

**PROGRAM REVIEW  
COMPUTER SCIENCE**

**M.S. in Computer Science**

**2016**

**Name of Degree: Computer Science, M.S.**

**Department: Computer Science and Information Technology**

**Department chair: Michael Soltys**

**Program/department website: <http://compsci.csuci.edu>**

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**Note the following document organization for CSUCI program review elements:**

Chapter II     Element 1 - Defining Program Purposes and Ensuring Educational Outcomes

Chapter III    Element 3 - Developing and Applying Resources to Ensure Sustainability

Chapter IV    Element 2 - Achieving Educational Outcomes

Chapter V    Element 4 - Creating an Organization Committed to Learning and Improvement

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## **I. Executive Summary**

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The Computer Science (CS) program at CSUCI provides strong undergraduate programs in both Computer Science and Information Technology, and a graduate program in Computer Science. We offer three minors that serve as specializations in Robotics, Game Design, and Cyber-Security. Our graduates are employed at a high rate in the “101 Technology Corridor” (latest study of alumni show that over 60% of Computer Science students are working within 3 months of graduation, but anecdotally we are certain that the figure is much higher). Our Master’s degree program has also produced graduates who have done well in getting employment after graduation in industry, banking or research and development units.

The paradigm of a CS faculty is a teacher-scholar, which means that we stress excellence both in teaching and research. Our faculty writes papers, presents at conferences, and applies for – and is awarded – grants. We have no trouble attracting students, and indeed, the CS department is growing every year. We have a strong relationship with the local community, especially the Navy, and we engage in interdisciplinary work with other programs on campus, notably Mathematics, ESRM (Environmental Science), and Biology.

CS is a busy department. We are currently shouldering the weight of introducing Engineering to campus, we are collaborating with ESRM in drones, robots, and UAVs, we provide expertise in Cyber-Security, Algorithms, Social Media, and other areas. We are helping the university fundraise with the local community, we do outreach to the local industry, and we run clubs that compete at regional programming contests. We are enthusiastic about our work, but it is undeniable that we are stretched pretty thin. In particular, we absolutely need a dedicated admin staff (currently we are sharing one among 4 programs), a dedicated IT Lab person (we have brand new labs, but no staff), and funding for release time to continue developing the program.

This is the second time in its short history that CS has undertaken a self-study. The chair of CS is new (joined CI in 2014), and during the time when the self-study was conducted (academic year 2015-16), the only other senior (tenured) faculty was on a half-year sabbatical, and the only administrative assistant was on maternity leave. Thus the chair ended up preparing the self-study during the summer 2016, at the time when the other faculty are not officially on campus (and catch up on much needed research time).

### **A. PROGRESS ON ACTION PLAN**

The program has a new chair that joined CI in 2014, and 4 out of its 5 faculty have been hired in the last 3 years.

### **B. SUMMARY OF SIGNIFICANT ACHIEVEMENTS AND PROGRESS SINCE LAST PROGRAM REVIEW:**

There were 2 tenure-track faculty, now there are 6. Mechatronics Engineering has been approved, and it will start in 2018. We are publishing in conferences and journals, and we are

building a culture of research in the department. The MSCS program was reopened last year. We are setting up an Advisory Board.

## **II. Program Purposes and Ensuring Educational Outcomes**

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### **A. HISTORY AND CONTEXT**

The program started under the auspices of Mathematics, and Mathematics itself was formed in 2001, at the very beginning of the existence of CI. The first Computer Science faculty was AJ Biesczad, hired in 2003/04, still under Mathematics, but CS split from Mathematics in 2003/04. The first chair of an independent CS was Bill Wolf, who hired – for example – Anna Biesczad, who to this day lectures in the program, most frequently our gateway courses COMP 150 and 151. IT started as an Extended University “degree completion” in 2007/2008. It was meant for transfers from associate technology programs at two-year colleges (Bill Wolf got a shared federal grant – with the College of the Canyons – to introduce such a program). IT became a regular “state-side” (i.e., non-Extended University) 4-year program in 2010/2011. The MSCS started in 2005/06, and AJ Biesczad was the director of the program until the new chair, Michael Soltys, took over in 2015/16. There was an interim chair between Bill Wolf, and Michael Soltys, namely Peter Smith. The Gaming minor was added in 2006/07, and the Robotics Minor was added in 2014/2015. The Cyber-Security minor was added in 2015/16. Most of the faculty has been hired in the last 3 years: David Claveau in 2013/14, Brian Thoms and Michael Soltys in 2014/15, and Jason Isaacs in the 2015/16. There is a new faculty, Pawel Pilarczyk, joining the department in the 2016/17. A new major in Mechatronics Engineering was approved by the CI Senate in 2015/16, but it will not start until Fall 2018.

