Computer Science Program:
Preliminary Six-year Report

Westmont College
Department of Mathematics and Computer Science
2014

I. Introductory Summary

We did not start with Key Questions at the beginning of this six-year cycle. Thus, this report summarizes a retrospective of our program review activities as guided by the evolving culture at Westmont over the last six years, with a focus on the last four years. During this time, our computer science program has launched students into careers in industry and graduate school, but has also been severely understaffed. With a nominal staffing of two full-time tenure-track computer science faculty, during only three semesters in the last twelve, and one in the last eight, have we had both faculty members present. Despite this, we have made improvements to our curriculum, continued involving students in our research, and continued our assessment work during this time.

II. Findings

A. Student Learning

In 2007, we established four program outcomes for our graduates. Except for minor wording changes, these outcomes remain unchanged. For each of our four outcomes, we discuss what we have learned about our students' learning through our assessment activities, and what changes (if any) we intend to implement in the future. For each outcome, we consider: (1) what we learned about our students' learning, (2) changes we have made and plan ta make to improve student learning, (3) effectiveness of our current method for assessing student achievement, and (4) potential changes to our assessment work.

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C1: Core Knowledge: Know the core ideas and methods in the field of computer science

Although computer science is still a young field with tremendous variations in emphasis, sets of core competencies have been identified by a number of organizations. At Westmont, we look to the guidelines created for computer science in the liberal arts (see Walker & Kelemen, 2010; and A 2007 Model Curriculm, 2007). Although not ideally suited for the liberal arts model curriculum, we have used the Major Field Test in computer science for the six years prior to 2014 as a means for measuring our students' mastery of the core ideas and methods in computer science.

1) What we learned about students' learning

For 18 students taking the MFT, 13 scored above the 50th percentile and 8 scored above the 70th percentile. As a program, we score in the 65th percentile among 217 other institutions using the Major Field Test. As of 2010, our benchmark has been 50% of our students score at or above the 70th percentile. The results for these 18 students do not quite satisfy that benchmark.

student	score	percentile
1	132	10
2	159	70
3	164	75
4	154	60
5	160	70
6	141	30
7	156	60
8	162	75
9	121	1
10	181	95
11	170	85
12	143	35
13	159	70
14	149	50
15	165	80
16	164	75
17	157	65
18	140	25

If we look at the sub-section scores for the three areas *programming*, *discrete structures and algorithms*, and *systems: architecture/operating systems/networking/database*, our students collectively score above average in first area and below average in the other two areas.

2) Changes made or planned to improve student learning

During the last several years, we have modified our core curriculum. For reasons related to the liberal arts model curriculum mentioned above, we added CS045, Computer Organization and Architecture, to the core requirements. Although this change was made prior to obtaining the sub-section scores, we expect that it will improve our programmatic score in the third area. We also removed from the core a seminar course, CS050 Morality, Information, Logic and Knowledge, that duplicated functionality with an institution-wide GE course in order to allow students to spend more of their major units on the core content of computer science.

3) Effectiveness of our current method for assessing student achievement

We are happy with the MFT as an external check on how well our students are learning the core knowledge of computer science. However, the cost, administrative load, and student motivational concerns have caused us to stop using the test. Through ongoing discussions, we may resume using the test but only if no better mechanism for assessment can be found and if these concerns can be satisfactorily addressed.

4) Potential changes to our assessment work

When we are fully staffed, we will revisit this assessment question in conjunction with open questions about our curriculum itself.

C2: Communication: Communicate ideas in writing and orally, following standard conventions of the discipline

1) What we learned about students' learning

In all of our classes, we want students to practice effective written and oral communication, whether it be oral presentations to peers, papers written on assigned topics, or merely asking questions in class. We have chosen to focus our assessment of this outcome within our Senior Seminar (CS195). We have decided to establish CS195 as our program's GE course satisfying the 'writing- or speech-intensive course within the major' requirement. As part of class, we have students give four formal presentations on the advancing phases of their senior projects, as well as several additional informal progress reports. We developed a rubric for scoring the oral presentations in the senior seminar. Our benchmark is that 75% of the students will show some improvement in communication. Of the 21 students who have taken CS195 over the last four years, 10 have shown improvement in their oral presentations over the course of the semester. At just below 50%, this may be a good outcome considering that students may have already improved significantly during their four years of college.

Rubric for Oral Presentations in Senior Seminar

	Superior	***Adequate***	***Lacking***
Organization of content into coherent flow of ideas	Elegant conceptualization and decomposition of content	Structures content into sensible units but places extra demand on listener to understand	Fails to structure the ideas into meaningful progression
Delivery of presentation: eye-contact, posture, appropriate attire, flow of speech, comfort level	Makes appropriate eye-contact, stands and moves in a natural manner, dresses appropriately, speech flows smoothly, and conveys a level of ease	Demonstrates three or four of the five qualities of superior performance	Fails to demonstrate at least three of the five qualities necessary for superior performance

2) Changes made or planned to improve student learning
We have experimented with informal oral presentations in other courses of our major, starting with the first introductory class, CS010. These experiments, while providing positive anecdotal support for improved learning in the area of communication, have subtracted from the coverage of core content in those courses. Therefore, we have not established a uniform practice of oral presentations in other courses of the major.

