Information Assurance and Security, and a reorganization of topics in Networking and Communications. Finally, the rise of platform-specific development (for example mobile computing and game consoles) is also addressed through the new Platform-Based Development area. Discussion of these new knowledge areas, changes in existing knowledge areas, and the larger-scale suggestions around curricular structure will provide numerous topics for engagement during this panel.

As mentioned previously, the goal of this panel is not simply to provide an update on the current thinking and state of CS 2013, but to actively engage the community in the discussions and work that will eventually manifest into the final published volume. Holding this panel at SIGCSE is an important step in further engendering that engagement in a broad forum. Indeed, the CS2013 effort has already reached out to a number of communities, holding presentations at SIGCSE-11 [5], CSEET-11, FIE-11, FCRC-11,

EAAI-11, as well as being involved in curricular discussions at SIGCOMM-11 and SPLASH-11. We believe that SIGCSE-12 will be the most relevant venue to provide the *first* discussions on the complete CS2013 Strawman draft, which will be available shortly before the conference.

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Mehran Sahami is co-chair of the Steering Committee for the Computing Curricula 2013: Computer Science volume. He is an Associate Professor and Associate Chair for Education in the Computer Science Department at Stanford University, where he led a redesign of the undergraduate Computer Science curriculum.

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6. REFERENCES

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