As can be seen from this brief history, CS has functioned for about 10 years with one or two tenure-track faculty (AJ Biesczad), and it has grown to 5 tenure-track faculty in the last 3 years. Thus the department is very young, and 3 out of the 5 faculty are in the process of getting tenure.

### **B. PROGRAM MISSION AND GOALS**

#### **CSUCI Mission Statement:**

Placing students at the center of the educational experience, California State University Channel Islands provides undergraduate and graduate education that facilitates learning within and across disciplines through integrative approaches, emphasizes experiential and service learning, and graduate students with multicultural and international perspectives.

In light of the above our program’s mission is the following:

CS permeates every aspect of human endeavor, and thus it is a truly interdisciplinary field. CS is fast growing, and its graduates are in demand in our community and nation-wide. We respond to this demand by teaching our students with a “hands-on” and “problem-solving” approach, and we strive to give our students a strong grounding in the fundamental science of computing, as well as the necessary technical knowledge to succeed in the job market. As the field is fast

growing, we realize that we serve our students best by being top experts in our respective research fields. Thus we aim to embody the teacher-scholar model in our academic lives.

CI's mission statement mentions four pillars: integrative approaches, service learning, and multicultural and international perspectives. CS is integrative in the sense that it applies the power of computing to problems that arise in other areas: from engineering, to social sciences, to the arts (computer graphics or a word-editor on which a novelist composes a masterpiece). Indeed, at CI our faculty work with all those departments; ESRM has already been mentioned, but we also run a Gaming minor with the Art Program. Service Learning is also easy for us as we collaborate closely with many companies in the area; for example, half of the software designers at OmniUpdate are our graduates; in turn, OmniUpdate provides the Content Management software for CI. There are many other such examples. Among the 6 TT faculty at CI we speak many languages, from Hebrew to French to Polish, and indeed to Spanish. Nothing proves multicultural credentials as well as the effort it takes to master a foreign language, as that requires the intimate familiarity with a foreign culture. We also represent many countries, giving us an international perspective.

### **Careers:**

Our students work in the local “101 Technology Corridor”, as well as other places throughout the country such as Google and Amazon. We recognize that Computer Science majors will have no difficulty finding jobs (as the US Department of Labor states, there will be 10 times as many positions in information technology as graduates in the next decade), but we want them to be consummate and ethical professionals, who love their careers, not just workers.

### **CI Mission-Based Student Learning Outcomes:**

CSU Channel Islands' graduates will possess an education of sufficient breadth and depth to appreciate and interpret the natural, social and aesthetic worlds and to address the highly complex issues facing societies.

Graduates will be able to:

Identify and describe the modern world and issues facing societies from multiple perspectives including those within and across, cultures and nations (when appropriate); and analyze issues, and develop and convey to others solutions to problems using the methodologies, tools and techniques of an academic discipline.

Following the above mission statement, we have developed program specific **Computer Science Program Learning Outcomes:**

We don't yet have learning outcomes for the MSCS program. The program was restarted just two years ago, and right now we are in the challenging situation of offering a sufficient number of interesting electives (based on the expertise of the faculty) to attract students. We understand that most of our Masters students are working professionals, with years of experience, and so we have to teach advanced courses. The students also come for the networking opportunity. We want to encourage our undergraduate students to do a Master's with us.

Here is an overview: The Master of Science in Computer Science (MSCS) at Channel Islands (CI) offers education in cutting edge theory and practice. The program prepares students for careers in high-tech, computer and Internet-driven industries, businesses, education systems, military, and local and federal government where interdisciplinary, dynamic and innovative professionals trained in latest data analysis, security, and surveillance technologies are increasingly sought. Students are given a strong background in Computer Science and Mathematics, as well as practical skills necessary to develop industrial-grade systems as well as to conduct independent applied and theoretical research.

