

Characteristics of Computer Science Graduates

The characteristics that will help computer science graduates realize their full potential while meeting the current and future needs of society are central to the design of computer science programs. Every recent iteration of computer science curricula (2001, 2008, 2013) has attempted to identify them. Given the dynamic nature of computer science, these characteristics have evolved over time. After obtaining input from surveys of 110 academics and 865 industry practitioners, the CS2023 Task Force identified characteristics along three dimensions.

- **Professional knowledge and skills** demonstrating technical expertise
- **Professional responsibilities** toward society, ethics, and the profession
- **Professional dispositions** such as persistence and life-long learning

Professional knowledge and skills—for a technical solution

A computer science graduate must have foundational technical knowledge and skills described as CS Core in CS2023, supplemented by more advanced knowledge of the KA Core and Non-core topics selected by each institution. A computer science graduate should be able to apply the knowledge and skills to develop complete and correct solutions to problems.

A computer science graduate must have minimally acquired the following **knowledge**.

- Fundamentals of software, systems, and applications development
- Current tools, libraries, and frameworks for developing solutions
- Mathematical and theoretical underpinnings of computing

A graduate must have developed essential **skills** including problem-solving (decomposition, recognition of solution patterns), algorithmic thinking, analytical reasoning, and working at multiple levels of abstraction to formulate computing problems and their solutions.

Other desirable characteristics include the ability to quickly learn the essentials of new problem domains and apply computing solutions to them, the ability to handle ambiguity and uncertainty, and the ability to work in teams.

Professional Responsibilities – for the whole solution

A computer science graduate must be committed to the **whole solution**: not just to the technical aspects but also to issues of the society, ethics, and the profession summarized in the CS2023 knowledge area of the same name (SEP) and elaborated as a separate knowledge unit in most other knowledge areas. To that end, a graduate must:

- Demonstrate knowledge of a code of ethics and conduct appropriate for computing professionals (e.g., ACM [1], AAAI [2], or IEEE [3]) and commitment to abide by such a code.

- Demonstrate awareness of responsibilities beyond those captured in a professional code (e.g., global and cultural competence and the priorities and impact of local values and practices across the world).
- Work to maximize the benefits of computing for the society at large while preventing harm to individuals.

Professional dispositions – the whole person view

Professional dispositions are essential for not just succeeding in the workplace but also thriving as a professional over the long run. The dispositions identified by multiple CS2023 knowledge areas as essential for computer science graduates include:

- **Adaptable**, as the discipline is continually evolving;
- **Collaborative**, as most real-world applications are team efforts;
- **Inventive** in order to devise new solutions and apply existing solutions to new contexts;
- **Meticulous** to ensure the correctness and completeness of solutions;
- **Persistent**, since computational problem-solving is an iterative process;
- **Proactive** to anticipate issues pertaining to usability, security, ethics, etc.;
- **Responsible** in all aspects of a solution including design, implementation, and maintenance;
- **Self-directed**, as commitment to life-long learning is required due to rapid evolution of the discipline.

These characteristics change in importance over the career of a graduate: some characteristics are more important during early career while others are essential for success over the long run [4]. Moreover, given the dynamic nature of computer science, the desirable characteristics of computer science graduates will also continue to evolve.

References

- [1] <https://www.acm.org/code-of-ethics>; accessed March 2024.
- [2] <https://www.ieee.org/about/corporate/governance/p7-8.html>; accessed March 2024.
- [3] <https://aaai.org/about-aaai/ethics-and-diversity/#ethics-conduct>; accessed March 2024.
- [4] Simha, R., Kumar, A.N., and Raj. R. K. 2024. Undergraduate Computer Science Curricula. *Commun. ACM* 67, 2 (February 2024), 29–31; <https://doi.org/10.1145/3624729>.