Workshop

ABSTRACT AWAKENINGS IN ALGEBRA: A GUIDED READING APPROACH TO TEACHING MODERN ALGEBRA VIA ORIGINAL SOURCES

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This workshop will explore a particular approach to the use of original historical sources in the undergraduate university mathematics classroom. The cornerstone of this approach is the extensive use of excerpts from original source material close to or representing the discovery of key mathematical concepts and theory as a means to develop the material in question. Through guided reading of the excerpts and completion of exercises based upon them, students are prompted to explore these ideas and develop their own understanding of them. Each excerpt is introduced by brief historical comments and biographical information about its author to set it in context and offer students a view of the humanistic aspect of mathematics. By placing a problem in its historical context, the student is also able to follow the thought process that led to the discovery of complicated and subtle mathematical concepts while simultaneously being guided to construct their own understanding of the present day ideas evolving via the project exercises.

Examples of this approach are found in a compendium of projects developed and tested since 2008 by an interdisciplinary team of mathematicians and computer scientists for the teaching of topics in discrete mathematics with support from the US National Science Foundation. All our projects are available via our two web resources:

(http://www.cs.nmsu.edu/historical-projects/, http://www.math.nmsu.edu/hist_projects/).

More specifically, the workshop will focus on student projects designed for use in a first course in Abstract Algebra in the standard US undergraduate curriculum, including portions of the project Abstract awakenings in algebra: Early group theory Lagrange, and Cayley the works of Cauchy, (project # 11 in at http://www.cs.nmsu.edu/historical-projects/). Successfully tested as a textbook replacement for a significant portion of an abstract algebra course at three US institutions to date, this project exemplifies the benefits of using select original source excerpts to draw attention to mathematical subtleties which modern texts may take for granted. In keeping with the historical record, this often leads to a more concrete approach than is typical of current texts. For example, to provide context for the abstract group concept first defined in an 1854 paper by Arthur Cayley, this project begins by studying specific mathematical systems (e.g., roots of unity in Lagrange,

permutations groups in Cauchy) which were well-developed prior to Cayley's explicit recognition of their common structure. Cayley's own references to these and other specific nineteenth century appearances of the group concept render his paper a powerful lens on the process of mathematical abstraction that more standard textbooks do not provide.

Additionally, workshop participants will explore portions of a student project in ring theory, based on excerpts from works by Dedekind, Fraenkel, E. Noether and Krull, which is currently under development for use in a first course on abstract algebra. The workshop agenda will also include a discussion of implementation and evaluation issues, an overview of the general pedagogical goals guiding our work, and analysis of specific features of these particular abstract algebra projects relative to those goals and other theoretical frameworks.