PhD Program in Computer Science

**Assessment of First Ph.D Exam**

Computer Science PhD students, among other requirements, must complete the following in order to pass the first PhD exam:

Take CSC 70010, the Algorithms course, and pass its final written exam with a score of at least 70 points out of 100 in at most two attempts. "Students who fail the Algorithms final written exam the first time, must formally register for the Algorithms class the next year as an Audit and take the final exam again”.

There is a maximum of two attempts in which if failing the final exam the second time, the student may be discontinued from the CS PhD program. Clearly there is a lot at stake from a student perspective and it is important to make sure all students taking the exam for the second time must audit the current Algorithms course. This clause was added in 2015 to avoid conflicts since two different course instructors may cover different materials, thus even if a student passed the Algorithm’s course, while failing the final exam, a different set of topics must be reviewed.

A. The Learning Goals for the First Exam

- Explain and analyze the performance (in terms of optimality and efficiency) of standard algorithms for sorting, minimum spanning trees, shortest paths, maximum flow, hashing, and knapsack, etc.
- Understand and program divide-and-conquer algorithms.
- Understand the principles of greedy algorithms (including matroids).
- Seek solutions to newly encountered problems by applying basic algorithm design techniques, such as divide-and-conquer, greedy, dynamic programming; and judge which approaches are most appropriate or promising for the problem at hand.
- Understand the use advanced data structures and how they affect the computational complexity of algorithms.
- Investigate or make informed judgments about whether a given problem is likely to be NP-complete.

B. Course Outcomes

- Students will obtain a sufficient background to tackle major challenges encountered during their graduate studies and they should be able to successfully complete their doctoral requirements.
C. Data and Other Information Drawn on in Conducting the Review

a) Preparation:
   i) Is the academic preparation for the exam adequate to produce results that meet your learning goals?
   ii) Do students understand the criteria for passing the exam?
   iii) Do students understand how to prepare for the exam?
   iv) Do students have adequate resources to prepare them for the exam (reading lists, faculty support)?

As the First Exam is created by the First Exam committee, feedback was requested from the First Exam Committee members, consisting of Professors Feigenbaum, Goswami, Herman (course lecturer), and Kletenik for the following questions:

1) Should the final exam be closely related to the material covered by the instructor of the Algorithms course, or we should stick to a predefined syllabus.

   Even though there was not a consensus among the members of the First Exam Committee, regarding this question, the idea of a predefined syllabus independent of the Algorithms course syllabus was the prevalent one. The majority thought that a mandatory syllabus (core) should be covered by the Algorithms instructor (Professor Goswami mentioned that the core material should represent about 80% of the material covered during the course and this idea was supported by Professor Herman) allowing the flexibility of covering other subjects of interests to the instructor. The First Exam Committee should prepare the core syllabus (as recommended by Professors Feigenbaum and Kletenik). In this syllabus the time allocated to each subject to be covered should be also specified. Two members of the committee considered the possibility of decoupling the course from the First Exam but the Curriculum Committee has previously voted to keep the status quo.

2) Student evaluation.
   Student evaluation is essential to correct and/or modify the content of the First Exam. Syed Ahmed, member of the Curriculum Committee, prepared and conducted a survey of students that have recently taken the first exam.

   The following questions were asked of the students.

   a) Do you think the questions on the First Exam were similar to the questions on the homework for the Algorithms course (1: very different, 5: very similar)?
   b) Did you feel someone other than the instructor composed the First Exam?
   c) Were there any topics on the test that were insufficiently covered in class?
   d) If yes, which topics were insufficiently covered in class?
   e) How long did you spend preparing for the test? (possible answers: 1-6 days, 1 week, 2 weeks, more than 2 weeks).
   f) How would you rate the preparatory material you received from the instructor or the department? (1: not helpful, 5: relevant and helpful)
   g) Any comments of how to improve the exam?
Even though only 8 students responded to the survey, it is very clear that better coordination should be achieved between the material covered during the lectures and the questions on the exam. In addition it is recommended that this survey (perhaps with additional questions) should be administered “immediately” after the conclusion of the exam to increase the statistical sample.

3) Should we keep a database of previous exams as a study-guide for the students?