3) Effectiveness of our current method for assessing student achievement
Although we observe some improvements just within the senior seminar, we realize that focusing our assessment in the final semester of students' final year leaves open the possibility that we will have already missed significant improvements in students' communication skills.

4) Potential changes to our assessment work
When we are fully staffed, we will visit this topic and consider options such as formally introducing a presentation component to one of our introductory courses or modifying our rubric from a relative improvement during the senior seminar to an absolute competence threshold.

C3: Creativity: Independently learn new ideas and techniques and to formulate and solve a novel problem in computer science

1) What we learned about our students' learning
We initially established our benchmark as 50% of our students will produce externally reviewed publications or posters. Over the last four years, students have not been generating such work at a rate that supports our current benchmark. Our reflections on this and on the C3 learning outcome itself lead to a rubric (established 2013) for evaluating students' performance with respect to this outcome.

Rubric for Creativity in Senior Seminar

	Unsatisfactory	*Satisfactory*	*Exemplary*
Independently learn new ideas	Most or all occasions of learning or overcoming significant obstacles require assistance from faculty or peers	Most significant obstacles are overcome independently through independent discovery and practice	Lessons learned while overcoming obstacles give rise to further discovery on related problems and/or to the articulation of connections between problems
Formulate a novel problem in computer science	Either cannot formulate a problem to be explored, or cannot distinguish novel problems from those that have been solved before	Able to distinguish novel problems from others, and able to formulate statements of the former	In addition to formulating novel problems, can identify the scope and significance of such novel problems
Solve a novel problem in computer science	Unable to implement a complete solution	Able to complete an implementation that solves the problem in a practical (even if sub-optimal) amount of time	Completes an ideal, or nearly optimal, solution to the problem, identifying places where the solution is sub-optimal and articulating the trade-offs adopted within the given solution

During the same period, department faculty approved significant changes to the CS major; these changes included the elimination of the Research requirement. As such, we are increasingly relying on the capstone course, CS195 Senior Seminar, to provide data on students' creative problem solving skills. The application of the new rubric to our senior projects over the last two years indicates: 15 of 15 students demonstrated learning new ideas independently at a *satisfactory* or better level; 9 of 15 formulated a novel problem in a satisfactory or better way; 11 of 15 students implemented solutions to their problems in a satisfactory or better manner. Overall 12 of 15 students demonstrated satisfactory or better performance in at least two of the three areas.

Primarily, this rubric will be applied to projects in CS195 Senior Seminar. However, it can also be applied to other research projects on which students participate. As a preliminary benchmark, we expect 80% of our students to perform satisfactorily or exemplary in two of the three categories. Based on the last two years, our students are meeting this benchmark.

Changes made or planned to improve student learning
None at this time.

Effectiveness of our current method for assessing student achievement
We believe that better alternatives exist for assessing this student learning outcome.

Potential changes to our assessment work
When we are fully staffed, we will begin consultations with other creative arts, such as studio art,

music composition, theater arts, and composition with the goal of more effective assessment approaches.

C4: Connections: incorporate computer science and skill into a wider interdisciplinary framework and especially into a personal faith and its accompanying worldview

What we learned about our students' learning
The rubric that was established in 2010 proved to be overly complex and unwieldy for our purposes. A revised rubric in use for the past year looks at two areas – interactions between faith and academics and interactions between computer science and other academic disciplines – and for both areas it assesses students' work as lacking, adequate, or superior. Students lacking a quality in one or both areas are unable to identify (let alone develop) any interactions or relationships. Students deemed to have an adequate level of ability will perhaps identify, but not develop, an insightful interaction or relationship. Alternatively, some students demonstrating an adequate level may identify and carefully develop superficial relationships. Either of these levels of performance are assessed as adequate. Finally, students may identify and develop *insightful* interactions and relationships and are soaid to have acquaried a superior level with respect to the area of this learning outcome. Our initial benchmark with respect to this rubric is that 70% of our students will demonstrate adequate or superior performance in articulating their thinking about interactions between faith and learning as well as CS and other disciplines. Over the last two years, 2 students were evaluated as lacking in both areas, 3 students as superior in both areas, and the remaining 10 students as adequate or superior in both areas.

Changes made or planned to improve student learning
None at this time.

Effectiveness of our current method for assessing student achievement
We consider the current rubric to be adequate for our purposes.

Potential changes to our assessment work
When we are fully staffed, we will revisit this learning outcome and how we assess it.

B. Alumni Reflections
On June 16, 2014 the department sent an e-mail to 180 alumni (1979–2014) inviting them to complete a SurveyMonkey questionnaire. As of this writing 72 responses have been received (thus giving a 40% return, with 60% of the respondents being male and 40% female). Appendix A contains the survey questions; Appendices B and C give the free-form responses.

