NEW MEXICO STATE UNIVERSITY
INTER-OFFICE MEMORANDUM
COLLEGE OF ARTS AND SCIENCES
Department of Mathematical Sciences

TO: William V. Flores, Provost
THROUGH: Peter Gregware, Associate Dean, College of Arts and Sciences
FROM: Ross E. Staffeldt, Department Head
DATE: February 21, 2006
SUBJECT: Report on graduate outcomes assessment, AY 04-05

Item 1: Current copy of outcomes assessment plan. We have attached a copy of the current outcomes assessment plan for the graduate program. For 2004-05 the plan is an extension of the earlier plan. As before, we continue to use the assessment questionnaires at comprehensive and final exams, but faculty members are now being asked to report on student performance in courses. At present we are requesting general comments on performance on homework, exams, projects, and presentations. One goal is to obtain direct information on development of students’ abilities to analyse intricate mathematical problems and to write mathematics, and another is to improve our placement decisions.

Item 2: Outline of activities, 2004-05. At the discussion of the outcomes assessment report for 2003-04, which took place in January, 2005, we observed that the questionnaires used at the oral graduate student examinations provide only implicit information about the specific program goals of developing the ability to analyse intricate mathematical problems and the ability to write mathematics clearly. As a step toward formulating a tool to get at these issues, the department decided to review commentaries of instructors on the performance of students in graduate classes for information on these points. Use of this tool should improve placement decisions and student advising, which are concerns of the faculty. In another effort to improve student advising, faculty advisors and students meet to discuss progress and long-term planning of study programs.

For Master’s degree students, the overall goal of the program is to provide each student with a broad training in mathematics. The objective is for each student to successively complete the Master’s final oral examination. At the final oral examination, the chair of the exam distributes a short questionnaire:

1. Does the student’s performance provide evidence that the student has obtained broad training in mathematics? Please respond by a cross in the appropriate box below.

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2. Additional comments?
In the academic year 2004-05 the survey was conducted at eight Master’s oral exams, and there were 26 responses. The average rating was 3.85 out of 5. As we intend for the ratings to be at least 3 on this scale, we view these as a favorable result for the overall program. There were thirteen comments:

- “This student’s exam was about his thesis which is in a very specific area of mathematics.”
- “Wrote a publishable thesis”
- “This exam was primarily about thesis.”
- “The student shows precise knowledge of the material he presented and the courses he took. His general mathematics training would benefit from a course in differential geometry.”
- “Exceptionally strong student.”
- “Drew together mathematical ideas from different areas — but the technical nature of the material made it seem more narrow than the required training.”
- “The examination tested a diverse background of subjects all of which Sarah showed preparation for the areas.”
- “She showed a good grasp of definitions and basic ideas, but had more difficulty with some of the deeper concepts.”
- “The student managed to answer on the spot a couple of ‘out of the blue’ interesting mathematics questions asked by the outside member (a professor in the chemistry dept.). I thought this was cool!”
- “(Name removed) is a good student. I am quite satisfied with his Master’s Oral Exam performance. His answers show broad and sound knowledge of mathematics.”
- “(Name removed) struggled with articulating some of the fundamental ideas of 525/526 but overall I think he understood the material.”
- “The questioning was specific to the student’s area of study.”
- “(Name removed) is planning to pursue her PhD in our department. She is taking a topology course, and a reading course from me (continuing work she did last semester).”

For Ph.D. students assessments are undertaken at the Ph.D. oral comprehensive and at the final oral exam. The goal of the program is for each student reaching the comprehensive examination to have obtained a broad knowledge of mathematics. The objective is for each student to exhibit strong performances on the written and oral comprehensive exams. At the oral comprehensive examination, the chair of the exam distributes a short questionnaire:

1. Does the student’s performance on the oral Ph.D. comprehensive examination provide evidence that the student has obtained broad knowledge of mathematics? Please respond by a cross in the appropriate box below:
During the academic year 2004-05 a survey was taken at one oral comprehensive examination. Two responses were received and the average rating was 3. Again we expect our ratings to exceed 3, so this is a favorable result.

