

Engineering Online Gateway System

Ensuring Student Learning through Automated, Milestone Exams

Marcial Lapp, Jeff Fleszar and Jeff Ringenberg



Presented at the *Fourth Annual Research and Scholarship in Engineering Education Poster Session*. 10/22/09.

Research Question

Can we ensure student learning of core-class-concepts through regularly-timed, automated, milestone examinations?

Abstract

Through the development of a computer-based “gateway” examination system, we seek to ensure adequate apprehension of the material presented in introductory engineering courses. Our goal is to statistically show that these gateway exams are beneficial to students enrolled in a particular course.

Background

Most engineering courses use a sequential teaching strategy by which new material builds on concepts previously presented. While such a strategy lends itself to a natural presentation of course concepts, students who do not have a solid grasp of the initial material often fall behind and continue to struggle through the remainder of the course.

To combat the problem of the struggling student, we will develop a computer-based examination system that can be used throughout various times of the semester to ensure students have grasped the vital concepts of the course up to that particular point in time.

The overall idea is that a student must take this “gateway” exam until he/she receives a passing score. A failure to pass indicates that a student requires additional help in understanding the material. After reviewing the concepts tested with a graduate student instructor or professor of the course, the student will be permitted to attempt the exam again. This process is repeated until the student successfully completes the exam.

System Overview

The automated examination system has the following features:

Multiple question types

- Standard Multiple Choice
- Fill In – Write Code → Compile → Evaluate
- Determine the Output

Question Definitions

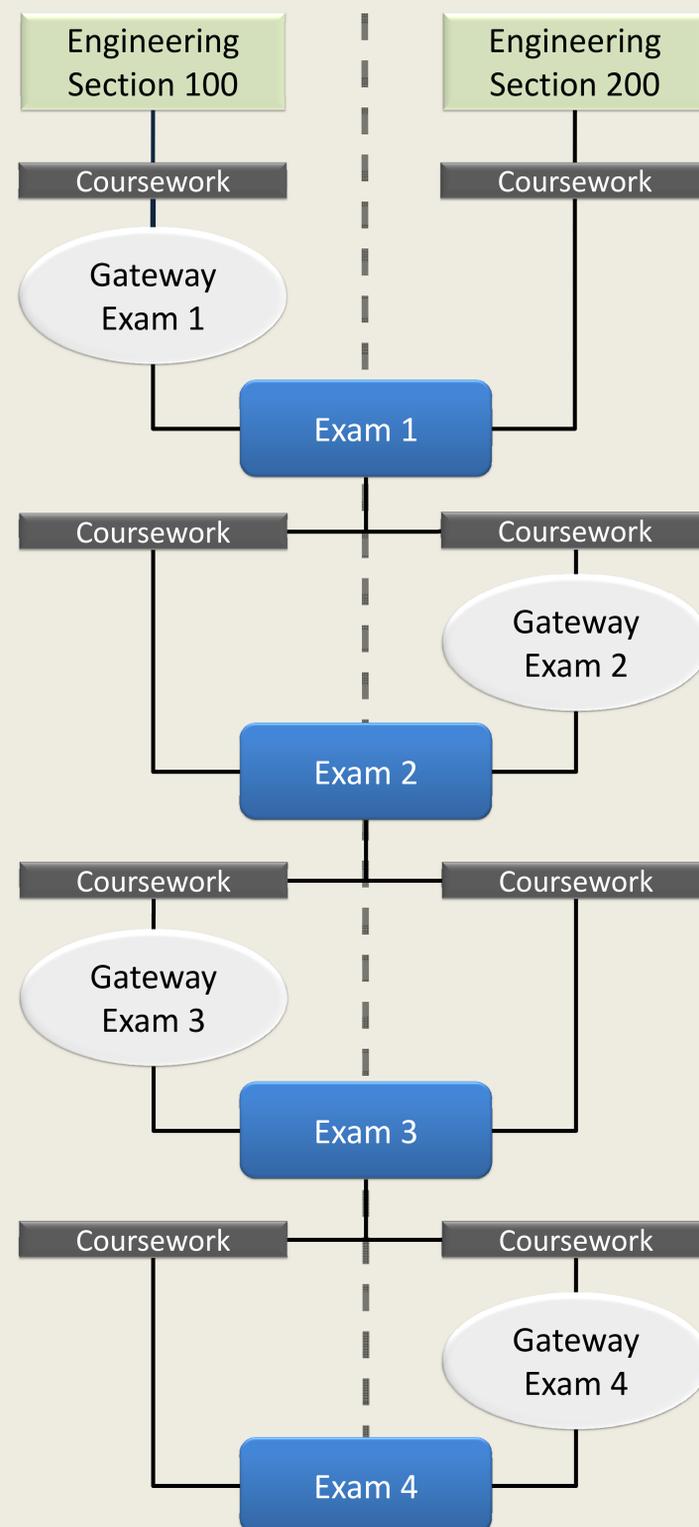
Fill-In: This type of question asks the student to write several lines of C++ code to complete a given task. The code is then compiled and evaluated by the system.

Determine Output: The student is presented with several lines of C++ code and is asked to determine the specific output. The system then evaluates this output.

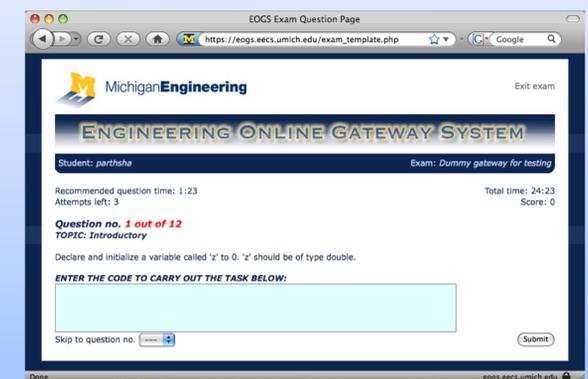
Additional Features

- Limit the number of test/question attempts
- Questions are weighted on type and difficulty
- User and group based security for class separation

Execution Timeline



Sample Examination Screen



Data Collection Strategy

Once the system is developed and deployed, data collection will be performed through the following steps:

- Development of four (4) milestone gateway examination.
- Each milestone exam will cover the core concepts within a quarter of a semester. (See execution timeline).
- Development of four (4) course exams. Questions will focus specifically on the core concepts to assess whether students acquired these required skills and are able to apply them.
- Evaluation: Compare midterm exam scores of the control group and the experimental group.

Sample Information

- Two (2) sections of Engineering 101: Introduction to Computer Programming in C++/Matlab.
- Each section usually has 120+ student enrollment.
- Sections will alternately serve as control and experimental groups.

Acknowledgements

We would like to acknowledge the contribution of our undergraduate research assistants: Tim Diamond, Uppili Rajagopalan and Parth Shah. Additionally, we would like to thank CRLT North for their invaluable input and feedback.