More information:

<http://compsci.csuci.edu/degrees/mscs/index.htm>

### **III. Developing and Applying Resources to Ensure Sustainability**

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#### **A. ACADEMIC PROGRAM**

##### **a. Summary of the program degree requirements for Master of Science program in Computer Science**

Our Master of Science program is designed to give depth to our students, and accommodates working students in that classes meet once a week in the evening for three hours. The goal is to give students the necessary background to start a PhD, or prepare them for more advanced work in their computing careers, with the majority of the students falling in the latter category.

#### **MS in Computer Science Description from the CI catalog**

The Master of Science in Computer Science (MSCS) at Channel Islands (CI) offers education in cutting edge theory and practice. The program prepares students for careers in high-tech, computer and Internet-driven industries, businesses, education systems, military, and local and federal government where interdisciplinary, dynamic and innovative professionals trained in latest data analysis, security, and surveillance technologies are increasingly sought. Students are given a strong background in Computer Science and Mathematics, as well as practical skills necessary to develop industrial-grade systems as well as to conduct independent applied and theoretical research.

#### **Prerequisites for the program:**

Students seeking admission are expected to have an undergraduate degree in Computer Science, Mathematics, Science, Engineering, or related fields. Candidates with undergraduate degrees from other disciplines will be considered on a case-by-case basis and may be conditionally accepted. The conditions will usually include taking a selection of foundation courses in

Computer Science and Mathematics as prescribed by the admission committee.

The applicant is expected to have a 2.75 or higher cumulative undergraduate grade point average (GPA). A Graduate Record Examination (GRE) is recommended, but not required. Applicants with high GPA and strong support letters can still be admitted. Three letters of reference are required.

Conditions may include successful completion of one or more of the following foundational/remedial Computer Science and Mathematics courses as determined by the admission committee:

Introduction to Programming (COMP150)  
Data Structures and Algorithms (COMP151)  
Computer System Architecture and Assembly Languages (COMP162)  
Programming Languages (COMP232)  
Software Engineering (COMP350)  
Operating Systems (COMP362)  
Calculus I (MATH150)  
Calculus II (MATH151)  
Logic and Mathematical Reasoning (MATH230)  
Linear Algebra (MATH240)  
Discrete Math (MATH300)  
Probability and Statistics (MATH352)

### **Requirements for the Master of Science in Computer Science - 32 units**

Required Coursework	32 units
Graduate Seminar	2 units
Master Thesis	6 units
Electives	24 units

Required Courses		
COMP 599	Graduate Seminar	1 unit
COMP 597	Master Thesis	1-3 units
Electives		
COMP 510	Advanced Image Analysis Techniques (PHYS)	3 units
COMP 520	Advanced Database Systems	3 units
COMP 524	Security	3 units
COMP 529	Network Computing	3 units
COMP 546	Pattern Recognition (PHYS)	3 units
COMP 549	Human-Computer Interaction	3 units
COMP 550	Advanced Software Engineering	3 units
COMP 554	Algorithms (MATH)	3 units
COMP 566	Geometry and Computer Graphics	3 units
COMP 569	Artificial Intelligence	3 units

COMP 571	Biologically Inspired Computing	3 units
COMP 572	Neural Networks	3 units
COMP 575	Multi-agent Systems	3 units
COMP 578	Data Mining	3 units
COMP 581	Mathematical Methods in Artificial Intelligence (MATH)	3 units
COMP 590	Special Topics in Computer Science	3 units

To accommodate the need to acquire multidisciplinary experience and knowledge beneficial to their research, MSCS students may take up to 6 units of any other course upon obtaining authorization from the MSCS program director in consultation with the Master Thesis advisor.

### **MS Thesis**

After enrolling into COMP597 Master Thesis, you will work with your supervisor until the supervisor decides that your research and the thesis document are ready for a defense before your thesis committee. You will go through numerous revisions of your work, as not only the core research, but also the presentation of the results is important. It is expected that your work will be publishable, so your supervisor may ask you to write a summary of the work in a form of a conference or journal paper. A paper is not a required element of your thesis, however.

After your supervisor instructs you to go ahead with the distribution of the thesis, you need to distribute the drafts to all members of the committee. At this time, your supervisor should schedule the defense giving the committee approximately one month to review your thesis. For defense, you will have to prepare roughly one-hour presentation that will be open to the public. It should consist of the following segment as applicable: introduction, demonstration if available and feasible, analysis of the results, conclusions, future, Q&A.

