

Original Research Article

## Design of general examination question databases based on Founder bookmaker

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**Abstract:** The purpose of this study is to establish a beautiful and simple operated examination question database system that meets the requirements for complex formats such as scientific and technological symbols and the needs of different disciplines. Aiming at this, combining with batch processing mode for texts of Founder bookmaker system, sample files that conform to syntax norms of Founder system are stored in the examination question tables. Then, examination paper tables satisfying requirements of all disciplines are generated in the double-scan mode and the examination papers generated are proof files of Founder system. It is convenient to browse, print and output these files. Therefore, this examination question database has strong generalization.

**Keywords:** typesetting, examination question database, sample files, proof files, Founder bookmaker.

### INTRODUCTION

At present, examination papers in schools and society are mainly designed artificially and then they are typeset and printed. It takes a lot of time and efforts for teachers to design an examination paper, which shows strong subjective randomness, poor sharing ability of resources and low accuracy of the quality of examination questions. Owing to many links are involved in designing an examination paper, the examination questions are easily to be leaked and it is hard to assure the responsibility for leaking. Although there are large numbers of examination systems, such as national computer grade exam system, based on examination question databases currently, the format of the examination questions of these systems are generally simple. The examination question databases with chemical structure formulas, complex mathematical formulas, figures and images are rarely seen.

Commercial printing system of Founder bookmaker as stable, standard, fast, and professional typesetting software independently developed by Peking University Founder Group Co., Ltd, China is used for producing publications, editing office documents, and making electronic books. It is significant to explore a method for applying its typesetting advantages in the design of examination question databases to effectively combine it with the databases, so as to construct an examination question

database containing a large number of scientific and technological questions.

### STRUCTURE OF THE EXAMINATION QUESTION DATABASE

#### Main function structures of the examination question database

In general, before making examination questions, teachers need to know the objects, subjects and ranges of examinations. In the specific design process, teachers need to constantly modify the examination difficulty to control it in the suitable level regulated by teaching syllabus. In addition, teachers determine the scores for each question and present reference answers and scoring criteria. After examinations, teachers will score, combine the daily performances and examination scores into the total scores of students according to a certain proportion, write quality analysis reports, and then submit the score results to relevant personnel. Teaching administrators will uniformly register the score results handed by teachers and print students' transcripts, make-up or relearning notices.

From the perspective of system functions, the examination question database system should have the ability of recording, modifying and deleting examination questions and can automatically generate examination papers from existing examination question databases. Furthermore, the difficulty coefficients of examination questions can be set artificially or

automatically and the scores of each question can be labeled. In addition, the system is expected to provide certain learning examples for students and can be remotely operated. As shown in Figure 1, the examination database administrator can add, delete and update examination questions and teachers can generate examination questions and answers and write quality analysis reports of examination results. Examination

question cases can be updated through the quality analysis to update some records in the examination question database. For example, if the exam results for a certain examination question of most students are not matched with the difficulty coefficients in the examination question database, the difficulty coefficients can be modified by the system automatically[1,2].

