February 14, 2020

TO: David Lassner
   President

   Michael Bruno
   Provost

FROM: Aloysius Helminck
      Dean, College of Natural Sciences

SUBJECT: Response to External Review Report of the Information and Computer Science Department

The process of external review is critical to the health of departments, the college and the university. I am very grateful for the careful work of the external review committee and for their thorough and thoughtful evaluation of our ICS Department and programs.

The College is happy to see the response of the ICS Department and is supportive of the initiatives they outline in their response. Over the last few years the College has been working with the Department to make changes that align with the recommendations of the review committee. Along with the initiatives proposed by the Department, some changes need to be made within the ICS programs and policies as described below.

The review committee describes the importance of Computer Science for the University and the world. This fully aligns with the College’s vision of the importance and role of Computer Science. In the following we will describe the College’s perspective on the current and future role of ICS within CNS.

ICS and interdisciplinary initiatives:

ICS is, itself, a multi-disciplinary department and has played a critical role in developing several new interdisciplinary initiatives both within the department and across the University. The College worked with ICS and ITS faculty to spearhead the initiative for the Hawai’i Data Science Institute, which has been highly successful. ICS faculty have also played an essential leading role in developing computational sciences initiatives across all the departments in the College. We are working to create an interdisciplinary center for computational sciences that would support
both UH and the State of Hawai‘i with computational science expertise, as well as offer interdisciplinary degree programs for students at all levels. The College is hiring faculty to be housed in several different departments to support this initiative.

ICS faculty have also spearheaded the new Certificate in Creative Computational Media. Another interdisciplinary area that the ICS department needs to focus on is building strength and curriculum in Applied Security. I was pleased to see that they are planning to do this, and the College will be supporting this effort.

Computer Science curricula and research:
While I applaud and strongly support the critical role ICS plays in so many interdisciplinary initiatives, it is extremely important that they also continue to build their own Computer Science program and that the Department has accredited, nationally ranked programs with high profile research in the discipline. As they indicate in their response, ICS will not be able to make the needed changes to the Computer Science programs without appropriate additional faculty support. The College has been highly supportive of the computer science hiring requests with an applied focus and will continue support requests for these kinds of positions.

The Department needs to develop more areas of excellence, in addition to the current strength in visualization with the LAVA lab. Some potential areas of expansion are applied AI and Machine Learning, and High-performance Computing. The department has been seeking to fill positions in these areas already.

Another focus area for the ICS Department is improving and growing their graduate programs. A top research institution must produce high caliber PhDs and Masters students. There are also opportunities to develop certificates and professional Masters degrees. Such programs will serve the State of Hawai‘i.

ICS in CNS:
High powered computation, visualization and the ability to analyze big data are revolutionizing how we do science. We are fortunate to have ICS and the discipline of Computer Science in the College of Natural Sciences. This has enabled us to start building interdisciplinary initiatives, such as Data Science (e.g., through the Data Science Institute), Computational Science (e.g. through targeted faculty hires and the planned development of a Computational Science Center), and the Genome-to-Phenome-to-Biome (G2P2B) initiative in the life sciences (which allies “-omic”-scale biological data with the development of new computational methods for their analysis), and we are working across all CNS departments to develop degree programs related to these initiatives. If ICS is in a different college, developing interdisciplinary degree programs will be much more difficult. All our scientists benefit from having a strong ICS program co-located in CNS.
ICS at UH:
While thus far most interdisciplinary initiatives involving ICS have been within CNS, there are many opportunities for even broader impact by involving more programs at the University. We will be reaching out to other units at UH to further develop multidisciplinary opportunities, as exemplified by the certificate in Creative Computational Media, which is a successful collaboration between ICS, the Academy for Creative Media, and Theatre & Dance. At the same time, ICS also should collaborate on their course offerings and programs with other units, including Computer Engineering. This will maximize the use of UH resources and strengthen all of our programs.

ICS in Hawai‘i:
A strong Computer Science program coupled with innovative interdisciplinary programs in fields such as Data Science, Computational Science and Applied Security has the potential to become a major driver of the future economy of Hawai‘i. In addition, strong Computer Science training aligns with the State initiative to include Computer Science in the high school curriculum.

ICS Departmental Structure:
The external review report noted some issues of faculty under-performance. The initiatives outlined in the Department’s response will require significant changes to the Department’s expectations for faculty. The Department should update both their workload policies and the DPC policies and procedures to properly reflect the Department’s expectations, as outlined in the Department response. This will show that the Department is seriously embracing the changes that are proposed.