Alumni attitude towards the departmental program
Alumni were enthusiastic regarding the teaching in the department, as the following (rounded) response percentages demonstrate: superior (36), strong (60), adequate (4), weak (0), very weak (0). Written comments corresponded with these percentages. All but one alumnus responded to the free-form question regarding strengths of the department. Of the responses 60% listed either faculty access, care, attention, or teaching capability as the best aspect of the program. Other comments mentioned high standards, the rigor of the curriculum, small class size, and collaboration as strengths. All but two respondents would likely recommend Westmont to others.

Regarding suggested improvements to the program 68% gave suggestions, although 17% indicated either that no improvements were necessary or didn’t feel qualified to offer any suggestions (usually

because too much time had elapsed since graduation). Many of the suggestions could only be implemented with an increased budget, such as offering upper-division courses every year, having more faculty, or offering a larger selection of courses. Several indicated the department should have a greater emphasis on applied areas, class projects, overseas options, or practicum opportunities.

Preparation for life after Westmont

Alumni similarly gave high marks regarding the preparation they received as compared with their co-workers, peers, or colleagues: stronger (38%), above average (49%), average (10%), less than average (4%), weaker (0%). As the following table depicts, they also gave high marks (shown in percentages) for the department's four core outcomes (learning the core content of the discipline, communicating clearly in written and oral forms, creativity, connecting faith with discipline).

	Importance for Life's Work			Degree of Achievement		
Outcome	**Very**	**Somewhat**	**Irrelevant**	**Good**	**Average**	**Poor**
Learning Core Content	51	40	8	63	33	4
Communicating Clearly	90	10	0	78	21	1
Creativity	81	19	0	72	26	1
Faith and Discipline	29	38	33	63	35	3

About 54% of the respondents have received advanced degrees of various kinds, with 12% listing a Ph.D. Vocationally our alumni are engaged in a variety of pursuits. Appendix C lists the responses.

Recommended changes

On balance the department is delighted with the strong positive response that alumni gave on all aspects of our program. Many of the recommended changes are beyond departmental control (e.g., hire more faculty, increase course offerings). One curricular suggestion, however, came up often enough to warrant further attention: the desire to have more of an applied emphasis. Due to the instrument used to collect this data, it may not be possible to determine if this sentiment is expressed across graduates from both majors or, as suspected, comes primarily from majors in Mathematics; looking into this question will be a priority for the department in upcoming discussions.

C. Curriculum Review

Our goal in the computer science program at Westmont has always been to provide a foundational preparation that will serve students as the basis for life-long learning. As a field that is changing more rapidly than most, the importance of life-long learning is much more immediate than in most disciplines. If we were to focus on the techniques, languages, or hardware of the day, our students would be out-of-date by the time they graduated. Holding this foundational perspective, we have nevertheless made significant changes to our curriculum over the last three years. In summary, these changes have strengthened the core requirements to ensure that all students cover a common core of the field, and increased the number of electives in service of student preferences and choice. In detail, our changes included:

- Elimination of CS050 Morality, Information, Logic and Knoweledge from the core requirements for majors. This is a great class that is fun to teach and (usually) fun for students. However, with two CS faculty, we should focus our efforts on the material that we really want

our majors to absorb. This is even more relevant given that we have had only one CS faculty for seven out of the last eight semesters. If we have any margin after satisfying those curricular needs, we should consider offering CS service courses that we are arguably most qualified to teach, vs. Philosophy courses where others may be more qualified.

- Elimination of interdisciplinary tracks. These options previously allowed students to substitute one CS elective with two upper-division courses from a second field (for the BA) or simply replacing two CS electives with two from another NBS field (for the BS). CS naturally lends itself to interdisciplinary study. These tracks were intended to encourage and support such study, as well as to increase double majors. Instead, they seem to have had the effect of reducing the rigor of the CS portion of a student's major. Effectively, we were offering a BA in computer science for 36 units. Given the lack of benefit to students, the administrative and advising overhead did not appear to warrant the continued practice.
- Addition of CS045 Computer Organization and Architecture and CS105 Programming Languages to the core requirements. This change actually reverts back to the shape of the major during the years 1999 through 2005. Again, these additions improve the uniformity of what students graduating with a degree in computer science may be expected to know.
- Elimination of CS192 Project and CS198 Research requirements. All of our upper-division courses (with the exception of the cross-listed course MA/CS135 Formal Languages and Automata) are organized around a significant term project. Requiring the CS192 Project units proved to be an administrative burden to our understaffed program. In the case of CS198 Research, we discovered that a significant fraction of our students were unprepared to participate in computer science research.
- Revision of the minor to require CS120 Data Structures and Algorithms and one elective course, instead of CS005 Fundamentals of Computing and CS195 Senior Seminar. This change significantly improves the rigor of the minor, making it very plausible that students completing just a minor could obtain employment in the software industry.

