Perspectives on Computer Science Curricula 2023 (CS2023)

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CCS CONCEPTS

• **Social and professional topics** → **Computer science education**; **Model curricula**.

KEYWORDS

Computer Science Curricular Guidelines, Model Curricula

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1 SUMMARY

Undergraduate Computer Science (CS) curricular guidelines have been published regularly since 1968, and the latest released in 2013 [1]. From early 2021, a task force of the ACM, IEEE-Computer Society, and the Association for the Advancement of Artificial Intelligence (AAAI) has worked on a decennial revision titled the ACM/IEEE-CS/AAAI Computer Science 2023 Curricula (CS2023).

The CS2023 task force includes a 17-member steering committee, 17 knowledge area subcommittees, and an international group of disciplinary experts. CS2023 provides **curricular content** – a knowledge model largely backward compatible with CS2013, supplemented by a competency model – and **curricular practices**, comprising articles by independent experts on program design and delivery that complement curricular content guidelines. CS2023 will inform educators and administrators on the **what**, **why**, and **how** to cover undergraduate CS over the next decade.

Ongoing work on CS2023 has been disseminated widely over the past two years: via the task force website [3]; presentations at computing education conferences, e.g., SIGCSE Technical Symposium 2023 [4]; articles, e.g., ACM Inroads [5]; emails to various computing education mailing lists; gathering community feedback via surveys and special sessions; and soliciting and receiving expert blind peer reviews. Building on earlier drafts, a gamma draft [2] was released in September 2023, with the final version due by the end of 2023.

This panel examines CS2023 from different perspectives. All panelists serve on the CS2023 steering committee and have an intimate understanding of CS2023. The moderator will lay out its overall vision and structure while panelists will emphasize three major perspectives of CS education: software development fundamentals; systems development; and the increased role of societal, ethical, and professional aspects crucial to a modern CS graduate. Strong interdependencies exist between these perspectives, along with tensions arising from how much can be squeezed into a tight undergraduate CS curriculum. Attendees will take home an understanding of the approach taken by the CS2023 task force, the constraints on curriculum design, and how best to use the CS2023 guidelines to educate the next generation of CS graduates.

2 PANEL PRESENTATION STRUCTURE

The panel structure is shown in Table 1, and the panelist position statements are provided in Section 3. Ample time will be available for active audience participation.

Table 1: Panel Structure

	Description	Duration
1	Introductions and Background	2 minutes
2	Overall Vision	5 minutes
3	Panelists' Perspectives	30 minutes
4	Audience Q & A	21 minutes
5	Summary	2 minutes

3 POSITION STATEMENTS

This section presents the panelists and their different perspectives of CS2023.

3.1 Raj (Moderator) – Overall CS2023 Vision

Rajendra K. Raj, a Professor of Computer Science at Rochester Institute of Technology, focuses on cybersecurity, data science, and distributed systems. Also interested in computing program development and quality, he served as the 2021-22 Chair of ABET's Computing Accreditation Commission, and led ABET accreditation visits to CS programs, both in the US and internationally. In the 1990s, Dr. Raj designed, implemented, and led high-performance private-cloud infrastructures for a multinational financial services

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firm. He has a PhD from the University of Washington, Seattle, an MS from the University of Tennessee, and a BTech from IIT Madras.

As co-chair of the CS2013 task force, Dr. Raj will outline the vision and structure of CS2023, emphasizing its algorithmic and mathematical foundations. He will then introduce the panelists, facilitate audience Q & A and discussion, and summarize the session.

3.2 Jalote – Software Development Perspective

Pankaj Jalote is a Distinguished Professor at IIIT-Delhi and also its founding Director. He has been a Chair Professor at IIT Delhi, Head of the Department of Computer Science and Engineering at IIT Kanpur, and an Assistant Professor at the University of Maryland at College Park. On leave from academia, he was Vice President at Infosys Technologies Ltd. for two years, and a Visiting Researcher at Microsoft Corporation, Redmond for a year. He has a PhD from the University of Illinois at Urbana-Champaign, an MS from Pennsylvania State University, and a BTech from IIT Kanpur. He is the author of six books including the recent Building Research Universities in India. He writes a blog on Higher Education in India. He is a Fellow of the IEEE and INAE.

Software Development Fundamentals (SDF) and Software Engineering (SE) comprise two of the CS2023 knowledge areas that focus on developing and writing software. SDF focuses on developing basic skills using a modern programming language, understanding data structures and libraries, appreciating the role of testing, and achieving a degree of comfort with modern development environments. While SDF focuses on individual activity, SE is a collaborative one, deeply tied to issues of professionalism, teamwork, and communication. Further, SE requires the ability to develop solutions for others, deal with software evolution, as well as software testing. SDF and SE also require familiarity with front- and back-ends and integrating many existing frameworks and components. Many of these concepts should no longer be considered as CS electives. Dr. Jalote will present this perspective of CS2023.

3.3 Goldweber – Systems Perspective

Michael (Mikey) Goldweber is a Professor and Chair of Computer Science at Denison University in Granville, OH, USA. His main area of research is Computing Education with a focus on operating systems. He was the primary author of the Kaya (now Pandos) OS project and a founder of the Computing for Social Good in CS Education movement. Dr. Goldweber served on and chaired the ACM SIGCSE ITiCSE Steering Committee; served as a past Chair and current Executive Board member of ACM SIGCAS; and also served an Associate Editor of ACM Inroads. Author of multiple operating system project manuals, including a graduate text on virtualization systems, he was also the lead author of multiple ITiCSE Working Group Best Paper award designees.

Systems (e.g., operating systems, networking, database systems, or specialized platform development) remain an important area of study in spite of the observation that most current undergraduates will rarely do systems-level programming. However, graduates should know how their programs actually get executed; after all, stack overflows happen. Putting aside the educational value of completing a large systems-level project (e.g., an operating system), it is incumbent that students be assisted in building an appropriate mental model for how a (distributed and/or parallel) program gets executed, or similarly how large data sets are stored, maintained, and accessed. Dr. Goldweber will present his perspective on how we need to not only demystify the language gap between what the programmer writes and what the hardware is built to execute but also provide an understanding of the distributed multi-core execution environment itself.

3.4 Becker – Societal Perspective

Brett A. Becker is an Assistant Professor in Computer Science at University College Dublin. He currently serves as ACM SIGCSE Vice-Chair and the Steering Committee Chair of CompEd, the ACM Global Computing Education Conference. Dr. Becker is also an Associate Editor at ACM Transactions on Computing Education (TOCE) and has won several recent best paper awards including at ACM ICER and the ACM SIGCSE Technical Symposium. He is the author of a high school CS textbook aligned with the Irish national curriculum. Dr. Becker is also an Irish National Forum Teaching and Learning Research Fellow, the highest individual national distinction the sector offers to those teaching in higher education. He holds a PhD in Parallel Computing, an MSc in Computational Science, and an MA in Higher Education.

Much has transpired in the last decade in terms of society, ethics, and the computing profession – and their relationship with computing is constantly changing. We have seen social media affect democratic elections, and today fake news, data leaks, hacks, and scandals involving personal information are rife. Recent advances in generative AI have led to a flood of societal, professional, and ethical issues in mainstream media, and now it is possible that some of these articles themselves were AI generated. The impacts of computing on society have never been more high-stakes and our ethics have never been tested in these ways or to this degree. Dr. Becker will present the major role of this perspective of CS2023.

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