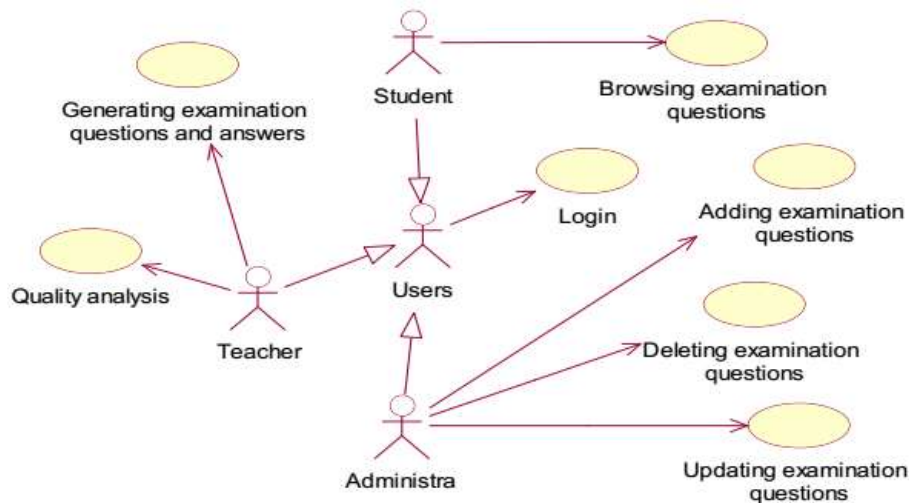


Fig-1: Use-case of the examination question database

**Structures of the examination question database**

The data of the examination question database are stored in the database to describe the relationships of entities using two-dimensional tables. The main fields of each data table consist of numbers, topics, answers, question types, difficulties, knowledge points, and scores. When storing examination questions, each topic and its attribute fields are stored in a record of a table and each question is numbered automatically to set to be the primary key. Symbols that cannot be displayed in the database exist in sample files of Founder system and the typesetting parameters including documents of book versions and instructions of type areas in typesetting are set in a file with an extension of .pro. Therefore, topics and answers can be separately stored outside fields of database while only file names of topics and answers need to be stored in the database. There are two purposes for this. On the one hand, syntax errors of sample files are excluded from the database. On the other hand, parameters of page composition file (.pro) of generated examination questions are set automatically to finally produce examination questions and answers, as well as scoring criteria that suit for the requirements of users[3,4].

**SYSTEM DESIGNS**

**System structures of application programs of Web database**

The web general examination question database system based on Founder bookmaker and C# language

is established by using B/S mode and all application and service programs as well as the database are stored in server. The system is developed on Microsoft Visual Studio .NET 2003 platform, and users merely need to access the home page of the servers through browser. The application programs of the Web database include a Web server, server components, a database server and a browser (Figure 2). First, the Web browser makes a request to the Web server, which finds this page and then transfers it to the application program server. Then, the application program server finds and executes the dynamic commands in this page and then sends the query command to the database server. Database server returns the query results to the application program server which puts the data into the page and then transfers to the Web server. Finally, the Web server sends the finished page to the Web browser making the request.

**Application platform structures of the Web general examination question database system**

The examination question database is constructed in .NET platform. Step 1 is the development of Web service programs and Step 2 is to develop Web application programs. Web service programs connect the examination question database and read and write the record sets of the examination question database based on ADO.NET object model. The main operations consist of inserting, deleting and update, and Web service programs are stored in SQL Server 2000 server

in the form of stored procedures. The ADO.NET object model comprises a data provide program and a data set. The former connects with physical data sources, while

the latter represents the actual data. These two parts can communicate with data usage program (Figure 3).

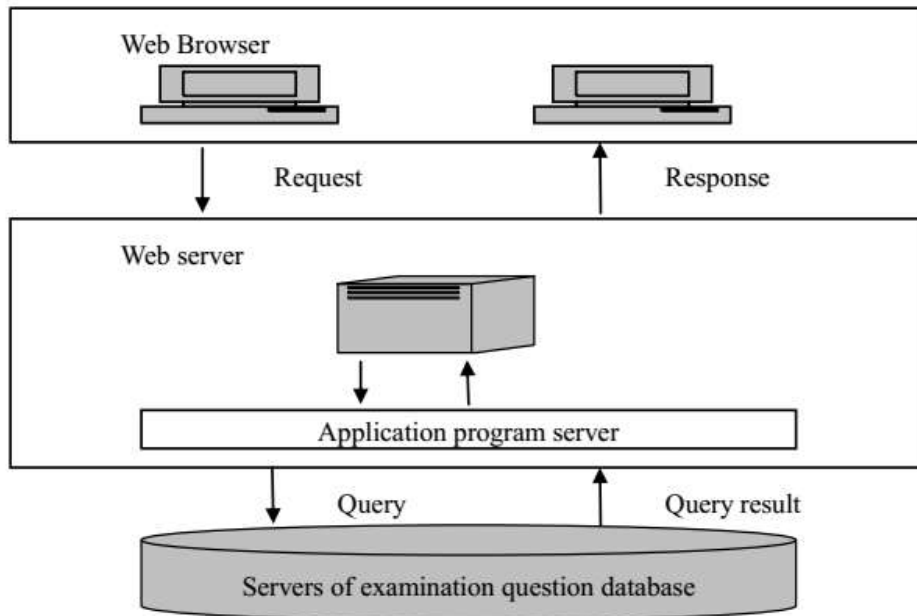


Fig-2: System structure of application programs of the examination question database

