Auto-grading System

Make the life easier for students and instructors

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The Problem

For Instructor:
- Time consuming
- Repetitive
- Annoying

For Student:
- Slow
- Uncertainty
What can we do?
Current Solutions

• Give complete testing scripts to the students
  • Problematic
    • Student can hack the solution by reverse engineering from the testing scripts

• Commercial Solution
  • Example: Grade Scope
  • Expensive
  • Poor customizability
  • Made by UC Berkeley
# Commercial Pricing

<table>
<thead>
<tr>
<th>Functionality</th>
<th>Basic SOLO</th>
<th>TEAM SOLO</th>
<th>Complete SOLO</th>
<th>TEAM SOLO</th>
<th>INSTITUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborative Grading</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Unlimited Course Staff</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Assignment Statistics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Regrade Requests</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Full Grade Export</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Late Submissions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>AI-Powered Grading</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Code Autograder Platform</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Support</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Email Support</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dedicated Support</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4 business hr response time</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
30 \times 100 \times 5 = 15000
Open-source Solution
Autolab

- Developed by a team of undergraduate students in Carnegie Mellon University.
- Started in 2010. CMU has been using it ever since.
- Open source under Apache License 2.0.
- Unlimited Customizability
Features

Autograding

Grade any assignment in any language using any software package. Instantly.
# Feature

## Scoreboards

Encourage healthy competition with a real-time rank ordered scoreboard.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Nickname</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>☕️ 1</td>
<td>Batman</td>
<td>100</td>
</tr>
<tr>
<td>☕️ 2</td>
<td>Alan Turing</td>
<td>98</td>
</tr>
<tr>
<td>☕️ 3</td>
<td>2b</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>ByteMachine</td>
<td>91</td>
</tr>
</tbody>
</table>
Feature

Code Annotation

Augment the autograder with additional feedback directly on the student's code.

def foo(bar):
    bar += 5
    while (bar < 15213):
        bar = foo(bar+1)

Avoid magic numbers -5
Feature

```
def foo(bar):
    bar += 1
    while (bar > 10):
        bar = foo(bar-2)
    if (bar == 15150):
        return bar - 1
    return bar + 1
```

```
def foo(bar):
    bar += 5
    while (bar < 10):
        bar = foo(bar+1)
    if (bar == 15112):
        return bar - 1
    return bar
```

Cheat Detection

Maintain academic integrity by comparing assessments with each other and with past submissions. Uses Stanford's Moss Cheat Detector.
Technology Stack

- Ruby
- Rails
- Docker
- Python
Interface for Instructors

- Mature and familiar open source toolchain
- Markdown for generating static homework instruction page
- Makefile for managing handout construction
- Write auto-grader script in any of your chosen language
- Grading result in JSON format
Experience for Students

• Simple one-click submission
• Specification checking
• Instant Feedback
• Rich Feedback Information
• Work until you get the grade you want
• No worry about missing something
What is left to do?
Challenge

• Primarily used inside Carnegie Mellon University. Deployed with the assistance of developers.

• Documentation is there but incomplete

• Main developers are busy seniors. No time to support us.

• Work with legacy code.

• Integration with UCLA IT Infrastructure.
Rewards

- Impactful
- Reachable
- Get full-stack development experience with cutting-edge technologies
- Agile Development
- Contribute to open-source project
Question?