

SIGNATURE SHEET FOR EVALUATIVE CRITERIA
APPROVED CRITERIA SHALL HAVE ALL REQUIRED SIGNATURES
Tenure & Recontracting

Department/Office: Computer Science

Department Chair/Head: Vasil Hnatyshin
 Print

Hnatyshin Vasil
 Signature

Academic Year (circle): 15-16 **16-17** 17-18 18-19 19-20

Date Sent to Dean/Supervisor: 9/15/16

Signature
[Signature]
 Dean/Supervisor: Karen Magee-Sauer

Date
11/10/16

Approved
 (Y) / P / N

Add'l Admin:
[Signature]
 Provost/designee:

3/16/17

Y / P / N

Y / P / N

President/designee:

Y / P / N

Y = Approved	P = Approved pending modifications	N = Not approved
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For P or N decisions, the departmental committee should be provided with the reasons for non-approval, as well as suggested changes to the criteria within a reasonable time to ensure timely approval for first year candidates.

DIRECTIONS: Sign each line and print or stamp name below the line. This signature page must accompany the evaluative standards throughout the entire approval process, and serves as a record that all levels have contributed to the approval process. After all levels have approved the evaluative standards, this cover page and the criteria shall be duplicated, and a copy sent to the Senate office for archiving. The original criteria packet is returned to the Department/Office.

SUGGESTED TIMETABLE:	DATE
Departmental approval, sent to Dean/Supervisor:	September 25 (earlier if possible)
Dean provides feedback regarding criteria	October 9
Final administrative approval and forwarding to Senate, Department, and Dean	November 1

RECONTRACTING AND TENURE
Computer Science Department

September 12, 2016

1. STATEMENT OF TERMINAL DEGREE

The terminal degree for Computer Science is a Ph.D. in Computer Science or a closely related field. The terminal degree is required for appointment to Assistant Professor or higher ranks.

2. BALANCE AMONG TEACHING, RESEARCH AND CREATIVE ACTIVITY, AND PRACTICE AND PROFESSIONAL SERVICES

The Department T&R Committee will use the following weighting system for the evaluation of candidates.

Teaching Effectiveness	45%
Scholarship & Research	40%
Service to Department & University	10%
Service to Wider and Professional Community	5%

3. CRITERIA FOR EVALUATING TEACHING EFFECTIVENESS

Successful candidate should illustrate his or her teaching effectiveness in the following categories:

- Academic Instruction
- Developing learning activities
- Developing as a teacher
- Student Mentoring

3.1. Academic Instruction

Desirable characteristics of Academic Instruction are:

- Teaches in a way that helps students learn
- Explains clearly
- Promotes thinking
- Provides useful feedback
- Shows fairness and respect
- Actively engages students
- Encourages students to express ideas or opinions
- Prepares course material thoroughly
- Communicates course and lesson goals
- Helps students see the relevance of course content
- Solicits student feedback about the course and instructional method
- Applies student learning outcomes to plans for future learning
- Appropriate use of instructional technologies

These characteristics will be assessed through self-assessment, peer observation, student surveys, and department T&R committee review. The candidate will submit materials which will enable the department T&R committee to evaluate performance in the characteristics listed above. These materials will include:

- Student surveys (e.g., SIR II's, Rowan on-line student survey, or other department approved instruments).
- Self-assessment, which must address each of the characteristics and indicate strengths and areas needing improvement.
- Peer observations, which should directly address most or all of the above characteristics that can be observed in a classroom setting as appropriate.

Other relevant materials may also be submitted by the candidate and evaluated by the department T&R committee. A list of examples that can be used to evaluate candidate's performance in category *Academic Instruction* is provided in Appendix A.

For pre-tenure reappointment application, the candidate is expected to provide evidence of adequacy and continued improvements in all of the above characteristics of academic instruction.

For tenure application, the candidate is expected to provide evidence of adequacy in all and excellence in many of the above characteristics of academic instruction.

3.2. Developing Learning Activities

For this category successful candidate should provide evidence of developing and revising computer science curricular. A list of examples that can be used to evaluate candidate's performance in category *Developing Learning Activities* is provided in Appendix A.

For pre-tenure reappointment application, the candidate is expected to provide evidence that he or she has been exploring ways to or has started to develop effective classroom learning activities.