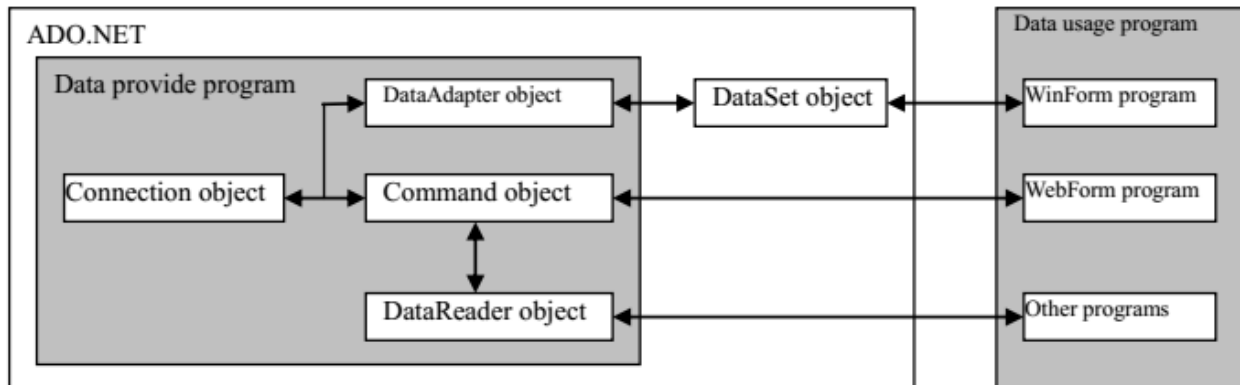


Fig-3: Structure of ADO.NET object model

**Database design**

The database in this system is mainly used to store sample files of examination questions and answers, as well as the supplementary information including knowledge points, difficulties, and usage frequency. In order to prevent generation failure caused by the appearance of syntax errors in proof files of generated examination questions, sample files stored in the database have to conform to the syntax norms of Founder system. In order to ensure the accuracy of sample files in the database, the system is firstly scanned when inputting data. If sample files are wrong, users are prompted to reedit, and a data entry cannot be finished until all errors are eliminated. The data tables in the database are mainly shown as follows.

Examination question table. It includes the name of course, serial number of topics, topics, answers, question types, difficulty, knowledge points and usage frequency. The name of course and the topic numbers are the primary keywords, while topic and answers are sample files. Moreover, the table is used to store all examination questions and is the critical data table of the system.

Student table. The table consists of student number, name, department, major and class, among which student number is the primary keyword.

Extracted question table. This table comprises question types, serial number of topics, difficulty, extraction time, and scores, among which the serial number of topics is the primary keyword.

Examination paper table. This table includes serial number of examination questions, course name, academic year, college, major, class, semester, examination time, total score, credits, questions, and answers. Among them, the serial number of examination questions is the primary keyword, while examination questions and answers belong to proof files.

The examination paper table is utilized to store generated examination papers and corresponding answers and scoring criteria, and examination papers can be printed and output directly.

Exercise table. Serial number of exercise, course name, student number, total score, exercises, and answers are included in this table. Serial number of exercise number is the primary keyword, while exercises and answers belong to proof files.

Among the above listed data tables, tables such as examination question table and examination paper table need to be stored for a long time, while some data tables only need to be preserved for a short time and then deleted.

Topic number	1	2	...	n	Total score
Score	...	...	...	...	...

(3) for ( i=1; i<=n; i++ ){

    Output the serial number i of a question, question type i and score i;

        for (j=1; j<= item number i; j++ ){

            jth item in the ith question is selected from the examination paper table and then output to .pro page composition files;

        }

    }

(4) Through the second scanning of Founder system, proof files are generated and stored in the examination paper table.

In the above procedure, multiple algorithms[5-8] can be used to select examination questions, while the simplest method is random selection according to the types of examination questions, difficulty and knowledge points, until scores are equal to those required by examination question types. If a topic is selected for many times, a random function needs to be set to decide whether the topic will be selected for the second time or not. For all extracted topics, their frequencies increase by 1. The initial values of all examination question frequency are 0 in the examination question table.

### GENERATION OF EXAMINATION PAPERS

Examination papers and exercises are generated in the same method but with slightly different parameters. By using a final examination paper as an example, it is generated as follows:

- (1) Inputting parameters. Parameters include academic year, department, major, class, semester, examination time and total scores; total number n of question types, question type 1, score 1, item number 1, blank line number 1... question type n, score n, item number n, and blank line number n.
- (2) According to the templates of examination papers, parameters consisting of academic year, department, major, class, semester, examination time and total number n of question types are put in .pro page composition files. In this way, principal topics of examination papers and scoring table are formed. The scoring table has n+2 columns, as shown below-

### CONCLUSIONS

Founder bookmaker shows significant advantages among numerous text processing software, and its specific programmed text processing mode makes it convenient for programming, which explains why system is established based on Founder bookmaker. Examination papers output from the examination question database system accord with the syntax norms of Founder system, showing beautiful forms and meeting the typesetting requirements for complex formulas including a large number of scientific and technological symbols. Moreover, it is easily operated in the Web environment. Therefore, as a platform of general examination question databases, it is convenient to solve current situations that schools lack of general examination question databases, especially for science disciplines, using the system.

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