Additional curricular issues remain to be addressed. These include:

- Revision to the introductory sequence. The traditional introductory sequence of a CS1 and CS2 (corresponding to our CS010 and CS030) focuses on teaching computer programming skills. Although everyone acknowledges that programming is not computer science, it is also agreed that programming is our basic literacy by which we actually do computer science. Thus, students need to quickly come up to speed in this literacy in order to proceed with more advanced courses. Because computer science is largely a mystery incoming students, these students may not see the end-goal that motivates the acquisition of programming skills; computer science is internationally recognized as having a high attrition rate. It is believed by some that finding ways to introduce actual computer science in the introductory sequence can help improve retention. Reordering existing introductory course content or even overhauling introductory courses are possibilities we intend to explore.
- Reframing our Software Development course (CS130). When the CS major was instituted, the software development course was designed as an upper-division (Senior and Junior) course. During the last four years, we have been advising students to take CS130 during either their Sophomore or Junior years. The rationale for this has been based on the importance of the large-project skills covered in CS130 and which are applicable to the course projects in all our other upper-division courses. However, it may make sense to change CS130 to a lower-division course and require it to be completed before the rest of the upper-division coursework. We will explore this possibility in conjunction with our introductory sequence.
- Internship experiences. The value of internships has long been recognized across the academy

but especially in computer science. As a liberal-arts institution with limited number of units feasible for a major, we find it difficult to require such experiences when they take the place of the core content of the discipline. Indeed, we have restricted the number of practicum or project units that may be applied to the major to one-half of a regular four-unit course. However, we continue to recognize the value of internship experiences and we intend to explore ways that we can encourage or even require students to encounter such experiences without watering down the core content they must learn.

For all of these issues to explore in the future, we have them on hold until our computer science program is fully staffed.

D. Program Sustainability

During the last six years, we have graduated 24 majors in computer science. Of these, 7 graduates are female and 2 are persons of color. This representation of women (29%) exceeds national percentages (14%). However, we would like to see even greater representation by women in our program at Westmont, where approximately 60% of the student body is female. As a whole, Westmont has made great progress in increasing the diversity of our student community; we continue to hope that we will see a corresponding increase in students of color in our major.

All of our graduates who seek employment in the computer industry have at least one offer, with many having to choose among multiple offers. In these roles, they participate in developing the applications of tomorrow that will serve end-users or internal corporate needs. Because of the ability to draw significant salaries right out of Westmont, most of our students choose not to attend graduate school. Again, this is a nation-wide phenomenon that does not bode well for the ability to attract and retain faculty to teach computer science. Indeed, we are in the second year of a search to fill our vacant tenure-track position. This challenge in filling our open position points to the crux of sustainability for our program.

Even if we were to increase the number and quality of students four- or eight-fold, we will not be able to teach those additional students (let alone our current number of students) without a full complement of qualified computer science faculty. We point out that we have only had two permanent tenure-track computer science faculty for three out of the last twelve semesters. In other words, we have been 50% staffed for 75% of the last six years. This is our biggest challenge for the ongoing health of the program. Unfortunately, it is unclear what changes are in our control that could increase the number of applicants for our open position.

III. Looking Forward: Changes and Questions

Our computer science program has effectively followed a path of continuous tuning in response to changes in the discipline, changes in the strengths and preparation of our students, and changes in our faculty staffing. While in some sense this approach has been necessary, it has created a series of program instances that calls into question the light that any methodical evaluation can shed on the overall effectiveness of our program or the changes that we should make next. Be that as it may, we can conclude several points:

- our graduates are highly successful in getting high-paying jobs, thereby enhancing the affordability of their education;
- the changes to our curriculum over the last four years (described above in II.C) have unquestionably enhanced the rigor of our major and the disciplinary foundation that our

graduates receive;
- the next changes we make in our program will depend on the makeup of the computer science faculty once the open position is filled.

This last point merits additional comment. Our current program reflects a strong commitment to the theoretical foundations of computer science as the basis for successful careers for our students, whether in the software industry or in graduate school. This commitment requires of our program's faculty a particular type of background and orientation. If we are unable to recruit a suitable faculty candidate, then the character of our program will need to change. Similarly, even if we hire a like-minded colleague, we do not have the luxury of limiting our candidate pool to a specific area within computer science that dovetails perfectly with our current faculty. Therefore, the specifics of her or his background will constrain the division of teaching responsibilities and consequently the possible changes to our curriculum over the next six years.

Reflecting on our mission statement – *to prepare students to participate in the redemption of the information universe by conceiving, creating, analyzing and critiquing computational technologies* – we believe it continues to express what we want for our graduates in computer science. If one thing is lacking from this articulation, it would be an explicit sense of leadership that we hope for our graduates. However, 'participating' in the redemption of this aspect of creation includes leaders as well as followers. The fact is that some of our graduates will not be innovators in the field; however, they can all contribute to the general improvement in computational technology whether through their creative, analytic, or moral qualities. Our thinking about leadership is elaborated in our vision statement. This latter document continues to express who we are and want to become.