The College will work with the Department to address workload and HR concerns. All HR complaints are taken seriously, and the College and the Department must address them swiftly and appropriately.

Summary:
ICS has the potential to become a top Computer Science program as well as to play a critical role in many interdisciplinary endeavors and serve the community through programs that create a well-educated workforce for the jobs of the future. CNS will collaborate with ICS to make the changes necessary for this to happen.

The review committee describes four possible scenarios for the department’s future. The College and the Department feel strongly that the first option is the right one: ICS belongs in CNS. We know there is much work to be done to raise the profile and revitalize the Department. Some key faculty have volunteered to lead that effort. There is a strong commitment from both the Department and College to make this happen. With the support of the University we will be successful in revitalizing and strengthening ICS to realize its potential as a key collaborative unit for strategic directions and programs both within CNS and across UH.
TO:    David Lassner, President
       Michael Bruno, Provost

FROM:  Scott Robertson, Chair
       Information and Computer Sciences Department

RE:    ICS Department Chair Response to External Review Report

The ICS Department is appreciative of the time and attention of the external evaluation team. The focus on general computing-related programs, with emphasis on the Department of Information and Computer Sciences, demonstrates how central computer science at UHM is to the university, the community, and the state. As a faculty, we will dedicate ourselves to improving computer science education in order to better prepare our students for their careers in addition to maintaining a high level of research productivity and impact.

The External Evaluation of UHM Computing-Related Programs contained several recommendations for the Department of Information and Computer Sciences (ICS). Six broad recommendations were specified:

1. Increase the number of Computer Science graduates from UH Mānoa.
2. Increase the employability of UH Mānoa Computer Science graduates, with emphasis on local private sector and public sector employers.
3. Increase interdisciplinary research collaboration by Computer Science faculty.
4. Increase engagement with external public sector and private sector entities.
5. Increase the faculty productivity in terms of PhD production, research expenditures, etc.
6. Increase entrepreneurial activities of CS faculty and students.

In response to these broad recommendations, a steering committee of committed, concerned, and productive faculty members (“Change Team”) has been formed to develop an action plan. The Change Team produced two preliminary documents:

- Improving ICS: A Plan for Action
- A Quantitative, Objective Process for ICS Faculty Assessment

The first document (hereafter referred to as IPA: “Improvement Plan for Action”) lays out an administrative structure, preliminary task analysis, timetable, and responsibility proposal for starting an ambitious improvement program in the areas of teaching, research, and service. There are multiple themes, focusing on the stakeholder areas of undergraduate experience, graduate student experience, faculty experience and responsibility, and community/employer and outreach. The second plan (hereafter referred to as FAP: “Faculty Assessment Plan”) will codify metrics and establish procedures for faculty assessment and evaluation in a way that provides clear goals and expectations and unambiguous outcomes.
The plans have been accepted by the Department Chair who commits to seeing that they are implemented and carried through. The plans have been shared with the Dean, Provost, and President.

The Change Team and the Chair have identified the following themes that address the six broad recommendations of the external review team:

1. Revise ICS curriculum
2. Revise ICS evaluation metrics and procedures
3. Improve ICS community
4. Improve external relations

We are currently identifying tasks, developing deadlines, and creating sub-teams to work on these themes. Below are descriptions of several activities currently underway or planned relevant to the themes:

**Revise ICS Curriculum**

- **Curriculum 2.0 Committee**: The ICS Department has formed a “Curriculum 2.0” committee to examine every course offered for its correspondence to professional guidelines (ACM, IEEE, ABET), alignment/duplication with similar courses in other departments, and inclusion of practical, project-based software assignments. The Curriculum 2.0 group, and undergraduate experience aspect of the IPA document, will address all aspects of the curriculum in order to identify how and where a specific set of learning objectives for all ICS graduates are being met. Engagement with undergraduates, especially in research activities, will become an important part of the faculty evaluation procedure being developed in the FAP document.

- **Capstone Requirement**: A new ICS graduation requirement for completion of a capstone project course has been approved by the university and will go into effect in Fall 2020. This new course is designed specifically to engage students in a team-based software development experience in their senior year, reinforcing (while assessing) their coding expertise and providing much needed experience with project management, communication, and delivery of a significant software artifact. The course will culminate in a poster presentation day to which all ICS stakeholders, including external stakeholders and especially local employers, will be invited. We consider this an initial step toward a multi-year, multi-stage project requirement modeled after the College of Engineering (specifically, the Vertically Integrated Project program).