For tenure application, the candidate is expected to provide evidence that he or she has been active in developing effective classroom learning activities.

3.3 Developing as a Teacher

For this category successful candidate should provide evidence of efforts to improve oneself as a teacher. A list of examples that can be used to evaluate candidate's performance in category *Developing as a Teacher* is provided in Appendix A.

For pre-tenure reappointment application, the candidate is expected to provide evidence that he or she has been exploring ways to or has started to develop his or her teaching skills.

For tenure application, the candidate is expected to provide evidence that he or she has been actively working to develop as a teacher.

3.4. Student Mentoring

For this category successful candidate should provide evidence of student advising and mentoring. A list of examples that can be used to evaluate candidate's performance in category *Student Mentoring* is provided in Appendix A.

For pre-tenure reappointment application, the candidate is expected to provide evidence that he or she has been learning or has started to play the role of the advisor.

For tenure application, the candidate is expected to provide evidence that he or she has actively taken on the role of the advisor.

4. CRITERIA FOR EVALUATING SCHOLARLY AND RESEARCH ACTIVITIES

Scholarly and research activity is the pursuit of an active or continuing agenda of reading, writing, speaking, or other forms of scientific or pedagogical inquiry whose purpose is to create new knowledge, integrate knowledge, or open additional knowledge-based areas for further exploration. The work of scholarly and research activity includes any of the following: basic research, research in the scholarship of teaching, applied research and evaluation, and externally funded research and creative projects.

It is important to note the importance of conference publication in the field of computer science. Most significant computer science conferences feature double-blind reviews of the full-text of those papers submitted.

In contrast to many academic fields, where journal publication is the established means of demonstrating academic impact, for many areas of computer science publication in prestige conferences is considered preferable to journal

publication. This is discussed at length in the Computing Research Associations Best Practices Memo entitled "Evaluating Computer Scientists and Engineers for Promotion and Tenure" (see Appendix F).

- A. Basic research includes scholarly efforts leading to peer-reviewed presentation and publication as defined in the candidate's discipline.

Venues for publications in this category should be peer-reviewed and have a readership appropriate to the segment of the scientific community interested in the candidate's subfield of Computer Science. The department does not use metrics such as impact factors to set any minimum standards of significance for a peer-reviewed venue. However, the department recognizes publication in especially selective venues as a significant accomplishment. The candidate should provide some brief discussion of the quality and appropriateness of the journals, conference proceedings, and other venues in which he or she publishes.

While the candidate need not be the primary author on all publications, the candidate should be making original contributions appropriate for an independent researcher. In many cases, the candidate's authorship will adequately convey the significance of the candidate's contributions, e.g., if the candidate is the sole, lead, or (in the case of publications where a student in the candidate's lab is the lead author) last author. However, sometimes in Computer Science authors are listed in alphabetical order. In those cases where authorship alone does not indicate the candidate's contributions, he or she should discuss his or her role in the production of the publication and the science behind.

This category also includes oral and poster presentations of research at national or international meetings or regional conferences of a national organization of the discipline, as well as invited talks at other institutions. As with publications, the relative significance of the candidate's contributions to presented research should be reflected by authorship, or else the candidate should explain his or her role in the presented research. Greatest weight will be placed on those presentations where the candidate has the greatest responsibility for bringing the research to the attention of his or her fellow scientists, particularly where either the candidate or his or her student is the presenter.

- B. Research in the scholarship of teaching includes but is not limited to conducting instructional and classroom research to benefit the teaching-learning experience that lead to peer-reviewed publications and/or externally funded grants. Specifically:
- a. **Scholarship of pedagogy** includes the conduct, presentation, and publication of peer-reviewed research on the teaching of the computer sciences at any level. This category distinguishes scholarship of pedagogy from research in the computer science subfield for which the candidate was hired. If a candidate were hired as a scholar of computer science education, then this distinction would not exist and scholarship of pedagogy would be considered the same as the candidate's area of research for evaluating publications and presentations.
 - b. **Textbook development** category includes the development of manuscripts for the teaching of the computer sciences at any level.
 - c. **Student Research mentoring** includes any evidence pertaining to the mentoring of Rowan undergraduate or graduate students in research activities, where the student is an active participant in the scientific process. Evidence of student mentoring includes formal inclusion of students in scientific pursuits, either for credit or for pay, participation of students in presentation of research at institutional or extramural scientific conferences, and student authorship on peer-reviewed publications. The Department recognizes that, because of the need for students to be trained first in the appropriate research methods, and because student aptitudes for research can vary greatly, student research progresses at a much slower pace than faculty research.
- C. Applied research and evaluation includes but is not limited to
- a. Applied study or applied pedagogical or scientific research (e.g., work in Professional Development Schools) lead to peer-reviewed publications and/or externally funded grants in the candidate's discipline.
 - b. Sponsored or contracted study or research (e.g., Engineering clinic projects)