Questions that serve as candidates for “Key Questions” during the coming cycle include but are not limited to:

- How can we provide a rigorous major in computer science with two faculty in a sustainable manner (assuming we can fill our open position)?
- generally, How can we reduce attrition among students who think they want to study computer science?
- specifically, What changes to the introductory sequence can help students reach a level of fluency that will lead to success in the rest of the program?
- How can we best introduce web-based applications and distributed computing in our curriculum?
- Can we virtually increase our faculty through local (or distant) friends of the program with extensive industry or academic experience?
- Can we attract and retain more female students and students of color?
- How can we better cultivate creativity in our students?
- If we abandon the Major Field Test as a measure of students' learning of core content and skill, how will we instead assess this outcome?

Appendix A: Survey Questions

Program

1. How effective was the teaching in the Department Mathematics and Computer Science?
    - superior
    - strong
    - average/ adequate
    - weak
    - very weak

2. How well would you say your Westmont experience in mathematics or computer science prepared you for your current work relative to your co-workers, peers, or colleagues?
    - stronger
    - above average
    - average
    - less than average
    - weaker

3. What was the best aspect of the departmental program?
4. What improvements would you suggest for the departmental program?
5. If a family member, friend, or business acquaintance asked you to recommend an educational institution, how likely would you recommend Westmont?
    - very likely
    - somewhat likely
    - not very likely

A follow-up question for those who responded not very likely: Why you would you not recommend Westmont?

6. How important has the non-technical (General Education, faith-learning, etc.) part of your Westmont education been to your life's work?
    - Very important
    - Somewhat important
    - Irrelevant

Outcomes

The following set of questions asks how important the department's program learning outcomes are for your current work, and how successfully you think you have achieved them.

• Outcome 1–Learning the Core Content of the Discipline:

How important is this outcome for your current work?

– Very
– Somewhat
– Irrelevant

To what degree would you say you have achieved this outcome?

– Good
– Average
– Poor

• Outcome 2: Communicating Clearly (written and oral forms)

How important is this outcome for your current work?

– Very
– Somewhat
– Irrelevant

To what degree would you say you have achieved this outcome?

– Good
– Average
– Poor

• Outcome 3: Creativity (ability to deal with non-standard problems or situations)

How important is this outcome for your current work?

– Very
– Somewhat
– Irrelevant

To what degree would you say you have achieved this outcome?

– Good
– Average
– Poor

• Outcome 4: Connecting your Faith and Major Discipline

How important is this outcome for your current work?

– Very
– Somewhat
– Irrelevant

To what degree would you say you have achieved this outcome?

– Good
– Average
– Poor

Demographic Data

7. Year of your degree from Westmont

8. Check the majors you completed at Westmont

• Mathematics

- Computer Science
- Other(s) (please list):

9. Gender
    - M
    - F

10. What graduate degree(s) (if any) have you received or are now pursuing?

11. What is your current role in society, and what do you consider to be your vocational calling?

Appendix B: Responses to Free-Form Questions

3. What is the best aspect of the departmental program?

• Collaboration of Mathematics and Computer Science, and size of classes allowing for close interaction between students and teachers.
• The personal attention we received from our professors. They always made time for students. They are also passionate about math and the bring that to the classroom every day.
• The heavy theoretical foundation has proven useful over and over.
• Excellent teaching. Excellent breadth of curriculum. Excellent preparation for post-college work and life.
• The care that the professors took in the students
• Access to the professors. This was true of more than just the Math and CS profs. But working with professors outside the classroom taught quite a bit.
• Teaching effective thinking and reasoning techniques.
• The fantastic student to prof ratio and the amount of 1-1 attention they were able to provide through their office hours.
• Professors
• Excellent teaching complemented by small class size.
• Professors had a high grading standards, and personal attention from professors was always available, both during class instruction time and office hours.
• A strong connection between the faculty and students lead to a deep understanding of the material and a confidence to put it into practice that other peers don't have.
• The rigor of the curriculum and the mentoring by the professors.
• In my year the ratio was 1-to-1 and the professors knew me personally. This was the greatest strength followed closely by the close ties of me and my classmates since they were only four math majors.
• Small classes– I should have taken more advantage of the opportunity to ask questions.
• High expectations combined with personal accountability.
• The teachers cared about you as a person and they shared their faith in their teaching.
• The small class setting and the interaction between students and professors.
• Discussions about the interconnectedness of between sub-disciplines of the field as well as discussions about the integration of computer science with the liberal arts and social justice.
• Small class sizes, and the personal interest taken by the faculty.
• At the time, it was small, lots of personal attention from professors rather than what you would get at a large school.
• Genuine and sincere care for individual students and their learning.
• The Support/help From The Professors
• The small class size was the best aspect of the department. It really allowed the students to get to know each other and the professors on a personal level. It also allowed me to fell more comfortable asking questions in class.
• Individual attention!! Access to professors and resources, openness to teach outside of the classroom and bring slower students up to speed. Very strong professors that are passionate about the subject.
• Personalization. Every professor seems to try and make time for the students
• The availability of the professors. If I ever had problems, each and every one of them was willing to help.
• Small class sizes and having teachers who truly took the time to work with their students.
• Ability to work closely with professors one-on-one. Professors and adjuncts are well connected in the SoCal computer science community and are great about linking students to internships and job opportunities.
• Genuine care by the professors for students' academic and overall well-being.
• Dr. Howell allowed me to run his math labs since I wanted to be a math teacher. It helped me learn the TI-83 graphing calculator.
• Finite automata, data structures and algorithm, math classes
• The teachers.
• The group study sessions in the math building. Collaborating with other students brought out our best critical thinking efforts.
• The low student to professor ratio. To me, it made the experience more personal and valuable by being able to

