Calculus Online Problem Set
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1. An introduction of your application, including why you want to develop the application and the main functions of your application.

   Our application is named as "Calculus Online Problem Set", which is a database with calculus problems categorized in many tags or information.
   The reason why we want to build the calculus question bank is, the vision to create a platform for people interested in calculus. Via this platform, people will be able to discuss and find questions based on textbooks, techniques, chapters, and other attributes to be developed in the future. As the first step of making the vision come true, we will create a system that have the following functions:
       1. One click to make a quiz paper based on the selected chapter or technique.
       2. Build a forum for all questions that students can discuss each question.
   This is why we want to start all the above with this final project. The database knowledge we learned during the semester will be the cornerstone of our future applications.

2. Database design - describe the schema of all your tables in the database, including keys and index, if applicable (why you need the keys, or why you think that adding an index is or is not helpful).
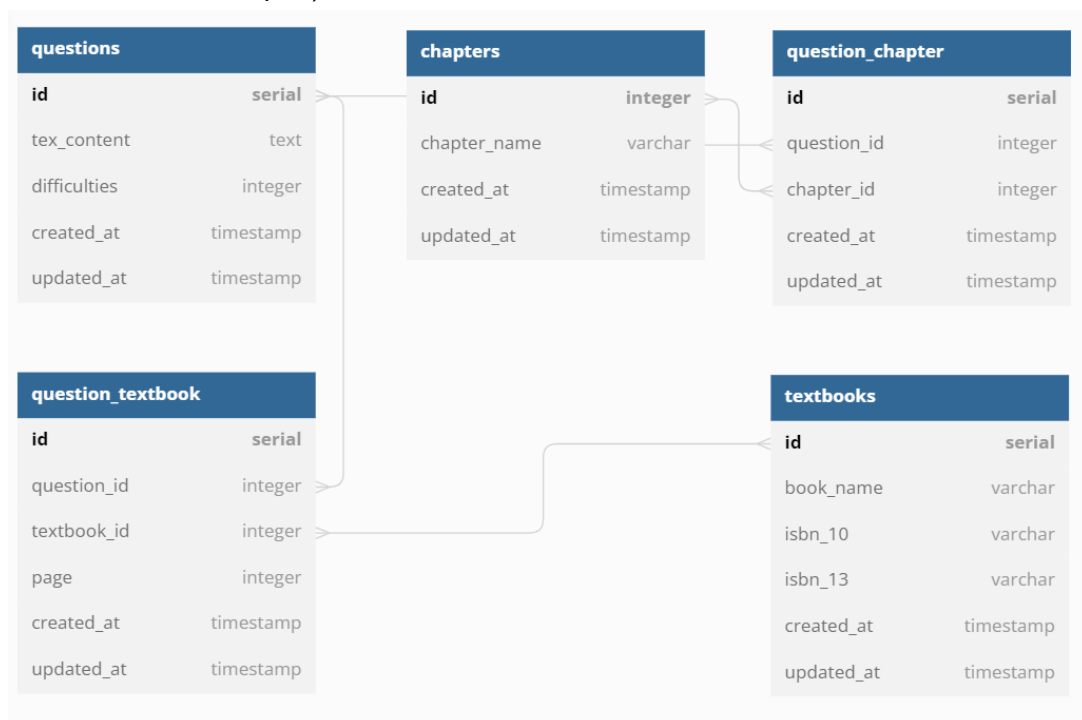
   - Why we need indices as keys

For "question_chapter" and "question_textbooks", we need an id to maintain the many-to-many relationship between two data types, {"textbook", "question"} and {"chapter","question"}.

For "questions", "chapters", and "textbooks", we use id to identify different questions, chapters, and textbooks, respectively. Although "tex_content" in questions table, "chapter_name" in chapters table and "book_name" in textbooks table may be unique, they are random large content with uncertainty, which make them inappropriate to be the primary key.

Because the indices are all unique, we can make sure the relationships based on id are all unique as well.

3. Database design - describe the normal form of all your tables. If the tables are not in BCNF, please include the reason for it (performance trade-off, etc.).
   questions : BCNF, because of the following dependencies
   >   **superkey: id**
   >   id → tex_content
   >   id → created_at
   >   id → updated_at
   >   id → difficulties
   >   *There might be two questions with the same text content
   >   , but from two different test, therefore the create time might be different
   question_chapter : BCNF, because of the following dependencies
   >   **superkey: id**
   >   id → question_id
   >   id → chapter_id
   >   id → created_at
   >   id → updated_at
   chapters : BCNF, because of the following dependencies
   >   **superkey: id, chapter_name**
   >   id → chapter_name
   >   chapter_name → id
   >   id → created_at
   >   id → updated_at
   >   chapter_name → created_at
   >   chapter_name → updated_at
   question_textbook : BCNF, because of the following dependencies
   >   **superkey: id**
   >   id → question_id
   >   id → textbook_id
   >   id → page
   >   id → created_at
   >   id → updated_at
   textbooks : BCNF, because of the following dependencies
   >   **superkey: id**
   >   id → isbn_10
   >   id → isbn_13

id → created_at
id → updated_at
id → book_name

*ISBN is an abbreviation of "International Standard Book Number", which is unique to each book. Since 2007, ISBN10 has been deprecated, and ISBN13 has been implemented. Books published before 2007 only have ISBN10, those published after 2007 only have ISBN13. Therefore, either of the two formats of ISBN can be candidate key.

4. From the data sources to the database - describe the data source and the original format.
   Our data source is sample data from calculus cram school. The original data files include original_data, chapters, and textbooks.
   "Chapters" contains all chapters of calculus which are defined by ourselves.
   "Textbooks" contains some textbooks' names and ISBN with 10-digit and 13-digit.
   "Original_data" is based on question descriptions and information connected to questions. Information includes chapters, difficulties, textbooks, pages in the textbook, and ISBN with 10-digit and 13-digit of the textbooks. All files contain time when the data is created and updated.

5. From the data sources to the database - describe the methods of importing the original data to your database and strategies for updating the data, if you have one.

6. Application with database - explain why your application needs a database.

   The goal of our application is to build a platform for students to discuss and look up to the solutions with efficiency. To fulfill this goal, we need to turn the process into a systematic operation, which is the reason why we would need a database to store problems and their attributes, maintain and update data, and speed up the query process at the same time.

7. Application with database - includes the queries that are performed by your application, how your application performed these queries (connections between application and database), and what is the cooperating function for your application.

8. All the other details of your application that you want us to know.