HMC Computer Science Department

Departmental Goals and Student Learning Outcomes (Spring 2015)

Part I: Goals for HMC students' computer science education

1. All HMC students will demonstrate the skill of designing, implementing, documenting, and testing their own programs and algorithms in order to complete computational tasks.

Student Learning Outcomes:

a. Students will break broad computational problems into their component sub-problems and compose solutions for and from those components.
b. Students will design algorithms to solve a wide variety of problems and they will then be able to translate those algorithms into an executable program in a specific programming language, e.g., Python, in recent years.
c. Students will write clear, appropriate, and concise documentation for their programs.
d. Students will develop test cases that reveal programming bugs – and then fix those errors.

2. All HMC students will appreciate the breadth of computer science as a field of study, as well as the breadth of CS's applications and connections to other fields.

Student Learning Outcomes:

a. Students will identify applications of computer science to society overlapping with at least three distinct non-CS fields.
b. Students will articulate some of the big questions, answers, and ideas of computer science, e.g., (un)computability, (non)universal models of computation, and execution efficiency.
c. Students will describe the relationship among a number of major sub-disciplines within CS, including functional and imperative programming, computer architecture, and theoretical computer science.

3. For all HMC students to enjoy the hands-on acquisition and application of computational skills.

Student Learning Outcomes:

a. Students both in and outside of the CS major will opt to further their computational abilities, e.g., by CS classes beyond those required for graduation or by learning computational skills independently in other academic contexts, professional contexts, or for other projects.
b. Students both in and outside of the CS major will apply computational skills and principles to problems of their own personal and professional interest – and will feel comfortable doing so.
c. At least some HMC students -- both inside and outside of the CS major -- will opt to undertake research and/or open-ended projects in computer science.

d. A majority of HMC students will undertake at least one *optional* computational challenge or opportunity during their span as undergraduates.
e. All HMC students will feel strongly supported by the HMC CS Department in the development of their computational skills.

4. To ensure that both CS and non-CS majors are able to participate in CS research.

Student Learning Outcomes:

a. Students will be able to apply the scientific process to CS research, including designing and conducting experiments and testing hypotheses
b. Students will be able to conduct research experiments that demonstrate facility with the knowledge of content, synthesis, technical proficiencies, and communication skills
c. Students will be able to design useful, feasible experiments to address a computational question, and they will be able to use problem-solving skills to create or adapt their initial approach.

Part II: Goals for the computer science major at HMC

5. For all CS majors to demonstrate competencies that make up the core of the discipline of computer science.

Student Learning Outcomes:

a. Students will demonstrate proficiency in the areas of CS considered central to the discipline: the design, analysis, and use of data structures, the impact of machine and memory architecture on software design and performance, the principles underlying programming languages and their paradigms, and foundational algorithms including sorting and searching.
b. Students will exhibit an understanding and facility with the mathematical and logical foundations of CS, including predicate and first-order logic, discrete mathematics, formal models of computation, and the analysis of algorithms' resource use.
c. Students will succeed in optional, advanced-topics CS courses by building upon the foundation they developed within the core CS curriculum.

6. For all CS majors to demonstrate success in open-ended, student-driven investigation. Students will be comfortable and competent with a variety of computing paradigms, platforms, and environments and thus can readily acquire new skills as needed.

Student Learning Outcomes:

a. Students will demonstrate skill with the computational hardware, software, and paradigms commonplace in today's academic and professional workplaces. This includes designing and

writing substantial code corpora in many different general-purpose languages, e.g., C++, Python, Java, Haskell, C, assembly, as well as special-purpose/domain-specific languages.

b. Students will demonstrate principles of software engineering in both small and large-scale projects, including both individual and collaborative efforts.
c. For a long-term (one-year) clinical project, students will exhibit the successful completion of background research, preliminary and conceptual project design, interim presentations, software design documents, models, and prototypes, and final deliverables and reports.
d. Students will demonstrate the flexibility to adapt to the specific needs of a project, e.g., within the clinic program, even if the required technologies are unknown beforehand.

7. For all CS majors to develop professional skills in writing, visual, and oral presentations, both in academic coursework and in open-ended clinical practice.

Student Learning Outcomes:

a. Students will be able to communicate through a polished presentation with professional and lay audiences about a computational challenge, their approach(es) to addressing it, and the results of those efforts.
b. Students will demonstrate team-interaction skills over an extended (year-long) effort in an open-ended computational project that satisfies both internal (HMC) and external evaluators.
c. Students will demonstrate that they can independently find and use information pertinent to their research and professional efforts.
d. Students will be able to write a substantial, collaborative project report using language, visual charts and diagrams, and overall organization characteristic of professionals in the field.
e. Students will demonstrate an understanding and appreciation of the broader impacts of their computational and other work on society.
f. CS graduates will succeed at high quality graduate schools in CS and related disciplines and/or will join (or found) companies, institutions, and other careers that further their personal and professional development.