- D. Externally funded scholarly and research projects include but are not limited to:
- a. Grant-seeking and proposal development to public and private sponsoring agencies for research.
 - b. Supervision and management of sponsored projects developed through the research field of the candidate.

This category includes all forms of external funding, though greatest weight is given to competitive programs that incorporate peer review in the evaluation process. Unfunded submissions are valued as evidence of scholarly output, especially if the submission received favorable reviews.

The general expectation of the Department is that a candidate should be able to sustain his or her research without additional direct support from the institution beyond start-up funds, adjusted load, and allocated space. Thus, the candidate is expected to pursue external funds for other direct costs required for the execution of his or her research. The Department does not specify any dollar amount, only that the candidate is able to obtain sufficient funds to maintain research productivity.

External grant submissions and awards are useful in other ways to the evaluation process. First, they provide evidence of the value of the candidate's research through peer reviews of proposals and through the validation of successful funding. Second, because they reflect ongoing or future research, they speak to the candidate's prospects for future productivity.

A list of examples that can be used to evaluate candidate's *Scholarly and Creative Activities* is provided in Appendix B.

It is expected that applicants for tenure will provide evidence of research productivity and promise for continued scholarship. The types of evidence should generally fall into the categories described above and should be appropriate in terms of quantity and quality for disciplinary norms given the length of the tenure clock and the constraints of necessary institutional support. Given wide variation in publication and funding rates across the many sub-disciplines of the computer sciences, it is inappropriate to assign a single number or measure for a given type of evidence. In addition, simple quantities of deliverables might not properly reflect the quality of the research that produced them.

The Memorandum of Agreement now requires that **candidates for tenure** provide an evaluation of their research by an external reviewer at another institution with expertise appropriate for assessing the candidate's research. The Department will consider more than one reviewer if the candidate wishes to provide more. The Department will ask the external reviewer(s) to comment on:

1. The quantity and quality of the candidate's research, and
2. The merit of the candidate's accomplishments in scholarship taking into account Rowan's infrastructure, institutional support for research, and other institutional factors that affect research productivity.

For pre-tenure reappointment application, the candidate is expected to show an increasingly stronger record of scholarly activities that include peer-reviewed publications and grant activities.

For tenure application, the candidate is expected to show a strong record of peer-reviewed publications in high quality journals and conferences, as well as the establishment of externally funded research programs.

5. CRITERIA FOR EVALUATING CONTRIBUTION TO THE UNIVERSITY COMMUNITY AND TO THE WIDER AND PROFESSIONAL COMMUNITY

Responsibilities/activities connected with Contribution to the University Community and to the Wider Community include:

- Contributions to the Department;
- Contributions to the College and University; and
- Contributions to the wider and professional community.

The Department recognizes service to the Department, College, and University as a significant aspect of faculty development. The expectations of the Department reflect the need for a probationary faculty member to learn about the institution, participate in the non-academic operations that are necessary for the functioning of the academic enterprise, and contribute to the institution in rewarding ways. At the same time, the expectations reflect the need for probationary faculty to balance commitments to service with their responsibilities for teaching and research. A list of examples that can be used to evaluate candidate's *Contributions to the Department, College, and University* is provided in Appendices C and D.

The Department expects that faculty will remain engaged in the promotion and development of their disciplines by participating in organizations appropriate to their fields of expertise and inquiry. A list of examples that can be used to evaluate candidate's *Contributions to the Wider and Professional Community* is provided in Appendix E.

For pre-tenure reappointment application, the candidate is expected to demonstrate some or increasing services in some of the three areas.

For tenure application, the candidate is expected to demonstrate services in all three areas and consistent and substantive services in at least one area.