- **Internship Program**: The ICS Chair, ICS Associate Chair, and STEM Coordinator in Natural Sciences, have been meeting with Career Services to develop an ongoing internship program. The internship program will provide a pathway to practical experience with local companies and local military. Career services is partnering with us to chart a process for advertising opportunities, facilitating the application process, developing objectives both on the educational side and on the employer side, and coordinating the liaison between faculty mentors and employers. We are working with two companies at present to pilot the first internships, possibly as early as summer 2020. Completing an internship (6-12 month)
will be one way of fulfilling the capstone requirement described above. We also intend that this will provide pipelines into local jobs and give our students the up-to-date, applied skills they will need for their ultimate employment. We expect the internship opportunities and the capstone project requirement to be linked.

- **New Introductory Courses:** The ICS Department has added two new introductory courses designed to introduce freshmen and other non-majors to exciting aspects of data science and computer science without any prerequisites or major restrictions. ICS 102: Introduction to Data Science (approved and offered once already) “provides students with an overview of the field of data science by introducing subjects such as data format, processing, visualization and storage. Special emphasis is put on historical context and simple practical examples” (quote from the catalog description). ICS 103: Introduction to Computer Science Principles (approved) “provides a broad overview of computer science. Will address abstraction, data and information, algorithms, programming, the Internet and the global impact of computers” (quote from the catalog description), and is designed to align with high school AP courses. These courses are “attractor” courses to interest broad audiences and increase interest in computer science and data science.

- **Data Science Track within ICS:** In May, 2018, the ICS Department received approval from the Interim Vice Chancellor for Academic Affairs to establish a Data Science track. In conjunction with this approval, two new upper-division courses were created in data science: ICS 434: Data Science Fundamentals, and ICS 438: Big Data Analytics. The track is highly collaborative with the Mathematics Department, and the departments are currently working on establishing a Data Science track for double majors.

- **Interdisciplinary Certificates and Tracks:** ICS has successfully partnered with the Association for Creative Media, the UHM Department of Theatre and Dance, and the Department of Electrical Engineering to gain Authorization to Plan an Undergraduate Certificate in Creative Computational Media. The certificate will be accessible not only to students within these programs, but also broadly to professionals and unclassified students. The four different cooperating units will rotate responsibility for administering and overseeing the certificate program. The ICS departments has also partnered with the Hawaii Data Science Institute to obtain an Authorization to Plan for a Data Science Certificate. We see these plans as a model for other cooperative and interdisciplinary certificate and degree projects (e.g. The ICS Department has also discussed an interdisciplinary certificate or degree with Social Sciences that would focus on data science.) One model we propose for these cooperative ventures is for Math and ICS to have a set of core courses offered to all students interested in Data Science, and students would then complete their degrees or other requirements within their respective majors.

- **BAM Pathway in Computer Science:** ICS was one of the first departments to successfully gain approval for a 5-year BS/MS pathway plan under the university’s BAM program.

- **Three-year Outlook:** A three-year outlook for course offerings has now been developed by the Associate Chair. The three-year outlook will be published on the ICS website and distributed to advisers. The three-year outlook will be continuously updated as a responsibility of the Associate Chair.
Revise ICS Evaluation Metrics and Procedures

- **Teaching Evaluation**: The ICS Department voted in Spring 2020 to make all course evaluations available to the Chair for use in measuring teaching effectiveness and identifying potential issues.
- **Workload**: The ICS Chair has modified the annual faculty workload evaluation to stress outcomes (as opposed to hours) and has circulated and applied a quality (in addition to quantity) metric for success in teaching, research, and service. The annual evaluation now includes higher standards for publication, proposal writing, external funding, and graduate student involvement in research.
- **Faculty Assessment Plan**: A draft FAP has been prepared by the Change Team and will be refined and presented to faculty for modification and approval in Fall 2020.

