**FQ HALLMARKS**

Hallmarks appear in bold; explanatory notes appear in italics.

**Introduction:** Courses in Foundations Quantitative Reasoning (FQ) should present quantitative reasoning as a means of facilitating reasoning, and not merely as a technique to represent course content. Instructors should engage students in the active use and application of mathematical concepts, but should not present the use of numeric reasoning strategies and techniques in a strictly mechanical way. Rather, instructors should focus on presenting concepts and tools of quantitative reasoning to help students further understand the course material. The majority of an FQ course should address issues of quantitative reasoning, and impart an appreciation of the power and clarity that such reasoning brings to our thinking and understanding. Courses that apply for the FQ designation must meet all four Hallmarks.

**To satisfy the FQ requirement, a course will:**

1. **provide students with theoretical justifications for, and limitations of, mathematical or statistical methods, and the formulas, tools, or approaches used in the course;**

2. **include application of abstract or theoretical ideas and information to the solution of practical quantitative reasoning problems arising in pure and applied research in specific disciplines, professional settings, and/or daily and civic life;**
   - A minimum of 10% of course content (lecture content, homework problems, and exam problems) should include practical examples. Faculty members are encouraged to exceed this.
   - Practical examples might involve a physical situation, professional application, or daily life. Faculty members are encouraged to situate some practical examples in a rich context.
   - Practical examples should be integrated throughout the academic term.

3. **provide opportunities for practice and feedback that are designed to help students evaluate and improve quantitative reasoning skills by including a course component at least once per week with a maximum 30:1 student-to-teacher ratio;**
   - Examples of acceptable formats include, but are not limited to: small lectures with maximum enrollment of 30 students; large lectures with 30-student-maximum weekly recitation sections, discussion sections, or problem sessions led by trained graduate assistants or trained undergraduate peer-tutors; large lectures with weekly 30-student-maximum supervised computer lab sessions designed to reinforce and practice lecture material.
   - Acceptable training for graduate students and undergraduate peer-tutors may include, but is not limited to, University and/or Departmental start-of-semester TA training, weekly course TA meetings, or other consistent guidance and supervision by faculty.

4. **be designed so that students will be able to:**
   a. **identify and convert relevant quantitative information into various forms such as equations, graphs, diagrams, tables, and/or words;**
   b. **select appropriate techniques or formulas, and articulate and evaluate assumptions of the selected approaches;**
   c. **apply mathematical tools and perform calculations (including correct manipulation of formulas);**
   d. **make judgments, create logical arguments, and/or draw appropriate conclusions based on the quantitative analysis of data, the assumptions made, the limitations of the analysis, and/or the reasonableness of results;**
   e. **effectively communicate those results in a variety of appropriate formats.**

   *Individual practical examples will likely emphasize some aspects of this hallmark while omitting others. However, the course as a whole must ultimately address each aspect of this Hallmark.*

   *Hallmark 4 is intended to help students identify the major components or factors involved in an analytical problem and determine the arrangement of evidence in evaluating the problem.*
Students will be able to:

1. **Select** an appropriate mathematical approach for a given problem or practical application, and identify relevant quantities or other information for the selected approach;
   - *Herein, a “mathematical approach” refers to a set of formulas, models, algorithms, or other mathematical or statistical methods.*
   - *Selection includes verifying that the assumptions and limitations of a mathematical approach are appropriate for a particular practical problem.*

2. **Convert** relevant quantities/information into the necessary symbolic, numerical, or graphical form as needed for the selected approach;
   - *Conversion includes understanding the meanings of individual variables in a given context, and the correct association of quantities with their corresponding variables.*

3. **Use** mathematical approaches successfully, including performing correct chains of algebraic steps, symbolic manipulations, and/or numerical calculations;
   - *Successful use also includes knowing the names and understanding the meanings of operational symbols and using them correctly in a given context.*

4. **Evaluate** the validity of a mathematical approach and its conclusions;
   - *Evaluation may include: verifying correctness of solutions, where possible; reexamining initial assumptions; assessing reasonableness of numerical results in practical applications or physical contexts; applying other accepted methods of judgment within particular disciplines.*

5. **Communicate** final conclusions in appropriate formats.
   - *Appropriate formats may include symbolic expressions, graphs, or written statements.*
   - *Final conclusion statements should reflect the outcome of deductive or statistical reasoning.*