6. METHOD FOR COLLEAGUE ASSESSMENT OF TEACHING EFFECTIVENESS

The Computer Science Department will use classroom observation as the primary method for colleague assessment of teaching effectiveness. We believe that this is the most effective method for gaining information about the new faculty member's teaching effectiveness and also provides a good opportunity for more experienced faculty members to act as mentors for less experienced teachers. The observers are encouraged to comment on both good things that they see in the class presentation and those areas that need improvement. The observers should directly address most or all of the following characteristics that can be observed in a classroom setting as appropriate:

- Teaches in a way that helps students learn
- Explains clearly
- Promotes thinking
- Provides useful feedback
- Shows fairness and respect
- Actively engages students
- Encourages students to express ideas or opinions
- Prepares course material thoroughly
- Communicates course and lesson goals
- Helps students see the relevance of course content
- Solicits student feedback about the course and instructional method
- Applies student learning outcomes to plans for future learning
- Appropriate use of instructional technologies

7. PROCESS FOR COLLECTING AND UTILIZING STUDENT RESPONSES

Student responses will be collected using SIRs and/or Banner Student Course Evaluations in at least two classes of the candidate's choice during the last 5 weeks each semester.

8. ROLE OF DEPARTMENT CHAIRPERSON ON TENURE AND RECONTRACTING

The Department Chairperson is a voting member of the Tenure and Recontracting Committee.

9. APPENDICES

Appendix A: Examples of activities used to evaluate candidate's Teaching Effectiveness

Academic Instruction:

- Facilitating learning by instructing Rowan University students in courses, laboratories, tutorials, workshops, and seminars.
- Managing instruction, e.g., planning and arranging for learning experiences, maintaining student records, grading.
- Supervising students in laboratories, fieldwork, internship experiences, and in independent study.

Developing learning activities:

- Participation in development, review, and redesign of courses and programs.
- Participation in developing and revising curricula.
- Developing teaching materials, manuals, web pages, PowerPoint presentations, software, and computer exercises.
- Developing online courses.
- Contributing to study abroad programs.
- Contributing to service learning programs.
- Participating in development of learning outcomes assessment tools and analysis of assessment results.
- Creating assignments including written exercise, programming problems, laboratory projects.
- Building or maintaining a laboratory or technologically equipped classroom.
- Developing an archive or portfolio for one or more courses, illustrating the high quality of the candidate's work on the course or courses; a portfolio could include electronic versions of lectures (PowerPoint, HTML, etc.), demonstration programs, handouts, tests, homework assignments and projects.
- Developing courseware for a course.
- Incorporating collaborative learning techniques in a class.
- Pioneering a new use of technology in the classroom and disseminating information both within and beyond the department.
- Successfully proposing a new curricular program or major changes to an existing one.
- Successfully proposing or teaching a new course.
- Successfully making a major modification in an existing course.

Developing as a teacher:

- Reflecting on one's instruction and classroom to benefit the teaching-learning experience.
- Attending and participating in professional development activities.
- Maintaining currency in discipline-specific and pedagogical concepts.
- Collaborating with colleagues.
- Observing and providing feedback related to the teaching of colleagues as such observations contribute to one's own development in the classroom.
- Attending a professional conference.
- Attending a pre- or post-conference workshop at a professional conference.
- Attending teaching workshops either at Rowan or outside of Rowan.
- Auditing a course or a part of a course taught by a senior faculty member.
- Taking a course at other institutions.
- Obtaining, using, and evaluating new hardware, software, etc.
- Working under the guidance of a senior faculty member.
- Supporting teaching activities at venues such as the Faculty Center for Excellence in Teaching and Learning.
- Team teaching a course.

Student Mentoring:

- Mentoring students; e.g., with regard to academics and career planning.
- Mentoring students in senior research projects, theses, dissertations, and other curricular projects.
- Actively supporting and supervising student research projects.

- Actively working with students to help them customize their advanced course selection to best meet their career needs.
- Serving as a member of a master's thesis committee.
- Serving as a mentor to minority, underrepresented, or foreign students.
- Supervising a master's student in thesis work.
- Supervising and/or training the student workers with responsibility for maintaining the department's local network servers and the advanced computing lab.
- Teaching a heavy project-based course such as Senior Project and Software Engineering.
- Teaching the Computer Field Experience course.
- Teaching a Rowan Seminar Course.