develop relationships with both the professors and fellow students.
• Individual attention, small class sizes for the junior / senior classes.
• The interest the faculty demonstrated toward each individual student.
• The small department was great, as I got to know the professors and they knew me. Different from a big university.
• The Professor's accessibility and care for the students' success.
• Small class size, teachers making sure that each student is understanding, offering office hours
• Personal communication with the professors as well as availability to students greatly enhanced the learning environment.
• Drs. Iba and Kihlstrom were very strong in understanding of their topics. They also understood their weaknesses and brought in adjunct professors to assist in their various fields.
• I received awesome instruction from super-caring professors.
• The culture of the department encouraged student to be competitive and still work as a group of students to help everyone reach their potential.
• Investment of teachers into development of math skills
• Small classrooms. Greater access to professors. Hands on work with computers.
• The faculty and their connection to the students.
• The professors
• The professors are truly invested in their students and genuinely care about their students' success
• The personal interaction with the professors and with the other members of my cohort. Developing an enjoyment of learning.
• I loved how accessible the professors were. I spent many hours doing homework in the math dept front office, and having the ability to simply walk back to my professor's offices and ask questions was crucial to my understanding the material.
• Small teacher / student ratio allowed for strong learning and relationships with educators
• Close relationships with/access to professors
• Learning the fundamentals of programming gave a good footing to learn on the job later on, even if I didn't learn the specific skills in school.
• The size, the community that was encouraged, and the hearts/passion of the professors
• The care and attention of the faculty.
• The ability to get to know the professors–personal-ness of the teachers. I believed that each professor really wanted me to learn and wanted to know me as an individual.
• Close contact with students Individual nurturing of talent
• The size of the program at Westmont meant I was able to work closely with my instructors and peers to better comprehend the concepts presented.
• The close contact with Professors. I don't know of any university or college that would promote and encourage the instructive 1-1 tutoring (essentially) I received from my advisor/professor
• Relationship between students and professors, availability of professors for discussion and help (also about life, not just about academics), professor's strong knowledge of mathematics
• Close knit, great professors who cared about each of us individually
• Solid fundamentals across the board. Required courses in a variety of subjects from algebra to analysis to probability to number theory. Very well taught and care for the students.
• Small class size of very dedicated and resilient peers, longsuffering of instructors
• Small class size provided comfortable learning environment
• Requiring students to have a solid foundation in Real Analysis, since it is prevalent to a vast majority of mathematics.
• Direct engagement with professors, both in and out of the classroom
• The one on one interaction with faculty and general encouragement from the department.
• I think the problem solving skills and critical thinking that we were taught.
• The one on one time with professors.
• Small class size and awesome professors.

