MEMORANDUM

To: Executive Senate
From: The Department of Mathematics and Computer Science
Re: Request for New Faculty Position in Computer Science
cc: Warren Rogers

January 14, 2008

The Department of Mathematics and Computer Science hereby requests a third faculty position in computer science. Our rationale is three-fold:

1. A global, Christian, liberal arts college that wants to engage modern society and culture through the sciences should have a vibrant, high-quality program in computer science. As computing becomes more and more pervasive throughout today’s world, we feel called to develop competent and compassionate practitioners of this discipline.

2. Computer science should be making more of a contribution to Westmont’s general education program. A thoughtful exposure to the concepts of computing and the associated ethical concerns can benefit students from all majors. Furthermore, computer science provides especially fertile ground for interdisciplinary connections.

3. Our computer science program is not sustainable in the long-term with the current level of staffing. Computer science is a very young discipline that demands continual development of courses and curriculum. Undergraduate research is fundamentally important, and recruiting is essential for building a robust and effective program. Our two faculty have worked extremely hard to be faithful to all these demands, but they need help.

1 Offering a Quality Program in Computer Science

1.1 Goals and Vision

Our Departmental Learning Outcomes state that we want our graduates to be able to:

1. Demonstrate knowledge of the main concepts, skills, and facts of the discipline.

2. Be able to communicate ideas from the discipline following the standard conventions of writing or speaking in the discipline.

3. Demonstrate ability to formulate and attack a novel problem.

4. Know how to incorporate their discipline-specific skills and interdisciplinary knowledge into their thinking about their vocations as followers of Christ.

Our Computer Science Vision Statement reads, “Like many excellent and rigorous computer science programs around the world, we emphasize the fundamental and theoretical foundations of computation.” We claim to “… lay a solid foundation of the fundamentals on which constant changes are ultimately based. The formal foundation we lay serves our students well in their continued education in graduate school.”
An additional faculty position in computer science will enable us to meet these departmental and institutional goals of rigor and excellence.

Undergraduate research is a key component of our curriculum and is a hallmark of a quality undergraduate science program. Undergraduate research contributes significantly toward all four of our departmental learning outcomes: in core knowledge because students learn science by doing science; in written and oral communication skills through writing and presenting research papers and posters; in formulating and attacking a novel problem because research problems are inherently novel problems; and in incorporating their knowledge into their faith through the close mentoring that takes place as part of the research process. We currently require all computer science majors to complete at least two units of research, and we encourage and expect many to complete additional units and/or to engage in research during the summer. Having a third faculty member who can supervise student research in a new area will add much-needed help to this area of strength.

1.2 Comparable Institutions

The ACM’s Computing Curricula 2001 is the profession’s primary document on curricular guidelines for undergraduate programs in computing. This report states,

The number of faculty in a computer science department may vary from as little as three or four at a small college or a private liberal-arts college to 40 or 50 at a large research university.

Westmont’s staff size of two computer scientists is below what is generally accepted as minimal. Institutions to which we aspire almost always have more faculty: Taylor and Calvin each have seven faculty members in computer science, Gordon\(^1\) and Pomona have four, and Harvey Mudd has nine. Many other institutions also have more faculty: Point Loma and Master’s each have three, North Central College (Naperville, IL) and Benedictine (Lisle, IL) each have five.\(^2\)

1.3 Enrollment in the Computer Science Major

Although the number of students majoring in computer science at Westmont has recently experienced a dip (as did virtually every computer science program in the US), we are already seeing a rebound in the numbers in our first year class and our potential incoming students. In Fall 2007, the enrollment in CS 10 was the largest it has been in some time.

The new scholarship grant of $287,500 from the National Science Foundation will likely have a very positive impact on the number of students majoring in computer science. We are able to offer scholarships of up to $10,000 per student per year, for two students in the first year, ramping up to ten students in the fourth year. We are currently undergoing a major push in recruitment due to the scholarship grant.\(^G\) The scholarships will bring students who are committed and talented, which will lift the quality of the program. Additionally, our new facilities in Winter Hall should have a positive effect on student numbers.

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\(^1\)One of Gordon’s CS professors has a joint appointment with Chemistry, and another is joint with Mathematics.

\(^2\)Data collected from department websites, October 18 and November 3, 2007.
Although the number of students in computer science courses is currently low, we believe that it will grow significantly in the future, back to previous levels and well beyond. As it grows, it will bring to Westmont more male students, who are historically over-represented in computer science, addressing the institutional goal of gender balance among students.

1.4 Course Offerings

Computer science by its nature is a broad field that requires many different courses to be offered as part of a major. Even if we have only a few students majoring in computer science, we need to offer the courses required for them to complete the major. Currently, we are offering a very limited program due to staffing restrictions. Some courses are not being offered at all, and others are being offered infrequently. We have canceled several courses due to lack of staffing.

When we offer courses for the major, those courses should primarily be offered by tenure-track faculty who hold a Ph.D. in computer science or a related field, have an on-campus presence, and are subject to the regular faculty review process. In the past two years we have needed to hire four different part-time people, all without Ph.D.’s and outside the normal review process, to teach five different computer science courses. Adjuncts have taught both lower division and upper division courses in our major, and we will need to hire adjuncts regularly in the foreseeable future until we hire a third person. We are also relying regularly on the services of David Hunter and Jonathan Leech to teach computer science courses, neither of whom holds a degree in computer science.