Appendix B: Examples of accomplishments used to evaluate candidate's Scholarly and Creative Activities

- Presenting a poster at a conference.
- Giving an invited talk at another institution.
- Writing a software laboratory module accepted to the ACM Laboratory Repository (refereed section).
- Writing a chapter in a book published by a commercial or university press.
- Writing a paper accepted for presentation at a regional conference.
- Writing a substantial application for an external grant.
- Writing an article in a widely-distributed, but non-indexed journal or newsletter, such as those published by ACM special interest groups.
- Receiving a patent for Computer Science related work.
- Receiving a significant, competitive external grant from a prestigious funding agency or foundation, such as NSF or DARPA.
- Receiving a significant and competitive grant from industry.
- Writing a paper accepted for presentation at a national or international conference that uses a competitive review process for acceptance.
- Writing an article published in a refereed, indexed journal.
- Writing a book published by a commercial or university press.

Appendix C: Examples of accomplishments used to evaluate candidate's Contributions to the Department:

- Directly Supporting CS Students
 - Advising a CS student club
 - Advising a CS student research group
 - Assisting with or maintaining the department's job and internship listserv
 - Organizing or contributing to the department's Learning Community
 - Serving as a liaison/contact person for department's alumni; e.g., keeping track of alumni achievements, introducing alumni to current students, setting up departmental events for alumni, inviting alumni to give presentations and/or talks in the department.
 - Serving as a department representative at various advising student sessions such as admissions open house, freshman or transfer orientation, exploratory studies workshops, etc.
- Directly Supporting CS Faculty and Staff
 - Mentoring other faculty or staff within the department
 - Reviewing material written by colleagues within the department prior to submission to a conference, journal, etc.
 - Serving as a mentor to a junior faculty member in the department.
 - Working with Instructional Technology to support software, hardware, or laboratories
 - Serving as a department liaison for industrial partners; e.g., reaching out to outside companies and helping students secure internships with them, inviting representatives from outside companies to give presentations and/or talks to students and faculty in the department, etc.
- Supporting CS Courses, Degrees, Governance, Programs, and Research
 - Assisting with departmental activities; e.g. New Student Orientation.
 - Chairing the department

- Contributing to tasks central to the department's day to day activities serving students and/or faculty
- Departmental course and program development, review, and redesign
- Departmental program or course coordination
- Developing or managing a laboratory
- Participating or chairing the formal assessment process for departmental programs
- Participating or chairing the development of new academic programs within the department
- Preparing materials such as labs, courseware, or a set of web pages for use by other faculty and/or students within the department
- Serving as a member or chair of a departmental committee
- Serving as departmental advising coordinator
- Serving as the coordinator of a graduate program
- Supporting CS Beyond the Department
 - Assisting with or editing a department newsletter
 - Assisting with or heading the development and maintenance of the department web page
 - Assisting with or heading the development and maintenance of the departmental facebook page
 - Helping the department meet the expectations of the College and the University
 - Participating in the formal assessment process for the college and/or university
 - Representing the department for its advancement, e.g. participation in major/minor fairs, high school outreach, open houses, student recruitment, outreach for bringing more resources to the department, participation in institutional planning, participation in the development of new academic programs, etc.
 - Representing the Department on the College adjusted load committee
 - Serving as the department's representative to the AFT
 - Serving as the department's representative to the university senate
 - Supporting Department efforts for external accreditation and other recognition
 - Supporting Department efforts to maintain connections with area employers of CS students.

Appendix D: Examples of accomplishments used to evaluate candidate's Contributions to the College and University:

- Directly Supporting Students
 - Advising a non-CS student club
 - Assisting with or maintaining university listservs
 - Organizing or contributing to university student programs such as EOF/MAP, Rowan After Hours, STARS, etc.
- Directly Supporting Faculty and Staff
 - Working with Instructional Technology to support software, hardware, or laboratories
 - Mentoring other faculty or staff outside the CS department
 - Reviewing material written by non-CS colleagues within the department prior to submission to a conference, journal, etc.
 - Serving as a mentor to a junior faculty member outside the CS department.
- Supporting College and University Courses, Degrees, Governance, Programs, and Research
 - Assisting with campus-wide activities; e.g. Homecoming, Rowan Day, New Student Orientation, etc.
 - Contributing to tasks central to the College's and/or University's day to day activities serving students and/or faculty
 - Course and program development, review, and redesign
 - Interdisciplinary program or course coordination;
 - participation in institutional planning
 - Participating or chairing the formal assessment process
 - Participating or chairing the development of new academic programs
 - Preparing materials such as labs, courseware, or a set of web pages for use by other faculty and/or students in the College or University
 - Serving as a member or chair of a College or University committee
 - Serving as a university senator