After the presentation, in a session closed to public, the committee will ask some questions relevant to your thesis. Next, you will be asked to leave the room, so the committee can confer behind the closed door the overall quality of your thesis. After that relatively short meeting you will be asked to come back and the outcome will be communicated to you by the chair of the committee. The possible outcomes of the defense are: accept with no changes, accept with minor changes, accept with major changes, reject.

If your work is accepted with no changes or with minor changes, and all other requirements for the graduation have been met, then you will be granted the title of Master of Science in Computer Science. A request for minor changes will be handled between you and your supervisor. If you are asked to make major changes to your work, then you will have to resubmit a revised copy of the thesis to the committee for another review. In such case, your degree will have to wait until the committee accepts the changes. If the committee rejects the thesis, you will have to select a new research topic and a supervisor, and repeat the whole process satisfying the continuous registration requirement.

All members of the examination committee must sign the acceptance form after the deliberations. Subsequently, the Dean of the Extended University must sign the acceptance form

as well on behalf of the University. The chair of the examination committee must deliver the acceptance page to the Extended University Office.

## B. FACULTY

### 1. Faculty Profile

#### a. Faculty description (see CVs in appendix).

We have 5 permanent CS faculty and 14 lecturers (most of them with MSc degrees) and 3 Graduate Instructors – TAs. As the campus and program are growing we depend heavily on our lecturers – for example, Anna Biesczad runs the CI Computer Girls Club. TAs usually teach lower division courses, or run labs for upper division courses. Here is the list of the CS faculty:

Tenure line faculty:

Michael Soltys – *Professor, Program Chair*

*Graduate Advisor*

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*Undergraduate Advisor*

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Peter Smith – *Professor, FERP*  
Bell Tower West 2245  
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Full-time lecturers:

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There are 4 areas of research among our faculty: AI/Neural Networks headed by AJ. Biesczad, Robotics/UAVs headed by David Claveau and Jason Isaacs, Social Networks headed by Brian Thoms, and Theory/Cyber-Security headed by Michael Soltys.

*b. Need for future faculty hires.*

We are still a small department in terms of TT faculty, and our FERP (Peter Smith), may retire next year. CS is growing in students (as well as community obligations and opportunities), and we will expand with the addition of Mechatronics. CS provides an important community service, as the US Department of Labor foresees four times as many positions in IT as graduates; we are helping to shrink that gap.

CS has a unique difficulty in attracting lecturers. This arises from the fact that someone who can teach a university level course in CS can easily find a job in the industry that pays 3 times the (very low) CSU instructor salary. As such, the chair spends a lot of time looking for lecturers, as our sections burst at the seams, and many students are left out. We have lost or are losing 4 lecturers (Nancy Celniker, Tera Marquez, George Lazik, and Peter Smith). John Price is also thinking of retiring. Department Staff and Administration

Currently, we have one full-time staff positions shared among the Computer Science, IT, Mathematics, and Physics programs. Our Business Analyst Ms. Jacky Connell (permanent position) is in charge of all the office issues, including faculty support, scheduling, purchasing, travel approvals, etc. While she is very competent and is able to handle the challenges of running large departments, supporting students and faculty in four majors and several minors as well as 15% of all the courses offered on campus translates to enormous workload. The following table shows the division of workload among Arts and Sciences analysts. It is clear that our office is severely understaffed. Last academic year when Ms. Connell was on maternity leave the office had no staff (except for a student assistant) for four months. Currently, she is back in the office on the half-time basis. This situation is unacceptable.

The following table compares workloads for various program support offices on campus. Our office (under Jacky Connell) is highlighted in yellow, showing the largest workload on campus. It is worth to notice that typically CS programs at CSUs (even on campuses smaller than CI) do not share office staff with other academic units, and typically employ 2-3 people plus students assistants.