4. What improvements would you suggest for the departmental program?

• Larger variety of class options.
• None
• Maintain or establish strong ties with industry so that graduates have practical experience to help them get a job. This should also serve to help balance the theoretical bias.
• Stronger push for internships and research projects. Also a stronger push towards Sys Admin / Linux type work. It's good to be well-rounded.
• It's been long enough that any suggestions would be outdated.
• More professors, more courses, more coding
• Keep up the good work
• Don't use adjuncts to teach any classes, specifically the lower division ones. I had an adjunct lady teach Calculus, and I thought she was very weak. I always felt I had a hole in my integrating skills because I didn't learn the material that well. Ultimately, what I learn is my responsibility, but at the time, I was young and didn't have a vision for what math could be.
• The only thing I can think of is to offer the courses more than every other year if it is possible.
• It was wonderful!
• There is always a tension between the theoretical and applied aspects of these areas of learning, and although I sense that most of the faculty tend to favor theoretical over applied, in point of fact the latter serves the needs of most students much better. I would favor looking at the curriculum from the perspective of a dual track with expectation that 70 to 80% of the students would choose the applied track.
• More connections to other departments–seminars that combine the specialties of a computer scientist and another type of expert, such as a political scientist or a philosopher.
• More electives
• Additional career development resources- connect students with alumni/resources to explore opportunities for math grads and different applications. More real-world experience opportunities math/stats programming (even just supplemental and extracurricular opportunities), applied math, graduate school, etc.
• More community building, it seemed like every other department did mixers for the students except ours.
• It has been 25 years . . . not sure what is the same and what is different.
• I think that having some more get-togethers amongst the department would be a useful thing.
I know some classes got together within math, but the department as a whole rarely did things together.
• Keep curriculum and projects up to date and easily do-able with widely available technologies.
Ran into several issues where projects were assigned on outdated programs, or where extensive work-arounds were needed to accommodate multiple operating systems.
• Give a little more structure to the senior project class. Especially with the size of the program, division of labor is hard and it might be better for seniors to work on one project together instead of compete for scarce resources (other students).
• Training in technology.
• To treat EVERY student as important; it seemed like only A students were valued. For example, I was not encouraged to go on to grad school, why not? I actually did go and graduated from grad school. Don't pre-judge students.
• All academic advisers should recommend a semester abroad. Not doing that is my biggest regret from Westmont. I also would have liked to hear more about possible career choices once graduated.
• To encourage more exposure to working professionals and career opportunities.
• When I attended Westmont, some upper division courses were only offered once a year or once every other year. Maybe try to offer some courses more often. I will say that knowing you had to take certain classes when they were offered made scheduling much easier.
• More presentations - oral and written. I advocated for Speech as a core requirement, as this was a skill I had to learn on the job.
• I am not in a position to speak to this, with 35 years between then and now. (I would have said the dept. could have done a better job teaching us to master the computer, since it was optional at that time. That, naturally, has already changed!)
• I have no suggestions.
• I can't think of anything. I loved my experience and look back on my time in this department with great memories, even though I was not the best student.

• Many of the modernizing improvements that I would suggest from when I attended 20 years ago have probably already been implemented.
• Obviously the number of professors is lacking. Aside from that nothing springs to mind.
• It's been a long time and probably this has improved since then, but the one thing I missed was a little bit of preparation for the transition to the culture of research university for my PhD program. Two things I remember being pretty clueless about were (1) that I needed to take the GRE (this is my fault, I'm sure. but no one really mentioned it either) and (2) that in a research institution, you're supposed to attend talks. So for example a Westmont expedition out to UCSB to attend a talk would have been a good thing for me.
• This is hard to answer since I have been away from Westmont for so long.
• Increased investment into personal lives of students. (was not done poorly)
• I was in the first graduating class so I don't know what's changed since then, but in general, form partnerships with businesses in the area to give a practical, hands-on element to the program.
• After 35 years I hope they have a new computer, or maybe two! :) I am a little out of date to have any valid suggestions.
• It would be nice if the mathematics department had a more rigorous track that helped better prepare for grad school
• Involving more learning about industry practices such as processes, tools, and technologies.
• Expand software development into two or three courses that focus on trade-specific skills
• A focus on larger projects and/or web development. I mention larger projects because only then do problems with some short-sighted approaches appear.
• Strong focus on team/group work. There was some emphasis on this in my calculus lab, but working together is HUGE in my job. Also, solving real problems.
• Too many years have past. The department has grown beyond what I knew, making it difficult to offer constructive criticism.
• I seem to recall that efforts have been made to make the curriculum more rigorous since my time at Westmont. Would students be interested in earning a BS in math from Westmont and an MS in math from UCSB in 5 years?
• in some instances, professors could enhance their teaching or explanations when students ask for help by gathering and having at their disposal multiple ways to explain the same concept, especially big ideas in abstract mathematics that will be initially unfamiliar to an undergraduate student
• get more CS students! teach more on web development and software as a service / cloud based technologies.
• I'm not sure I know enough about how the department is set up right now to make a sensible suggestion.
• None
• Having two statistics courses. One that is purely probability and the second that is purely theoretical statistics.
• Update the computer science material to be more current. Require more of the courses that would be helpful to the work environment.
• More applied mathematics, but that may already be accomplished :)

11. What is your current role in society, and what do you consider to be your vocational calling?
• Graduate Student and TA training other Physics students
• I am transitioning from Assistant Principal (after teaching math for 25 years) to a district Coordinator for mathematics K-12.
• Software Engineer
• Software Engineer. I'm quite happy and content.
• I am currently an equity portfolio manager. Right now, I consider my calling to be a visible Christian in an industry that isn't focused on Christ.
• IT
• Professor. Teaching, mentoring, and research.
• Tax accountant/Mom.
• Lawyer
• Wife, mother, teacher of mathematics
• I am a husband and father, spiritual mentor, taxpayer, citizen of the United States of America, helper to the world's poor, and advocate for the advancement of the Gospel of Jesus Christ. Vocationally, I am a software