- Serving as an AFT representative
- Supporting the College and University Externally
 - Assisting with or editing external newsletters
 - Assisting with or heading the development and maintenance of web pages
 - Assisting with or heading the development and maintenance of the Facebook pages
 - Participating in the formal assessment process for the college and/or university
 - Representing the College and University for its advancement, e.g. participation in major/minor fairs, high school outreach, open houses, student recruitment, outreach for bringing more resources to the college and University, participation in institutional planning, participation in the development of new academic programs, etc.
 - Supporting College and University efforts for external accreditation and other recognition

Appendix E: Examples of accomplishments used to evaluate candidate's Contributions to the Wider and Professional Community

- Contributions to disciplinary and professional associations:
 - Assisting with the editing of the newsletter of an ACM special interest group.
 - Editing conference proceedings for a regional, national, or international conference.
 - Editing the newsletter of an ACM special interest group.
 - Membership on or chairing a committee for a regional, national, or international conference.
 - Positions in recognized professional organizations, such as the ACM (Association for Computing Machinery), the IEEE (Institute of Electrical and Electronics Engineers), and the ASEE (American Society for Engineering Education);
 - Refereeing a paper for a regional, national, or international conference.
 - Service to accreditation bodies or national examining boards;
 - Service to governing boards and task forces;
 - Service in organizing or reviewing submissions for annual or regional meetings and conferences sponsored by professional organizations.
 - Serving as an officer or director of an ACM special interest group.
 - Serving as a visitor in a ABET accreditation team or heading such a team.
 - Refereeing a paper for a conference.
 - Refereeing a paper for an indexed journal.
 - Sending technical correspondence to a Usenet newsgroup or professional publication.
 - Writing reviews for technical and research publications.
 - Organizing workshops, panel discussions and similar events at major CS conferences.
 - Serving as a member of or chairing a technical program committee for a national or international conference.
- General Public Support and Outreach
 - Briefings, seminars, lectures, and conferences targeted for general audiences;
 - Consulting or technical assistance provided to public or private organizations;
 - Designing a web site or database for a local community or charity organization.
 - Expert testimony or witness;
 - Public policy analysis for governmental agencies at all levels, e.g., concerning encryption policy or telecommunications policy;
 - Summaries of research, policy analyses, or position papers for general public or targeted audiences;
 - Writing articles published in a local paper explaining some aspect of computer technology to a lay audience.
 - Writing or editing newsletters;
 - Writing a book or providing a leadership role in the preparation of a multimedia presentation on some aspect of computer technology for use by the public.
- New products or practices:
 - Being inventor or co-inventor of a computer-related product or process which is patented.
 - Design or creation of new products, innovations, or inventions, e.g., new computer or communications hardware or software;
- Partnerships, Support, and Outreach to K-12 schools, County Colleges, and other Agencies.

- Briefings, seminars, lectures, and conferences targeted for K-12 and/or county college teachers;
- Chairing or Supporting contests for K-12 and/or county college students such as the Rowan University Programming Contest for high school students and the FIRST LEGO League competition for middle school students
- Chairing or supporting activities and programs for K-12 and/or county college students such as Math/Science/Computer Science day for high school students
- Collaboration with K-12 schools and County Colleges on articulation issues
- Collaboration with K-12 schools and county colleges on joint programs
- Collaborations with schools, industries, or civic agencies for program or policy development;
- Discipline-related voluntary community service.
- Economic or community development activities;
- Electronic productions, including educational/informational software, courseware, or web pages.
- Exhibits in other educational or cultural institutions;
- Membership on a committee, task force, or advisory board for a school, industry, or civic agency.
- Providing consulting or technical assistance to K-12 schools and county colleges
- Supporting the improvement of CS education at K-12 Schools and County Colleges
- Summer programs;

Appendix F: Evaluating Computer Scientists and Engineers for Promotion and Tenure

The following description is retrieved from <http://cra.org/resources/best-practice-memos/evaluating-computer-scientists-and-engineers-for-promotion-and-tenure/>. Last accessed, 8/31/15.