- “It is extremely difficult to assess this student’s knowledge. He seems to have knowledge of a large number of facts. On the other hand, his presentation did not indicate that there is a great deal of synthesis of ideas. It is unclear whether the synthesis is absent or that his communication skills were not adequate to represent the true state of his understanding.”

- “Student shows acquaintance with a wide swath of literature in his area. Understanding is in evidence, but deep understanding needs additional development.”

For students completing a dissertation, the goals are for the student to make an original contribution to mathematics and for the student to demonstrate the ability to access the relevant literature. The objective is for the student’s presentation at the final oral exam to provide evidence that the dissertation is an original contribution to mathematics and the student has learned to access the relevant literature. At the final oral examination, the chair of the exam distributes a short questionnaire

1. Does the student’s presentation at the final oral provide evidence that the student’s dissertation is an original contribution to mathematics? Please respond by a cross in the appropriate box below:

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<th>Unoriginal</th>
<th>Highly original</th>
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<td>1 2 3 4 5</td>
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2. Does the student’s presentation at the final oral provide evidence of the ability to access the relevant literature? Please respond by a cross in the appropriate box below:

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<th>Unable</th>
<th>Very Able</th>
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<td>1 2 3 4 5</td>
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3. Additional comments?

During the academic year 2004-05, two students had Ph.D. final oral exams. Seven evaluation forms were received with the following results. The average rating on question 1 was 4.29. The average rating on question 2 was 4.86. The target rating on each question is 3, so we are pleased with these results. There were also five comments

- “The student significantly generalized two important theorems in two completely distinct areas of mathematics.”
• “Good presentation - handled questions very well. Showed solid group of work.”
• “Strong thesis and fine presentation during defense.”
• “Very good presentation - well-prepared to address questions. Nice thesis.”
• “Well-prepared.”

Item 3: What we have learned. This year we had a much bigger sample of results from Master’s examinations (eight) than in the previous year (four). From the results we conclude that students exiting the program do have the abilities to understand and to formulate proofs and to communicate oral mathematics clearly. However, final examinations before 2004 indicated that some students had a weakness in the important subject of linear algebra. For Fall 2005 we have modified the algebra sequence to begin with a graduate level course on linear algebra, and rearranged the sequencing of other material. The comments on some of the Master’s examinations may indicate not that the student lacked breadth in mathematics, but that the examination did not show a breadth of knowledge. This was particularly true of Master’s examinations where the student wrote a thesis, as the exams tended to focus on the thesis. The chair of the Graduate Studies Committee would recommend that for Master’s examinations where a thesis is presented, that half the examination be on general material not necessarily related to the thesis. This proposal will be discussed at a faculty meeting.

The sample of results from Ph.D. examinations was roughly the same size as last year, and the averages are essentially the same. Once again we have difficulty in interpreting these results, because the sample size is so small. Therefore, we are seeking additional instruments to examine how students develop in our program.

Item 4: Anticipated changes in outcomes assessment activities. We anticipate continuing to make changes in the plan for graduate program assessments. The Graduate Studies Committee proposed to assess the program, in particular, placement and advising, through faculty reports on graduate student performances in each graduate course. Faculty members consider performance of students in class, on written assignments, on exams, and in oral presentations. This was piloted during the 2004-05 academic year, while the unmodified questionnaires remain in use. At the meeting to discuss this report, we will have the opportunity to review the data from the first round of faculty reports. As we have discovered with the undergraduate program, student portfolios may become a means of documenting improvements in students’ abilities to analyse and describe intricate mathematical situations. However, this must be discussed among the faculty.

Item 5: Communication of results to faculty. Results of outcomes assessment of the graduate program are discussed at a faculty meeting, with the department’s Graduate Studies Committee, and posted on the department’s internal web page.