

Techniques for Automating Assessment of Parallel Programming Assignments

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Abstract: Program assessment is the problem of generating feedback for programs expected to meet the requirements of some assignment given in a formal or informal learning environment. In both environments, it can help trainees calibrate their performance, receive feedback, and converge to a final solution. In formal learning environments, it also scores the final solution. Therefore, it is attractive to explore automation of program evaluation to not only reduce the instructor burden of scoring assignments but also be an extra collaborator for students. Program evaluation is particularly important for concurrent programs, as they are notoriously difficult to write, and substantial instructor effort is required to evaluate the performance and correctness of these programs, and identify potential problems.

As a concurrent program is an extension of a single-threaded program, techniques for evaluating the latter also apply to the former. Several techniques exist today for automating the assessment of a program. These can be classified according to various dimensions: Do they support feedback generation to help trainees converge to final solutions? Do they provide support for grading final solutions? Do they perform compile time analysis on source code or runtime analysis on the output and execution behavior? To what extent do they combine manual and automatic assessment? Do they provide special support for concurrent programs? Do they support problem-specific assessment? Are they extendible? How much programming effort does problem-specific assessment and extendibility require?

This talk will present a design space based on these dimensions using concrete examples of several systems/frameworks including Gradescope, Web-CAT, the JUnit testing framework, diff-based systems, and a system we have developed at UNC. It will point out future directions that can be pursued to develop a software framework for assessing concurrent programs written in multiple programming languages that improves the productivity and learning, respectively, of trainers and trainees

Bio: Prasun Dewan is a Professor in the Department of Computer Science at the University of North Carolina at Chapel Hill. Before joining UNC-Chapel Hill, he was on the faculty of Purdue University. He received a B.Tech. degree in Electrical Engineering from the Indian Institute of Technology of New Delhi and a Ph.D. in Computer Science from University of Wisconsin at Madison. His research interests are in frameworks for implementing interactive and collaborative applications, cyberinfrastructures, collaborative software engineering, distributed/migratory and replicated objects, and techniques and tools for detecting and resolving programming difficulty, automating assessment of programming assignments, and improving teaching of scientific, object-oriented, concurrent and distributed programming. He has been an associate editor of ACM Transactions on Computer Human Interaction, ACM Transactions on Information Systems, and Journal of Computer Supported Cooperative Work.