Online Programming Assignments with WeBWorK[1]

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1. Abstract

WeBWorK (http://webwork.math.rochester.edu) is a free open-source formative web-based assessment system to generate, deliver and grade homeworks, and distribute their solutions. It emphasizes online feedback and retesting opportunities to master learning. This workshop will explore the use of WeBWorK for teaching programming fundamentals. Attendees will experiment with the student and instructor WeBWorK interfaces, and write their own customized WeBWorK problem sets (with their solutions, grading schemas and deadlines) in the Problem Generating (PG) macro language. The developed WeBWorK problems will go from simple True/False, multiple-choice and matching problems, to more sophisticated problems testing program correctness using a WeBWorK plug-in interfacing WeBWorK with JUnit.

2. Presenters' background/biography

Dr. Richard Kline, Pace University, NY, is an Assistant Professor of Computer Science. His research background is in Human-Computer Interaction and Universal Access. He is an associate scientist in the Center for Advanced Media at Pace. He has taught courses in Programming and Human Factors.

Dr Olly Gotel, Pace University, NY, is an Assistant Professor of Computer Science. Her research background is in Software-Intensive Systems Engineering, with practical experience in the UK defence sector. She has taught courses in Programming with Java and Python, Software and Systems Requirements Engineering, and Software Reliability and Quality Assurance.

Dr Christelle Scharff, Pace University, NY, is an Assistant Professor of Computer Science. Her research background is in Software Verification. She has taught courses in Discrete Mathematics, Programming, Programming Paradigms, Databases, Data Mining and Software Engineering.

Dr. Andrew Wildenberg, Cornell College, IA, is an Assistant Professor of Computer Science. He has a Ph.D. in Computer Vision from the University of Oxford. He is currently working in Bioinformatics. He has taught courses in Discrete Mathematics, Programming, Programming Paradigms, Robotics and Software Architecture.

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3. Overall workshop objective

This workshop is designed to introduce computer science instructors to the use of WeBWorK – as an active learning, formative assessment and students' progress monitoring platform - to support the teaching of programming fundamentals. We are interested in building a community of WeBWorK instructors in the Computer Science field; WeBWorK is currently used to teach mathematics (calculus, pre-calculus, algebra, applied, finite and discrete mathematics) and physics by over fifty institutions. We want to get early feedback from the faculty who will participate in this workshop to inform further development of the project. Participants will also be invited to attend a fundamentally different and more advanced one-day faculty development workshop at Pace University in New York at the end of the project.

4. Intended audience

The organizers of the workshop will showcase and present the strategies required to write WeBWorK problem sets for teaching programming fundamentals: programming constructs, data structures and algorithms, object-oriented programming. This workshop is intended for instructors involved in teaching the previously cited topics. During this workshop the problem sets will target the Java language. The participants limit is 15.

The Problem Generating (PG) language is a macro language that mixes Perl, LaTeX, HTML and text. Knowledge of Perl and LaTeX will not be required for this workshop. PG permits the drawing of graphs and functions, and can be extended to use JavaScript and interface with Java Applets. Its power comes from its ability to recognize and substitute formulae (e.g. WeBWorK would equally accept x+1, (x^2+1)/(x-1) or x+sin(x)^2+cos(x)^2 as an answer), and to generate individualized versions of problems using predefined pseudo-random and Perl functions.

5. Description of material provided to participants

Prior to the workshop, participants will be provided with:

- A WeBWorK *student* account (login, password) on the Pace CSIS WeBWorK server to access our database of problem sets for the teaching programming of fundamentals, organized by topics, so they can experiment with WeBWorK.
- A URL with resources that will be necessary during the workshop (outline of the workshop, tutorial on PG, database of WeBWorK problems for programming fundamentals with PG source code, slides of the workshop).

During the workshop participants will be provided with:

- A WeBWorK *instructor* account (login, password) to add new problem sets.
- A handout of the documents posted on the provided URL.

After the workshop we will survey the faculty to assess their impression of the use of WeBWorK for the teaching of programming fundamentals as stated in the workshop objective section.

6. Audio/Visual/Computer requirements

This workshop will follow the **laptop format**.

The Pace University CSIS WeBWorK server is publicly available for full experimentation at http://webwork.csis.pace.edu/webwork/. The only software requirements for this workshop will be a web browser (IE 6.0, Firefox) and the ssh (Secure Shell) software available for free download at: http://www.ssh.com.

We will also require laptop projection and a whiteboard/blackboard with pens/chalk.