

## General Education Requirement in Quantitative Reasoning

December 16, 1994

(a) *Quantitative Reasoning* is the process of forming conclusions, judgments or inferences from quantitative information. There are many aspects to quantitative reasoning. These include the recognition and construction of valid mathematical models that represent quantitative information; the analysis and manipulation of these models; the drawing of conclusions, predictions or inferences on the basis of this analysis; and the assessment of the reasonableness of these conclusions.

(b) *Timing*: The Faculty Senate left some flexibility for each College to decide when the QR-A and QR-B requirements should be fulfilled and in what order. Our recommendations to the Academic Planning Council are:

(I) QR-A must be completed within the first 60 credits earned.

(II) In order for a course to be approved as a QR-B course, it must have as a prerequisite the completion of a QR-A course. This prerequisite may be either a specific QR-A course or any QR-A course.

The reason for recommendation (I) is that if the quantitative reasoning requirement is to have some effect on a student's ability to use quantitative reasoning in other courses (and not merely be an exit requirement), then the requirement should be satisfied early on. The reason for recommendation (II) is that it is the intent of the QR-Implementation Committee that QR-B courses make substantial use of some of the skills to be developed in QR-A courses.

Sanctions for not completing QR-A within the first 60 credits would be the same as those used for other requirements with a deadline for completion; namely, a student would have to obtain permission to register by consulting with an appropriate advisor.

(c) *Transfer students*: Our recommendation to the Academic Planning Council for the satisfaction of the QR-A requirement by transfer students is:

(III) Transfer students who have not fulfilled the QR-A requirement at the time of admission, and who are admitted with 60 or more credits, must complete the QR-A requirement during their first semester in residence.

Transfer students who have not fulfilled the QR-A requirement at the time of admission, and who are admitted with fewer than 60 credits, must complete the QR-A requirement prior to obtaining 60 degree credits (degree credits include courses transferred and those taken in residence).

(d) *Exemption:* Our recommendation to the Academic Planning Council concerning exemption from the QR-A requirement is:

(IV) Exemption from the QR-A requirement shall mean a score on placement tests that is high enough for entrance into Math 114 (College Algebra and Trigonometry).

Students who are exempted from QR-A have therefore demonstrated, through the placement tests, a level of mathematical knowledge and skills which is higher than Math 101 (Intermediate Algebra) but not necessarily as high as expected upon completion of Math 112 (College Algebra). Using this exemption criterion avoids creating (perhaps artificially) a new cutoff level on the placement exams.

(e) *Criteria for a course to be labeled a quantitative reasoning course* (Certification of courses):

(e1) *Criteria for a QR-A course:* To be certified as a QR-A course, a course must provide students with skills in mathematics, computer science, statistics or formal logic that are needed for dealing with quantitative information. The skills must be broad-based in order that they have a positive impact on the readiness of students to take a QR-B course in a variety of disciplines.

(e2) *Criteria for a QR-B course:* To be certified as a QR-B course, a course must make significant use of quantitative tools in the context of the other course material, for example:

- the recognition and construction of mathematical models and/or hypotheses that represent quantitative information,
- the evaluation of these models and hypotheses,
- the analysis and manipulation of mathematical models,
- the drawing of logical conclusions, predictions or inferences, and
- the assessment of the reasonableness of conclusions.

A QR-B course may, but is not required to, focus on quantitative reasoning in one specific discipline.

Courses that do *not* satisfy the criteria for QR-B courses include those that deal with quantitative information only in one or more of the following ways:

- Students are given a mathematical model (equations, formulas, ...) and are merely required to produce a numerical or qualitative answer through routine calculations or symbolic manipulation.
- Students are required to use a computer package to perform calculations or carry out a study without subjecting their results to critical analysis, comparing them to other numerical data, arriving at conclusions, predictions or inferences, and assessing their reasonableness.
- Students are required to deal with quantitative information in primarily descriptive or conceptual ways. For example, courses in "research methods" that lack a substantial reasoning component based on tools covered in a QR-A course would not be certified.

(f) *Assessment*: Assessment provides an opportunity to measure the degree to which the QR-A and QR-B courses meet the objectives for general education (Faculty Document 1065, dated 4 April 1994, and the Report of the Committee on Undergraduate Education, dated 20 August 1993) and those outlined for these QR requirements.

An important component of assessment is to provide a feedback loop of information for continuous improvement of our objectives and outcomes in quantitative reasoning. UW-Madison has an existing faculty committee on quantitative reasoning assessment which has concentrated primarily on developing specially constructed, course specific tests to determine the quantitative reasoning skills for junior year courses which have a variety of quantitative reasoning prerequisites. This core activity will continue.

The assessment measures adopted will be over and above the normal course evaluations conducted by individual instructors. Departments with courses that have been approved as meeting the QR-A or QR-B requirement should expect to cooperate, on a representative sampling basis, in a variety of outcomes assessments with regard to these courses. Among the techniques which may be used will be embedded questions, portfolios, course exit interviews, senior exit interviews, and alumni surveys.