Courses that are off the books that should be offered as part of a liberal arts program in computer science:

- Information Theory/Cryptography
- History of Computing

Courses that are on the books but offered infrequently that should be offered regularly:

- Computer Ethics (very important for the Christian liberal arts)
- Machine Learning (very important for Wayne’s research; draws on inter-disciplinary connections with psychology and philosophy)
- CS 145 Operating Systems

Courses that are offered every other year that should be offered every year:

- CS 45 Computer Organization
- CS 120 Data Structures/Algorithms
- CS 125 Database Design
- CS 140 Networks
- Graphics Programming
Courses that are offered once a year that should be offered every semester:

- CS 5 Fundamentals of Computing
- CS 10 Intro to Computer Science I
- CS 30 Intro to Computer Science II

We now provide a sample two-year schedule that reflects our vision of a vibrant, high-quality program in computer science. As shown, there are nine courses that should reasonably be offered every semester. We anticipate 10–12 computer science graduates per year. We predict average enrollments of 20 in CS 5, CS 10, and CS 30, and average enrollments of 10–12 in other courses.

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2 Contributing to the Broader Academic Mission

2.1 General Education

We believe that a modern Christian liberal arts education should include some exposure to computer science. We currently offer two courses, CS 5 and CS 10, that satisfy the Reasoning Abstractly category of the GE. The department would like to serve more students from other majors by offering more sections of these courses in the future.

The number of students in service courses has to do with the requirements of other majors and of the GE. Although the number of students in CS service courses is currently low, we believe that
it could very well grow in the future. Several majors (physics, math, psychology) list a computer science course as an option, but none require one. We expect enrollments to increase in the future, as computers continue to become more integral to every discipline.

Although one of our six college-wide learning standards is Research and Technology, there is no requirement in the GE related to technology. We hope that future discussions of the GE with respect to learning standards will address this omission, which may well lead to increased enrollment in computer science service courses. For example, we might suggest adding a “technology intensive” course requirement to the GE, similar to the “writing intensive” requirement.

2.2 Interdisciplinary Connections and Christian Perspectives

Since computers have impacted every academic discipline, computer science naturally fosters interdisciplinary collaborations. Furthermore, computing provides fertile soil in which to examine ethical, moral, and social issues from a Christian perspective. Having another computer science faculty member who can engage in interdisciplinary collaborations and discuss technology from a Christian perspective will contribute to Westmont’s mission of providing a Christian liberal arts education.

While Wayne and Kim have done interdisciplinary research in the past, the current staffing situation limits the amount of time they can contribute to these endeavors. In addition to research, the department offers several different interdisciplinary “emphases” within the major. A third computer science faculty member will bring in another area of research that could potentially foster additional connections and collaborations.

We feel called to examine ethical and social issues in technology from a Christian perspective. Wayne and Kim have actively pursued the integration of faith and computer science, both at Westmont and in the broader academic community. However, the shortage in staffing has two effects: important issues get less attention because there are not enough voices, and the available voices become overused. A third computer science faculty member will add a voice to this important discussion.

3 Sustaining our Faculty

The manner in which our two computer science faculty members are currently working to fulfill institutional and departmental goals is not sustainable. The particular demands of the discipline of computer science make the current shortage in staffing particularly burdensome to Kim and Wayne.

Computer science is a young, rapidly changing field. Courses and curriculum must be continually developed and redeveloped. This requires a commitment of time and energy beyond that felt by faculty in most other disciplines. While a textbook or pedagogical change in Calculus might create extra work for a mathematics professor, the material remains fundamentally the same as it has been for years. In computer science, even the introductory courses have undergone significant changes in overall paradigm, not to mention improvements in software and technology. Upper-division courses can change even more rapidly, and the burden on our faculty is especially acute when developing these courses in areas outside of their specialties.
Our computer science faculty have also shouldered the responsibility of recruiting students into the program. In addition to bringing in over $500,000 in NSF funds for research and scholarships, our faculty have worked diligently with admissions, going well beyond the call of duty to attract students to Westmont and to the computer science major. These recruiting efforts have borne fruit; we have had many outstanding graduates in computer science who are now active in the profession. We believe that recruiting is a crucial part of building a quality computer science program at Westmont.

In addition to the unique demands of the discipline, Kim and Wayne have dutifully answered the call of their full range of responsibilities as faculty members in the sciences. Their research with undergraduates has been exemplary; each has published multiple papers with student co-authors. They have been energetic and conscientious in their teaching, advising, and institutional service. And they participate fully in the broader Westmont community. They have done great work here, but they need help.

The addition of a single faculty member in computer science will have a huge effect on the sustainability of our program. This fifty-percent increase in staffing would transform our program from one in which the faculty feel stretched very thin, to one in which the three faculty could thrive. And the resulting impact on the quality of the program and its contribution to the Westmont community will make a significant return on the college’s investment.