The Curriculum Committee decided that a database of previous exams should be kept on the CS website. The CS website is now being updated with as many old Algorithm exams as can be found.

4) How do you think we should assess the First Exam (e.g., number of students passing the exam, number of students taking the exam for the second time, students that have been discontinued from the program?)

Information about how many students take the First Exam and pass it on the first try or on the second try should be gathered and made available to the Curriculum Committee and the Executive Committee. The following table was prepared by Professor Haralick for the years 2007-2016.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total # of students that took the exam</th>
<th>Passed</th>
<th>% Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>25</td>
<td>11</td>
<td>44</td>
</tr>
<tr>
<td>2008</td>
<td>20</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>2009</td>
<td>20</td>
<td>13</td>
<td>66</td>
</tr>
<tr>
<td>2010</td>
<td>31</td>
<td>24</td>
<td>77</td>
</tr>
<tr>
<td>2011</td>
<td>21</td>
<td>10</td>
<td>48</td>
</tr>
<tr>
<td>2012</td>
<td>28</td>
<td>18</td>
<td>64</td>
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<tr>
<td>2013</td>
<td>15</td>
<td>8</td>
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<td>2014</td>
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<td>2015</td>
<td>24</td>
<td>18</td>
<td>75</td>
</tr>
<tr>
<td>2016</td>
<td>21</td>
<td>16</td>
<td>76</td>
</tr>
<tr>
<td>Totals</td>
<td>223</td>
<td>144</td>
<td>65</td>
</tr>
</tbody>
</table>

It is clear that the change of curriculum that was implemented in 2015 has raised the percentage of students who passed the exam.
From 2007 through 2014, there were 178 students who took the First Exam and 112 passed, a percentage of 63%. For 105-2016, there were 45 students who took the first exam and there were 34 who passed, a passing percentage of 75.5%.

b) Grading: Do the faculty who prepare students for the exams also grade the exams? Do graders provide narrative feedback to explain the grades given? Do students perform comparably on this exam and the steps before it in the program?

Consistent with the CS Executive Committee directions, preparation of the First Exam is the responsibility of the First Exam Committee. Committee members who design a question for the First Exam will grade the question. Assigning the grades for the Algorithms course is the responsibility of the course instructor. The Algorithms instructor will meet with students who have questions on their course grades. A First Exam Committee member will meet with students who wish to discuss the grading of the questions that the committee member designed. First Exam Committee members can change the grading of their question. A First Exam Appeals Committee will meet with the students who appeal their first Exam grade.

c) Outcomes*: Have the exams from the past few years had sufficient depth of content? Are they of sufficient quality? Do students demonstrate a working knowledge of the professional vocabulary and concepts in your field? In the case of Qualifying Papers, do the faculty see competent use of current research tools and methods?

The curriculum committee judged that the exams of the old curriculum were too hard and that the difficulty of the First Exam under the new curriculum is in the right ball park.

D. Findings and Proposed Changes

Some conclusions can be drawn from the reply to the questions submitted to the First Exam Committee as well from the student survey (even though the statistical sample is small in comparison to the whole population).

a) It is recommended that a core syllabus should be designed and it should be fully covered by the Algorithms course instructor. Moreover the instructor should have the flexibility of presenting material close to her (his) research interests. The First Exam Committee should be responsible for developing the syllabus. The syllabus should be revised as often as necessary and students should be notified of the changes in a timely manner.

b) The First Exam Committee consists of the professor teaching the Algorithms course and three other faculty members in the algorithms area. Committee members serve staggered terms of three years. The mission of the committee each year is to determine the core syllabus of the Algorithms course, design the First Exam which is also the Algorithms class Final Exam, and write the solution to each question. The core syllabus comprises about 80% of the course syllabus. The remaining 20% of the course syllabus is designed by the instructor of the Algorithm’s course.

The First Exam Committee works by dialog. The dialog is about the design of the questions, their solutions, difficulty level, and number of points appropriate for each question. The set of questions determined by the committee should bear a high resemblance to the
syllabus that the committee establishes. The committee member who writes a question grades the question. Questions any committee member has about grading are resolved through committee dialog.

c) Student survey (with additional questions to the one mentioned above) should be administered to the students immediately after the conclusion of the first exam.

d) Exams from previous years should be posted as a study guide for the students to be better prepared for the examination.

e) Statistical reports should be developed regarding information such as

- Number of students passing the exam on the first attempt.
- Number of students passing the exam on the second attempt.
- Number of students discontinue from the program.

