The WeBWorKiR Project

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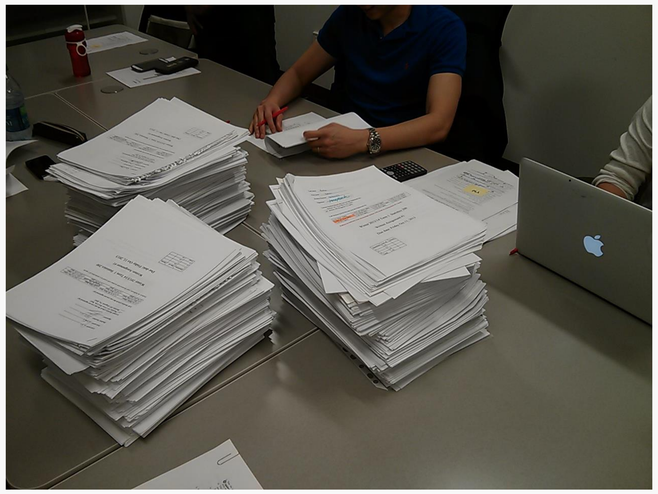
The Problem

- Students require regular practice problems to apply concepts in a course. On certain STAT courses, students were requesting more regular homework assignments.
- Research suggests that only about 20% of students seriously attempt homework questions that are without credit.
- Traditional paper-based assignments require much time to grade, and feedback to students is not timely.
- All students received the same assignment, with the potential for plagiarism going undetected.
- Thousands of sheets of paper are expended on written assignments …



Papers collected on a recent STAT 200 assignment

WeBWorK

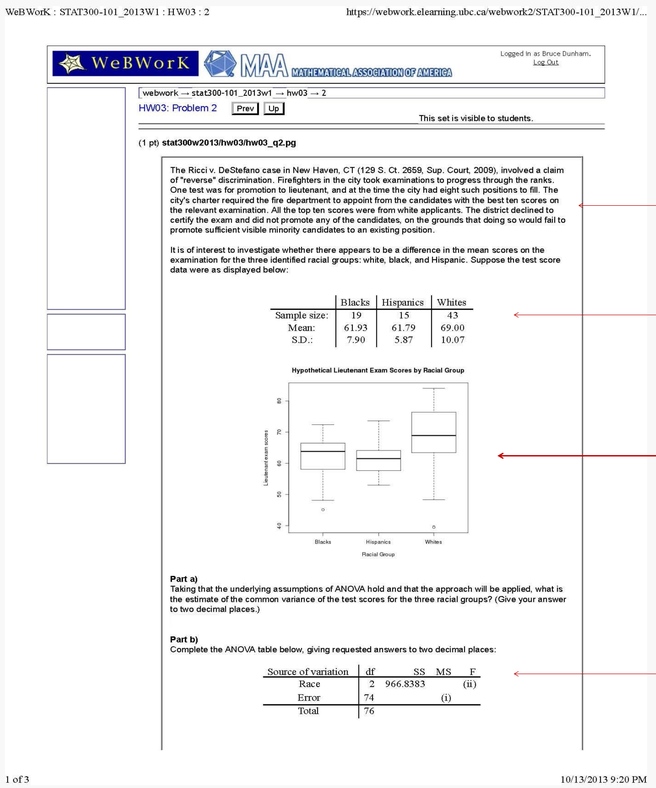
- Developed by the Mathematical Association of America, WeBWorK is an open-source on-line homework system, incorporating thousands of questions in mathematics.
- WeBWorK permits randomization in questions, allowing homework sets to be customized for each student.
- Grading is automated, students receive instance feedback on their answers and can be allowed multiple attempts at questions.
- Prior to our project, WeBWorK contained very few questions in statistical science.
- Coded in the Perl language, WeBWorK was not well suited for creating questions in probability and statistics.

Integrating R

- The R statistical software is a powerful open-source environment for statistical computing. R has been used extensively in undergraduate teaching at UBC.
- We have enhanced WeBWorK to enable it to communicate with R.
- This integration allows WeBWorK access to R's rich facilities for statistical data manipulation, analysis, and visualization, and hence permits the creation of probing and diverse problems in statistical science.
- Hundreds of questions have been coded in WeBWorK that use R functionality.

WeBWorKiR in Action

Questions have been created for use in STAT 200, 241/251, 300, 302, 305. 404, and SPPH 400. The screenshots that follow give an example of a question from STAT 300. As with most questions on the course, it features a case study that provides the basis for the simulated data.

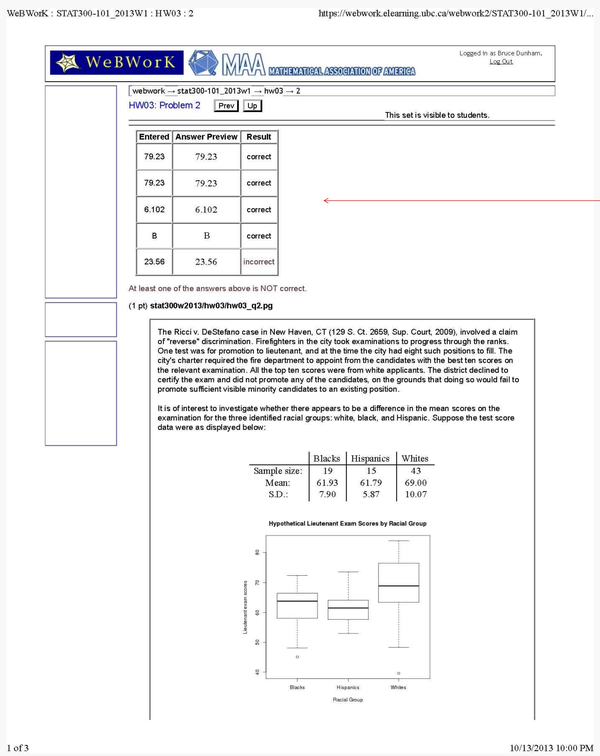


Questions are devised by faculty members.

Data are generated in R and called into WeBWork. Each student has unique data.

Graphics can be created in R and imported into questions.

Students attempt questions based on their unique data set.



Students receive instant feedback on their answers.

Multiple attempts can be permitted for each question. Students are motivated to revisit incorrect responses.

Outcomes

- So far around 5500 students have used WeBWorK on UBC STAT courses.
- Student feedback via mid-term surveys has been very positive:
  - on 200/241/251 around 90% either agreed or strongly agreed with the statement “The online WeBWorK assignments were useful to your learning.”
  - Comments include: “Good amount of questions - not too many but still reinforces learning", “Forces me to keep up with class”, “I like it when I get immediate feedback on questions that require more than one part. This at least allows me to know where I went wrong in the question.”
- Teaching assistants have been freed from tedious grading to work on other tasks, such as classroom support.
- Instructors report an increase in student engagement and performance.
- Other institutions are using the resources created, including Camosun College and University of Calgary.

Special Thanks

This project would not have been possible without the support of The Teaching and Learning Enhancement Fund. Assistance from CTLT has also been greatly valued, in particular the expertise of Pan Luo and Kalev Hunt.