Project Plan
AI Tutor for Programming Class (The Auto Grading Engine)

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Project Background

Nowadays, STEM education is introduced in Hong Kong and other countries, requiring the students to learn programming. Hence, Obama announced his intention to offer “Every student the hands-on computer science and math classes that make them job-ready on Day 1.”. Learning coding is the current trend. Although there are lots of online learning platforms for us to learn, they only provide autograders with questions and test cases. After the answers are submitted, the system will only show which test case(s) are passed or failed. However, no further information suggests the user on how to improve the programme. Therefore, we choose to do this project, AI tutor for programming class. It allows the students to learn coding online accompanied with an AI tutor. The AI tutor teaches the student how to improve their programmes with the recommendations after analysing on all the previously submitted answers.

Project Objectives

We aim to develop an “AI tutor” that will benefit future CS students. We have the following 3 major objectives. First of all, grading of programming tasks are automated in the Cloud. Secondly, it subsequently provides personalized feedback and coding guidelines to the students. Finally, once the students have completed their assignments, teachers may know the general performances of the classes. So as to aid them in adjusting strategies on teaching schedules and progress.
**Project Methodology**

The learning language that the system provides is Python because it is an relatively easier language to be learnt by beginners. Our project also uses Python as our major language since Python provides libraries to analyze Python programmes.

At the start of the project, collection of some programming questions with test cases for our system is required. Next, sample answers of those questions are gathered. Their sample answers will be analysed by the system. Generated observations are then stored in the database with a form of ID consisting observations. Those observations provides significant features of the programme which may guide students on the structure of the programme. For instance, it shows the occurrences of nested-loops or recursive functions.

For test cases, the system classifies the level of difficulty according to how many students have passed the test cases in their first submission. Since students may submit more than one version before they could pass all test case. There is a progression of submissions for each student. We may check the changes of every two consecutive versions so that the system may precisely find out the level of difficulty. In addition, the system would also find the relationships among test cases to determine the natures of test cases. For the above, analytics, statistical knowledge and data mining are applied.

Whenever a new student joins in a question, the system compares the ID of the newly submitted programme with the analysis from the database using R. The system then provides some customized recommendations to the student in the light of the analysis.
Flow Chart

Checker → Analysis → Recommendation

- Input Program
- Check Elements and Counting
- Consolidate Observations
- Observation Data Cleaning
- Analysis and Modeling
- Output Statistics
- Draw Insights
- Recommendation

ER Diagram for Database design

- UID
- VID
- Code
- JSON
- OID
- Content
- Result

Diagram objects:
- Student
- Question
- Do
- Submit
- Version
- Has
- TestCase
- OID
- Content
- Result
## Project Schedule and Milestone

<table>
<thead>
<tr>
<th>Period</th>
<th>Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct 1, 2017</td>
<td>Submission of Detailed Project Scheme / Project Web Page</td>
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<tr>
<td>Jan 8-12, 2017</td>
<td>First presentation</td>
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<tr>
<td>Jan 21, 2018</td>
<td>Submission of Intermediate Report</td>
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<td>Apr 15, 2018</td>
<td>Final Report</td>
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<tr>
<td>Apr 16-20, 2018</td>
<td>Final Presentation</td>
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<tr>
<td>May 2, 2018</td>
<td>Project Exhibition</td>
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