It is important to gather this information at the end of each Fall semester when the Algorithms is taught.

An additional survey should be administered to faculty supervising PhD students as they can recommend additions or changes to the core syllabus. This survey should help in determining item c) Outcomes of the previous section.

Respectfully yours,

Members of the Curriculum Committee
Report on Professional Development and Ethics Assessment
PhD Program in Computer Science

1) Statement of Learning Goals: The PhD program in Computer Science currently does not currently have a statement of goal in place for the professional development and ethics training as a learning objective. The department’s curriculum committee will deliberate on putting such a goal in place and upon approval from the executive committee, the statement of goal will be included in our learning objective in the coming years.

2) Professional development and professional ethics training provided to students in the program:

Students in the program are encouraged to participate in a one-day, in person workshop on Ethics in Research sponsored by the Vice Chancellor for Research. In addition, students are encouraged to complete on-line training on ethical conduct or research provided by CUNY. Besides the general training, the department focuses on the skills necessary in the field of Computer Science. Professionals in the field of computer science require effective presentation skills to be successful in their careers. The department offers various opportunities to the students to learn and hone these skills.

Courses:

a. Research Survey: The department has offered the research survey course in Spring and Fall 2016 semesters. This course is designed to introduce and practice the art of writing and presenting literature surveys on the student’s research area to an audience in both written and audio-visual formats. Students study and write several papers in their intended thesis topic and present their papers to their peers in a classroom environment. Students receive feedback on both writing style and content throughout the course. The goal in this course is to prepare students for their Level II exam paper and presentation. However, these skills are transferable to professional careers in academia and industry.

b. Computer Science Research: The department has this course and intends to offer it in the near future. This is a second part of the Research Survey that focuses on original research conducted by students in their thesis research topic. Students receive training in presenting their problem statement, background study, research methodology and results. This course emphasizes on ethics in research methodologies and data collection.

Seminars:

The department has offered several seminars including the Computer Science Colloquium, Natural Language Processing seminars, Cryptography seminar, Applied Probability, Category Theory and Statistics Seminar as well as Seminar in Logic and Games. Each seminar series concentrates on a focus area and invites expert speakers to talk to our student and faculty audience about their research.

Conference presentations:

Doctoral students in the program routinely attend conferences where they present their own research. They have also attended summer schools/winter schools that allow collaborative
experience and rigorous training in new and upcoming research tools and technologies. The program supports partial travel expense to those who present papers at external conferences.

Committee work:
Doctoral students in the program participate in committees where they work with faculty members in discussing and voting for important governance matters in the department.

Student workshop:
The CS student association organizes a research workshop where students present their research in poster format.

Role of research mentors and committees:
Each CS student is paired with a research mentor as well as a committee of 2 other faculty members. Students have access to their mentor and advisors who provide essential research and ethics training through their regular interactions.

3) Measuring the Effectiveness of the Professional Development and Training Program:
The Department conducted a survey to ask students in the program whether the professional development training being currently provided meets their expectations. The survey included questions regarding their current level of participation in various venues available to them and asked about their opinion and suggestions. The result is presented below:

4) The survey result (is the professional development training effective):

We surveyed our students to evaluate the effectiveness of courses. Seminars and role of their faculty mentors. 70% of the respondents attend at least 2-3 seminars each semester but 50% of the respondents found them useful for their professional development. 90% of the respondents have taken the research survey course and 90% found the course effective in their professional development as in the course was effective in giving them directions on how to prepare written reports. Students were also positive about the role of conferences but had mixed response on the role of committee work in helping them professionally. All students acknowledged the positive role of faculty mentors. Most importantly, 80% of students asked for workshops that taught certain programming languages such as R, Python, C++ and 100% of the students indicated that a faculty led workshop will be preferred over a student led workshop.

5) Proposed changes (TENTATIVE):
The department may consider seeking funding and resources to organize workshops during the semester and intersessions. The goal of these workshops will be cover programming languages such as R. The workshop will be supported by students who help faculty in running hands on training sessions.