The evaluation of computer science and engineering faculty for promotion and tenure has generally followed the dictate “publish or perish,” where “publish” has had its standard academic meaning of “publish in archival journals” [Academic Careers, 94]. Relying on journal publications as the sole demonstration of scholarly achievement, especially counting such publications to determine whether they exceed a prescribed threshold, ignores significant evidence of accomplishment in computer science and engineering. For example, conference publication is preferred in the field, and computational artifacts —software, chips, etc. —are a tangible means of conveying ideas and insight. Obligating faculty to be evaluated by this traditional standard handicaps their careers, and indirectly harms the field. This document describes appropriate evidence of academic achievement in computer science and engineering.

Computer Science and Engineering —Structure of The Field

Computation is synthetic in the sense that many of the phenomena computer scientists and engineers study are created by humans rather than occurring naturally in the physical world. As Professor Fred Brooks of the University of North Carolina, Chapel Hill observed [Academic Careers, 94, p. 35],

When one discovers a fact about nature, it is a contribution per se, no matter how small. Since anyone can create something new [in a synthetic field], that alone does not establish a contribution. Rather, one must show that the creation is better.

Accordingly, research in computer science and engineering is largely devoted to establishing the “better” property.

The computer science and engineering field in academe is composed of faculty who apply one of two basic research paradigms: theory or experimentation. Generalizing, theoreticians tend to conduct research that resembles mathematics. The phenomena are abstract, and the intellectual contribution is usually expressed in the form of theorems with proofs. Though conference publication is highly regarded in the theoretical community, there is a long tradition of completing, revising, and extending conference papers for submission and publication in archival journals. Accordingly, faculty who pursue theoretical work are often more easily evaluated by traditional academic mechanisms. Nevertheless, the discussion below regarding “impact” will apply to theoretical work, too.

As a second generalization, experimentalists tend to conduct research that involves creating computational artifacts and assessing them. The ideas are embodied in the artifact, which could be a chip, circuit, computer, network, software, robot, etc. Artifacts can be compared to lab apparatus in other physical sciences or engineering in that they are a medium of experimentation. Unlike lab apparatus, however, computational artifacts embody the idea or concept as well as being a means to measure or observe it. Researchers test and measure the performance of the artifacts, evaluating their effectiveness at solving the target problem. A key research tradition is to share artifacts with other researchers to the greatest extent possible. Allowing one's colleagues to examine and use one's creation is a more intimate way of conveying one's ideas than journal publishing, and is seen to be more effective. For experimentalists conference publication is preferred to journal publication, and the premier conferences are generally more selective than the premier journals [Academic Careers, 94]. In these and other ways experimental research is at variance with conventional academic publication traditions.

The reason conference publication is preferred to journal publication, at least for experimentalists, is the shorter time to print (7 months vs 1-2 years), the opportunity to describe the work before one's peers at a public presentation, and the more complete level of review (4-5 evaluations per paper compared to 2-3 for an archival journal) [Academic Careers, 94]. Publication in the prestige conferences is inferior to the prestige journals only in having significant page limitations and little time to polish the paper. In those dimensions that count most, conferences are superior.

Impact —The Criterion for Success

Brooks noted that researchers in a synthetic field must establish that their creation is better. "Better" can mean many things including "solves a problem in less time," "solves a larger class of problems," "is more efficient of resources," "is more expressive by some criterion," "is more visually appealing in the case of graphics," "presents a totally new capability," etc. A key point about this type of research is that the "better" property is not simply an observation. Rather, the research will postulate that a new idea —a mechanism, process, algorithm, representation, protocol, data structure, methodology, language, optimization or simplification, model, etc. —will lead to a "better" result. For researchers in the field, making the connection between the idea and the improvement is as important as quantifying how much the improvement is. The contribution is the idea, and is generally a component of a larger computational system.

The fundamental basis for academic achievement is the impact of one's ideas and scholarship on the field. What group is affected and the form of the impact can vary considerably. Often the beneficiaries of research are other researchers. The contribution may be used directly or be the foundation for some other artifact, it may change how others conduct their research, it may affect the questions they ask or the topics they choose to study, etc. It may even indicate the impossibility of certain goals and kill off lines of research. Clearly, it is not so much the number of researchers that are affected as it is how fundamentally it influences their work. Users are another group that might feel the impact of research.