consultant specializing in decision management systems and mathematical optimization.
• Software developer
• I am a secondary high school math teacher.
• I am a secondary educator although at the moment I am a professional substitute. I cannot imagine any other role for my service to God.
• I'm a math teacher!
• IT Professional and instructor. It appears to also be my vocational calling.
• I am currently the CEO for the company that my Grandfather started in 1985. We distribute power tools and hand tools to industrial and construction companies. I feel that God has me right where I am supposed to be. I remember fondly my time at Westmont and know that it helped to prepare me for the future.
• After teaching High School Mathematics for 10+ years, I am now a stay at home Mom working part time from home.
• Learner, teacher, and communicator. I consider communicating the synthesis of computer science and the liberal arts and connecting computer science to new problem domains to be my vocational calling.
• Mathematics Professor.
• Army Officer at U.S. Cyber Command. My vocational calling is as a cyber operations planner.
• I am currently staying in the home raising two wonderful children. I would consider my vocational calling to be teaching. I still get to practice this occasionally through volunteering in the schools.
• Instructing Students In Medical Fields Classes At The High School Level. Leadership And Encouragement. It Is Never Too Late To Follow Your Heart/Interests God May BE Calling You To Change Directions In Your Life.
• I am currently a grad student. I think my vocational calling is to teach.
• Digital Marketing and Sales Analytics at Google. Vocational calling is identifying data driven approaches and solutions to business/sales challenges and opportunities.
• I am a graduate student serving and learning. I feel my vocation is with college student affairs.
• I am teaching Junior High Math and have for the past 25 years...and YES, it was and still is my calling.
• Substitute teaching and tutoring. I consider teaching to be my vocational calling.
• Christian, Upper Middle Class office worker. Fitting in very happily with a job that balances software development and coordinating between all departments in the company.
• My current role in society is yuppie and husband. I consider my vocational calling to be one that facilitates solving human problems with technology.
• I teach Upper School Math at an International School in China to Third Culture Kids (TCKs).
• Vocationally, developer/manager
• Current role is cubicle jockey. My vocational calling is undetermined.
• I'm currently an intern with the public works dept, but I consider to travel and work abroad to be my vocation. I plan to make a photo journal documentary of a civil engineering project.
• Career: High School Mathematics Educator Main Responsibility: Wife, mother of 2, and step-mother of 2 Calling: Helping students to achieve and feel success in the area of mathematics
• Title: Enterprise Architect General description: Senior Technical Generalist for Computing Infrastructure, Fortune 150 Company Calling: Transformational Leadership
• missionary, pastor, teacher, discipler
• teacher
• Just finishing raising my 2 boys and getting them launched into their own pursuits. My vocation is as a pilot for United Airlines.
• Professionally I am a math teacher, but currently I am living on the mission field raising up the next generation of believers in India.
• High School Math Teacher, youth and women's ministry, homeschooling mom
• Currently I am employed by Special Olympics Montana doing data entry and web administration. I would say that I am leaning more and more toward teaching as a career...haven't really figured that one out yet.
• Part-time lecturer, physics, UC Irvine. Mom of 3 teenagers. Bible teacher at my church.
• High school mathematics teacher.
• Accountant
• CIO for the Superior Court of California, County of Los Angeles. I consider my role to be in alignment with my calling ("Justice", Micah 6:8)

• Role: Beginning as an retired Empty-Nester Vocation: I'll let you know next year when I discover it.
• Current role: Software Engineer (and is my calling)
• I am currently in transition
• My role is that I am an advocate for the motivations, concerns and effectiveness of the end-users of whatever software product that I am involved in helping to create. I have tried to promote empathy for our users in both my roles as a QA engineer and UX Designer.
• I am a 7th grade math teacher in Virginia. I just finished my 6th year teaching, I have taught at the high school and middle school levels.
• Sales / Marketing / Strategy
• software engineer
• Software Engineer
• Math Teacher
• Professor of Physics, which I consider to be my calling
• I teach high school. I believe that this job is also a calling.
• Director (Dean-level) of the STEM Division (includes natural and computational sciences with degrees in biology, chemistry, physics, mathematics and computer science) at a public university
• Part Time Math Teacher and full time mother and wife
• Software engineer.
• high school mathematics teacher; teaching, mentoring, discipling, and training students from multiple cultures and diverse backgrounds
• husband, father and a senior software engineer at a fast-growing company.. so hopefully I can impart not only good technical and programming skills, but pass on wisdom and Truth where possible.
• Senior Manager for the US Government
• Colleague inspiration, through calling others to challenging creativity; peer encouragement, support, resource provider.
• My role is to be a good model of Christ to my community. I am to be a role model and mentor to those around me. I fell my vocational calling is to serve people any way possible but especially in the area of mathematical appreciation and accounting/financial services.
• Current role is student and a job in STEM is my vocational calling.
• Father, Speaker, Programmer
• Epidemiologist
• Missionary in the field of Bible Translation
• software engineer for both
• Husband, Father, Church, Volunteer Youth Leader. Strategic Missile Defense