Python Online Judge System

Database Report

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# Introduction

In many schools where students learn computer programming, coding assignments are usually corrected by course conveners or teaching assistants. The code logic requires teachers to spend a lot of time to understand, and the results of the code run are also easily misjudged. To save time, improve productivity, and reduce false corrections, we designed a system that automatically evaluates Python language code assignments. Furthermore, our system allows teachers to divide students into multiple study groups, issue different tasks to different study groups, and set deadlines.

# Assumption

## 3.1 User System

Users are of two kinds – teachers and students. Generally, teachers have more authorities than students. The differences between “teachers” and “students” will be explained in detail below.

## 3.2 System Announcement

Only teachers are allowed to create, modify or delete system announcements. A teacher can create multiple announcements. An announcement must be raised by one teacher only.

## 3.3 User Group

In order to issue tasks to different groups of students, teachers are allowed to assign students to one or more user groups. A user can be in several user groups (or not in any groups). A user group can contain multiple users.

## 3.4 Task

Different tasks are assigned to some of the user groups by teachers only. Only teachers are allowed to create, modify and delete tasks, and also issue tasks to the user groups. Students can only see tasks of the user groups they are in. A user group can have several tasks, and a task can be issued to several user groups.

Meanwhile, each task must have a deadline. When the current time is before the deadline, the status of the task is “available”, or “End” otherwise. The functionality of deadlines will be explained in “Submission” part.

## 3.5 Problem

Problems are designed and released by teachers. Teachers are allowed to assign some problems to some tasks. Teachers are also allowed to set the visibility of each problem. All users can see all “visible” problems.

## 3.6 Tag

Tags are categories of problems set by teachers. A tag can be related to several problems, and a problem can be tagged by several tags. Teachers are allowed to change the relationship between every tag and every problem.

## 3.7 Submission

All users can submit code pieces for problems. The code and result are stored in a submission record. A user can make multiple submissions, and a submission record must be related to one user only. A problem can have multiple submissions, and a submission record must be related to one problem only.

When a task is “Available”, submissions of the problems in the task are automatically connected to the task. This allows teachers to export the result of a task after it ends. So, a submission may belong to several “Available” tasks, and a task can have several submissions.

## 3.8 Test Set and Test

A test is a piece of code and corresponding score point that corrects users’ submissions. A test set is a set of tests for a problem. When any test for a problem is changed, the system will create a changed test set for the problem. The previous test set will be preserved but disconnected to the problem. This function helps users to view the results of their previous submissions using previous test sets.

Only teachers can modify test sets and tests. A problem is currently related to one test set but can have several previous test sets. A test set must belong to one problem only. A test set must have at least one test, and a test must belong to at least one test set.

# ER diagram

# Schemas & Functional Dependencies

## 5.1 User

*user (uid, user\_name, password\_hash, is\_teacher, avatar, item\_per\_page)*

|  |  |
| --- | --- |
| uid | : **(Primary Key)** The id of a user |
| user\_name | : The name of a user |
| password\_hash | : Password encrypted by pbkdf2:sha256 |
| is\_teacher | : Whether a user is a teacher (or a student) |
| avatar | : The path to an image of the user’s avatar |
| item\_per\_page | : The number of items per page according to the user’s preference |

## 5.2 Announcement

*announcement (aid, uid, title, description, publish\_time)*

|  |  |
| --- | --- |
| aid | : **(Primary Key)** The id of announcement |
| uid | : ***(Foreign Key)*** The id of the written user |
| title | : The title of announcement |
| description | : The content of announcement |
| publish\_time | : The publish time of announcement |

## 5.3 User Group

*user\_group (gid, group\_name, description)*

|  |  |
| --- | --- |
| gid | : **(Primary Key)** The id of user group |
| group\_name | : The name of user group |
| description | : The description of user group |

## 5.4 Task

*task (task\_id, task\_name, deadline, description)*

|  |  |
| --- | --- |
| task\_id | : **(Primary Key)** The id of task |
| task\_name | : The name of task |
| deadline | : The deadline for task |
| description | : The description of user group |

## 5.5 Problem

*problem (pid, level, title, description, testset\_id, visible)*

|  |  |
| --- | --- |
| pid | : **(Primary Key)** The id of problem |
| level | : The difficulty level of problem |
| title | : The title of problem |
| description | : The content of problem |
| testset\_id | : ***(Foreign Key)*** The id of currently related test set |
| visible | : Whether the problem can be seen by students |

## 5.6 Tag

*tag (tag\_id, tag\_name)*

|  |  |
| --- | --- |
| tag\_id | : **(Primary Key)** The id of tag |
| tag\_name | : The name of tag |

## 5.7 Submission

*submission (sid, uid, pid, code, is\_solution, submit\_time, testset\_id, result, score)*

|  |  |
| --- | --- |
| sid | : **(Primary Key)** The id of submission |
| uid | : ***(Foreign Key)*** The id of the user who makes the submission |
| pid | : ***(Foreign Key)*** The id of related problem |
| code | : The code piece from the user |
| is\_solution | : Whether the submission is public to all users |
| submit\_time | : The submit time of submission |
| testset\_id | : ***(Foreign Key)*** The id of related test set |
| result | : The JSON string that stores results of each test in the test set |
| score | : The final score of submission |

## 5.8 Test Set

*testset (testset\_id, full\_score)*

|  |  |
| --- | --- |
| testset\_id | : **(Primary Key)** The id of test set |
| full\_score | : The sum of scores of all tests in the test set |

## 5.9 Test

*test (test\_id, score, code)*

|  |  |
| --- | --- |
| test\_id | : **(Primary Key)** The id of test |
| score | : The score of test |
| code | : The code of test that corrects users’ submissions |

## 5.10 Relationship schemas

*user\_in\_group (uid, gid)*

*task\_for\_usergroup (gid, task\_id)*

*problem\_in\_task (pid, task\_id)*

*tag\_of\_problem (pid, tag\_id)*

*submission\_in\_task (sid, task\_id)*

*test\_in\_testset (test\_id, testset\_id)*

All the attributes in the relationship tables above are ***foreign keys***.

# Workload

Yuepeng Long: 30%

Qiaomu Zhang: 30%

Wenbo Zhao: 20%

Jianxin Liu: 20%