<i>* Numbers based on Fall 2015</i>				
Row Labels	Sum of Personal Total	Sum of Majors	Sum of FTEs14/15	
Alison	64	255	509.12	
Chicano Studies	5	15	52.87	
History	13	112	204.12	
Political Science	9	128	172.4	
UNIV	37	0	79.73	
Carmen	48	597	764.88	
Communication	13	382	234.8	
English	23	171	356.22	
Spanish	12	44	173.86	
Ceaser	28	937	573.83	
Psychology	28	937	573.83	
Hilda	38	295	467.86	
Art	25	245	339.95	
Performing Arts	13	50	127.91	
Jacky	101	388	782.6	
Computer Science/IT	29	284	202.06	
Math	61	80	466.7	
Physics	11	24	113.84	
Jessika	72	738	600.19	
Biology	30	620	368.49	
Chemistry	38	118	202.73	
Geology	4	0	28.97	
Mia	28	543	429.37	
Anthropology	7	54	101.24	
ESRM	7	119	81.43	
Sociology	14	370	246.7	
<b>Grand Total</b>	<b>379</b>	<b>3753</b>	<b>4127.85</b>	

Currently, we have one temporary administrative assistant (Mr. Chris Bombara) and his work makes a lot of difference. He deals with the front desk issues, paperwork, faculty, administrative and student requests, etc. We have asked the Provost to move his appointment to a permanent position, but we are still waiting for the approval.

We also have one student assistant (Megan, ASA II), who is very helpful supporting the office staff.

## **Program organization and procedures**

Program Chair

Lab Coordinator

Program Advisor (major advising for students)

Director of the MSCS Program

Coordinator for COMP 101

The duties of the Chair are those spelled out in the Handbook on the Roles and Responsibilities of Program Chairs; the Chair oversees the operations of all degree programs within the Computer Science Program and fulfills all personnel-related functions for all faculty within the Program.

The Program Advisor advises students in the CS, IT, Minor in CS, and Minor in Computer Game Design and Development, Cyber-security, and Robotics.

The Lab Coordinator supervises advises the labs (see section below on Facilities).

The COMP 101 Computer Literacy Coordinator manages the delivery of the 15 or more sections of COMP 101 that are offered each semester.

## **Facilities, Equipment, and Information Resources**

We have new labs in the new building Sierra Hall. CS has 7 labs and a tutoring room. Three of the labs are dedicated to specific purposes: Robotics Lab (1141), Embedded Systems Lab (1432), Networks (1131), and four general purpose labs (1212, 1222, 1232, and 1242). Additionally, all CSUCI students have access to an array of services including campus-wide computer access, personal storage, email, personal Web page, and more. CS maintains additional facilities to accommodate special needs of computer science faculty and students: several servers in the data hosting center, a virtual server hosting on-demand Virtual Machines, a variety of computers along with an array of peripherals supporting student projects.

## **Summary and Reflection**

We are happy with our lab space, and it is sufficient at the moment, but as the program grows, we will require more space.

## C. FUNDING AND EXPENDITURES

Our state-based funding meets our faculty salary obligations and we receive a small operational budget. We have a modest CERF funding from Extended University and some grants overhead that we can use as discretionary fund for the faculty and students' needs.

We have not been engaged in significant fundraising efforts as a department, although individual faculty groups have had meeting with our director of advancement with ideas for specific fundraising initiatives. Success in the area has been limited. We would like to extend and enhance this program with additional private outside support.

### Summary and Reflection

We would like to include additional funding for equipment, course coordinators, assessment studies, web page supervision, student/faculty projects, and faculty research. We would like to continue fundraising efforts in collaboration with the university foundation.

## IV. Achieving Educational Outcomes.

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### A. STUDENT LEARNING ASSESSMENT

We need to work on implementing one for the next self-study. Currently we don't have one, and we have not been collecting data to conduct one. Data collection and analysis requires release time from other duties.

### B. STUDENT SUCCESS: ENROLLMENT, RETENTION, AND GRADUATION

#### Student Engagement and Satisfaction

- Brian Thoms is currently advising 5 Masters theses.
- Michael Soltys is advising 5 graduate student masters theses (Joel Helling, Chris Kuske, Matthew Morales, Ian McGuire, Hita Gambheer).
- One of the ways we serve our students is by bringing world experts to give seminar talks in CS:
  - “Enabling Sophisticated Autonomy for Mobile Robots through Optimization-based Control”, Dr. Steven A. P. Quintero (from AeroVironment, Inc.), organized by David Claveau and Jason Isaacs on November 4, 2016
  - “Trivial Objects, Nontrivial Problems”, by Bill Smyth on March 14, 2016. Speaker invited by Michael Soltys, and one of the results of the visit is a joint paper co-author by Joel Helling (one of our graduate students, and alum of our undergraduate CS program), Smyth and Soltys.
  - “Superbubbles and Clumps”, by Maxime Crochemore, Costas Iliopoulos, Ritu Kundu, and Fatima Vayani, visiting from King's College University London, under the auspices of a joint CI / King's College British Royal Society grant. All four visitors gave a talk.
  - Informal talk by Franya Franek, visiting for a week from McMaster University, February 2016.
- AJ Biesczad: Two research groups:

- CI Rainbow (Kevin Scrivnor, Michael Kaiser -MScS; Jeffrey Marzec, Taylor Dinkins, Nick Dolan - BSCS)
- ciNeuroBot (Tyler Bettencourt, Glo Mercado, Corey Smith, Eric Valenzuela - BSCS)
- AJ Biesczad: Three masters students defended their theses:
  - Custom Gesture Recognition Using 3D Motion Sensors and Hidden Markov Models – Alvin Bruce Little (defended on 9/16/2015)
  - Improving Optimization Capabilities Of The Swarm Algorithm Through Augmenting Stigmergy With Other Means Of Inter-ant (inter-agent) Communication - Alan West (defended on 2/10/2016)
  - Medicare Data Integration and Analytics using the Hadoop Platform – Sinu Bessy Abraham (defended on 2/29/2016)

a. *Feedback from alumni.*

We need to start alumni outreach.

## **V. Creating an Organization Committed to Learning and Improvement.**

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### **A. FUTURE OF THE FIELD AND CAREER OPPORTUNITIES**

It is not a secret that many students chose to major in Computer Science because of the vibrant job market that awaits them at graduation. Many sources confirm what the students already know, including the US labor statistics which say that there will be up to 10 times as many positions in IT as graduates. The companies in the “101 Technology Corridor” are constantly contacting us, looking for programmers and software engineers; our students fill their ranks. One of the goals of our program is to keep track of the employment statistics of our graduates; we are discussing this with Alumni Relations.

### **B. PROGRAM CAPACITY**

Right now, we can increase the size of our Master’s degree program with little additional cost. However, our ability to offer financial support in the form of TA appointments is becoming more limited. Increasing our Master’s degree program will require targeted recruitment efforts to attract qualified applicants.

### **C. DEPARTMENTAL LEARNING AND IMPROVEMENT**

We are a very young department, and we do not yet know each other very well. While the atmosphere in the department is positive and enthusiastic, we are learning to work effectively together. There are the usual frictions of people of strong opinions working together, but we are able to find compromises and move forward. Indeed, it is one of the highest aspirations of the

Chair to maintain a positive working environment, where people are not afraid to make mistakes trying new ideas, and where we support each other. One of the ways in which we are growing is by meeting every two weeks – this is an unusual high frequency (at CI), and we meet several times a year as a whole department (lecturers and support staff). This is important so that the department is always well informed of all developments, and so that we get to know each other well, and learn to work together effectively. As 4 of the 6 TT faculty are working toward tenure, they are naturally disposed to give their best, and the last two years have been very encouraging (publications, events, service, etc.).

## **VI. Conclusion**

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### **A. SIGNIFICANT FINDINGS**

What are the strengths of the program?

1. Our graduate program produces graduates who have done very well in getting teaching positions and industry positions, but we need to attract more students to the program.
2. We are currently able to offer our graduate students TA positions which give them “learn-by doing” experience in the classroom as well as needed financial support.
3. In the last three years, we have been able to hire and retain high-quality faculty who are talented teachers and promising researchers and professionals.
4. Over the last years, CS benefited from very good relationships with the rest of campus, especially with the administration (President Rush, Provost Hutchinson, Dean Carey), who were very supportive of the program.

What aspects of the program should be improved?

1. We badly need administrative support.
2. Resources for faculty to be successful in scholarship.
3. We need to grow the MSCS, specifically recruit strong students that can be partners in scholarship.

### **B. LOOKING FORWARD: STRATEGIC THINKING**

What should be your goals for the next six years?

1. Collaborate with the local industry on more projects, especially with the Navy.
2. Provide more time for faculty to focus on professional and scholarly activities.
3. Focus on growing our graduate program.
4. Work out the details of how MSCS will be integrated with our new program in Mechatronics.