For the purposes of evaluating a faculty member for promotion or tenure, there are two critical objectives of an evaluation:

- a. Establish a connection between a faculty member's intellectual contribution and the benefits claimed for it, and
- b. Determine the magnitude and significance of the impact.

Both aspects can be documented, but it is more complicated than simply counting archival publications.

Assessing Impact

Standard publication seeks to validate the two objectives indirectly, arguing that the editor and reviewers of the publication must be satisfied that the claims of novelty and ownership are true, and that the significance is high enough to meet the journal's standards. There is obvious justification for this view, and so standard publication is an acceptable, albeit indirect, means of assessing impact. But it can be challenged on two counts. First, the same rationale can be applied to conference proceedings provided they are as carefully reviewed as the prestige conferences are in the computer science and engineering field. Second the measure of the impact is embodied in the quality of the publication, i.e. if the publication's standards are high then the significance is presumed to be

high. Not all papers in high quality publications are of great significance, and high quality papers can appear in lower quality venues. Publication's indirect approach to assessing impact implies that it is useful, but not definitive.

The primary direct means of assessing impact—to document items (a) and (b) above—is by letters of evaluation from peers. Peers understand the contribution as well as its significance. Though some institutions demand that peer letter writers be selected to maximize the peer's stature in the field, e.g. membership in the National Academy, a more rational basis should be used.

From the point of view of documenting item (a), the connection between the faculty member's contribution and its effects, evaluators may be selected from the faculty member's collaborators, competitors, industrial colleagues, users, etc. so that they will have the sharpest knowledge about the contribution and its impact. If an artifact is involved, it is expected that the letter writers are familiar with it, as well as with the candidate's publication record. These writers may be biased, of course, but this is a cost of collecting primary data. The promotion and tenure committee will have to take bias into consideration, perhaps seeking additional advice. The letter writers need to be familiar with the artifact as well as the publications. The artifact is a self-describing embodiment of the ideas. Though publications are necessary for the obvious reasons—highlighting the contribution, relating the ideas to previous work, presenting measurements and experimental results, etc.—the artifact encapsulates information that cannot be captured on paper. Most artifacts “run,” allowing evaluators to acquire dynamic information. Further, most artifacts are so complex that it is impossible to explain all of their characteristics; it is better to observe them. Artifacts, being essential to the research enterprise, are essential to its evaluation, too.

Some schools prohibit letters of evaluation from writers not having an academic affiliation. This can be a serious handicap to experimental computer scientists and engineers because some of the field's best researchers work at industrial research labs and occasionally advanced development centers. Academic-industry collaborations occur regularly based on common interests and the advantage that a company's resources can bring to the implementation of a complex artifact. Letters from these researchers are no less informed, thoughtful, or insightful because the writer's return address is a company.

In terms of assessing item (b) the significance of impact, the letter writers will generally address its significance, but quantitative data will often be offered as well. Examples include the number of downloads of a (software) artifact, number of users, number of hits on a Web page, etc. Such measures can be sound indicators of significance and influence, especially if they indicate that peers use the research, but popularity is not equivalent to impact.

Specifically, it is possible to write a valuable, widely used piece of software inducing a large number of downloads and not make any academically significant contribution. Developers at IBM, Microsoft, Sun, etc. do this every day. In such cases the software is literally new, as might be expected in a synthetic field, but it has been created within the known state-of-the-art. It is not “better” by embodying new ideas or techniques, as Brooks requires. It may be improved, but anyone “schooled in the art” would achieve similar results. Quantitative data may not imply all that is claimed for it, and it can be manipulated. Downloads do not imply that the software is actually being used, nor do Web hits imply interest. There are techniques, such as the Googol page-rank approach [<http://www.google.com>], that may produce objective information about Web usage, for example, but caution in using numbers is always advised.

Summary

Computer science and engineering is a synthetic field in which creating something new is only part of the problem; the creation must also be shown to be “better.” Though standard publication is one indicator of academic achievement, other forms of publication, specifically conference publication, and the dissemination of artifacts also transmit ideas. Conference publication is both rigorous and prestigious. Assessing artifacts requires evaluation from knowledgeable peers. Quantitative measures of impact are possible, but they may not tell the implied story.