

Unitgrade: A minimal open-source e-assessment framework

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E-assessment frameworks have become an increasingly popular tool in computer programming education, allowing students to receive immediate feedback on their programming assignments [GMD11]. We present a new, free and open-source autograding framework for Python based solely on the concept of unittests [Tec23]. Unlike traditional frameworks that run tests on a central server, our framework runs tests directly on the student’s computer whereby we avoid most GDPR issues.

We argue that for a student, the positive benefits from automated testing such as [AVT18]

Immediate feedback: Immediately see which tests pass and which fail as code is being written,

Reduced debugging time: Both by catching errors early on and by being integrated with a debugger,

Better understanding of requirements: Unittests ensure that the students can clearly see the requirements of the program,

Good coding practices: Writing unittests encourages teachers to write modular, well-organized code,

overlap with the benefits software developers enjoy from automated testing. Therefore, by basing the assessment around regular unittests, both students and educators can benefit from decades of optimized workflows and IDE tooling.

We also show that the potential advantages from a centralized approach (reproducible, security, ease of hand-in for students and low administrative overhead) can easily be reproduced.

The resulting framework is offered open-source, works with both scripts and Jupyter notebooks, and any suite of unittests can be converted to a hand-out, hand-in ready assignment in a few lines of code, allowing savings of up to 5× the number of files compared to our existing solution.

The presentation will discuss experience from using the framework over two semesters in a medium-sized course at the Technical University of Denmark, and how it is being implemented for the campus-wide mandatory introductory programming course (+1000 students) beginning the next semester. We will also show how Unitgrade can be used in introductory math courses.

References

[AVT18] Martin Appiah and Fanus Van Tonder. E-assessment in higher education: A review. *International Journal of Business Management & Economic Research*, 9(6), 2018.

[GMD11] Joyce Wangui Gikandi, Donna Morrow, and Niki E Davis. Online formative assessment in higher education: A review of the literature. *Computers & education*, 57(4):2333–2351, 2011.

[Tec23] Technical University of Denmark. Unitgrade, 2023. Accessed: March 19, 2023.