Improve ICS Community

- **Improvement Plan for Action**: The ICS department’s IPA is segmented into themes involving undergraduate experience, graduate student experience, faculty experience, and community/employer/external stakeholder experience. Faculty focusing on change in each area will be charged with developing ideas about community building.
  - The IPA recommends the establishment of an Undergraduate Ombudsman. The undergraduate advisor (currently a Faculty Specialist position) will be further tasked with asking students in a more formal manner about their experiences in each course.
  - The IPA recommends the establishment a Graduate Student Ombudsman who will work with the Graduate Chair to deal with any issues regarding the graduate student experience.
- **Student Surveys**: The Chair will implement an annual, anonymous undergraduate- and graduate-student surveys, asking about students’ experiences in courses and other aspects of their ICS experience. In addition, the Chair will commit the department to holding an annual Town Halls for undergraduates and graduate students.
- **Undergraduate Chair**: A new position of Undergraduate Chair is being considered. One of the duties of the Undergraduate Chair will be to advise the ACM chapter. The Chair commits to meeting at the outset of each semester with the leaders of the ACM chapter and the Undergraduate Chair to map out activities, which will then be publicized on the ACM club website and the ICS website.
- **Cohort Activities**:
  - A project-based curriculum throughout each undergraduate’s years in ICS, together with capstone presentations, will help create a cohort atmosphere for undergraduates.
  - The graduate seminar has been redesigned to stress regular research project presentations which will help create a cohort atmosphere for graduate students.
- **Recognition**: The Chair will establish annual department-level teaching awards for outstanding undergraduate educators and mentors.
**Improve External Relations**

- **Director of Professional Programs and External Relations:** The ICS Department requested in AY2018-2019 a position to hire a Faculty Specialist who will concentrate on external relationships, internship opportunities, alumni relations, contests/hackathons, and any other liaison activities with employers and other external stakeholders. The role of this Faculty Specialist will also be to help establish, develop, and administer professional degree and certification programs in collaboration with external stakeholders. Hiring a person who is dedicated to external relations with both corporate and military employers, and to professional activities aimed at working and returning students, will be a huge step in the direction of broadened impact and community engagement. This position was approved in 2019 pending the opening of a slot. We anticipate that a vacancy will be available in 2021 (although the COVID-19 crisis may mean that the slot will remain unfilled in the short term).

- **Advisory Board:** An ICS Advisory Board is currently being assembled. The Board will have multiple components, including local employers and technology stakeholders, mainland employers, alumni, and thought leaders from other academic units and the broader technology community.

**The Future of CS at UH**

We understand that there is a meaningful difference between Computer Science and Computer Engineering, and we encourage administration to continue to recognize this difference and try to strengthen both programs.

We also realize that there is a difference between Computer Science and “Computational Science,” the former being the science of computing and the latter being the development of computing applications in other sciences, disciplines, and endeavors (e.g., informatics, visualization, data science). The ICS Department should offer a core education in both foundations and applications. As a Research I computer science department, our CS professors should continue to conduct basic and applied research in core computer science and related, computational science areas.

We commit to exploring how the University can best achieve a broad vision of computer science that includes 1) a core computer science effort, 2) a core computer engineering effort, and 3) a collaborative computational science program with other units across the campus and the university. There are many models for how this can be achieved, both as a distributed program across multiple colleges/units and as a unified college/unit with appropriate subdivisions. We believe that a strong computer science department successfully integrates both foundational science and application development. Faculty work best together in a unified environment, and student learning is optimal within a unit that can offer both strengths. Other units across the university should be able to look to a single center of computational expertise to find collaborators, expand their own offerings, and initiate projects.

We request at this time that the ICS Department be allowed to grow and thrive in collaboration with appropriate units (especially CE; HDSI; and programs in Natural Sciences, Social Sciences, and Arts and Sciences that are developing computational components relevant to their disciplines),
offering both core education and research in computer science as well as experience with application development in multiple domains. As we have already made a significant effort to develop Data Science within the ICS framework, this approach will continue a successful path forward.

The ICS department has recently expanded into Data Science and successfully created tracks and certificates in other computing application areas. In the last two hiring cycles, the ICS Department has proposed to hire in applied areas including:

- Applied AI and Machine Learning
- Applied AI for Cybersecurity
- Software Engineering
- Cyberinfrastructure
- Applied Data Security, Cyberforensics, and Information Assurance
- “Professors of Practice,” who are also grounded in the local industry sector, in support of a professional Master’s degree program and other, more applied instruction.

Future hiring committees will be broad-based and include representation from the Advisory Committee and from other stakeholders within the appropriate discipline. ICS will craft future position descriptions to specify that professors should be dedicated to educating professionals who are ready to engage in the workforce with up-to-date practical knowledge, expertise in modern computing tools and methods relevant to their area, and deep understanding of principles of computing.

ICS seeks to maintain our unique identity as we strive to become more relevant to the local workforce while still maintaining quality research productivity. As the external review states, these are not mutually exclusive goals, and we hope to receive the resources to continue growth and progress in this direction. We will actively seek and welcome the involvement of multiple stakeholders from throughout the university and community. We welcome scrutiny of this process and agree to transparency and communication about progress.