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DESIGN OF DATABASES BY BACHELOR'S DEGREE APPLICANTS WHEN WRITING A QUALIFICATION PAPER

ПРОЕКТУВАННЯ БАЗ ДАНИХ ЗДОБУВАЧАМИ БАКАЛАВРСЬКОГО СТУПЕНЮ ПРИ НАПИСАННІ КВАЛІФІКАЦІЙНОЇ РОБОТИ

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Abstract. For use by applicants for a bachelor's degree when writing qualification papers, the «BachelorDesignDB» methodology is proposed, which consists of the following stages: review of sources on existing databases; study of the subject area in order to form an initial attitude; database design using well-known methods («Normal Forms» and «Essence-Relation») and analysis of the design results obtained; creation of a designed database with the help of the selected software application and its protection; optimization and performance improvement of the created database; formulating conclusions and providing recommendations for the practical use of the created database.

Key words: subject area; relation; design; binary linking; normalization; protection; optimization; performance; research..

Анотація. Для використання здобувачами бакалаврського ступеня при написанні кваліфікаційних робіт запропонована методика «BachelorDesignDB», що складається із наступних етапів: огляд джерел щодо існуючих баз даних; вивчення предметної області з метою формування початкового відношення; проектування бази даних з використанням відомих методів («Нормальні форми» і «Сутність-зв'язок») та аналіз отриманих результатів проектування; створення за допомогою обраного програмного додатку спроектованої бази даних та її захист; оптимізація та підвищення продуктивності створеної бази даних; формулювання висновків та надання рекомендацій щодо практичного використання створеної бази даних.

Ключові слова: предметна область; відношення; проектування; бінарний зв'язок; нормалізація; захист; оптимізація; продуктивність; дослідження.

Introduction

Formulation of the problem. At the present stage, people are constantly using databases without even knowing it. For example, the database turns out to be a phone book; the search for necessary medicine is based on the use of a database; receiving

wages for work performed also involves working with a database and there are an infinite number of such examples. Catalogs occupy a special place. A catalog is a list of information about objects, compiled in order to facilitate the search for these objects on some basis. For example, a library catalog, a catalog of postage stamps (scott), an astrological catalog, a catalog of resources on the Internet, a catalog of goods (services), a catalog of music albums and many others. The creation of any kind of catalog or some kind of reference book requires the design of a database and the solution of relevant problems, which confirms the relevance of the topic.

Analysis of the latest research. Earlier, the author proposed the «Foreign DistLearnDB» methodology for the formation of competencies in applicants for a bachelor's degree of foreign origin in distance learning in the discipline «Databases» [7-8], as well as the «SoftSkillsDatabase» methodology for the formation of competencies and social skills in the performance of a group task in the discipline «Databases» [9].

The purpose of the work this is the development of a methodology for the formation of competencies in applicants for a bachelor's degree when designing a database when writing a qualification work.

General characteristics of the methodology.

The «BachelorDesignDB» method is proposed, which consists of the following stages: review of sources for the creation of databases; study of the subject area in order to form an initial attitude; database design using known methods and analysis of the design results obtained; creation of a designed database with the help of the selected program and its protection; optimization and performance improvement of the created database; formulation of conclusions and provision of practical recommendations on the use of the created database, and was used by applicants for a bachelor's degree when writing relevant qualification papers [1-6, 10-11].

1. Database design using known methods.

To design a database, it is possible to use the following methods: the method of Normal Forms (the classical method based on the use of the mathematical concept of «relation») and the method of «Essence-Relation» (graphical method based on the use of ER-instance diagrams and ER-type diagrams).

The process of designing a database using the method of Normal Forms is iterative and is consecutive interpreting relation of the first normal form (1NF) in the normal form of high order according to certain rules. Each of the following normal form restricts certain type of functional dependencies, eliminating related anomalies

in the performance of operations on relations database and retains the properties of the previous Normal Forms.

When designing a database, the following stages of normalization take place:

• the first stage of normalization (transfer of the relation from 1NF to 2NF), which eliminates partial functional dependence, which generates a clear unprofitable duplication of data;

• the second stage of normalization (transfer of the relation from 2NF to 3NF), which eliminates the transitive functional dependence, which generates implicit unprofitable duplication of data;

• analysis of the resulting relations regarding the requirements of the Normal Form of Beuys-Codd (BCNF).

For example, the design of a database of SQL constructs was carried out in [11]. The initial relation includes 12 attributes, between which dependencies are identified and shown in Figure 1 [11]. The primary key of a relation is composite and consists of three attributes (Construction, Program, Question).
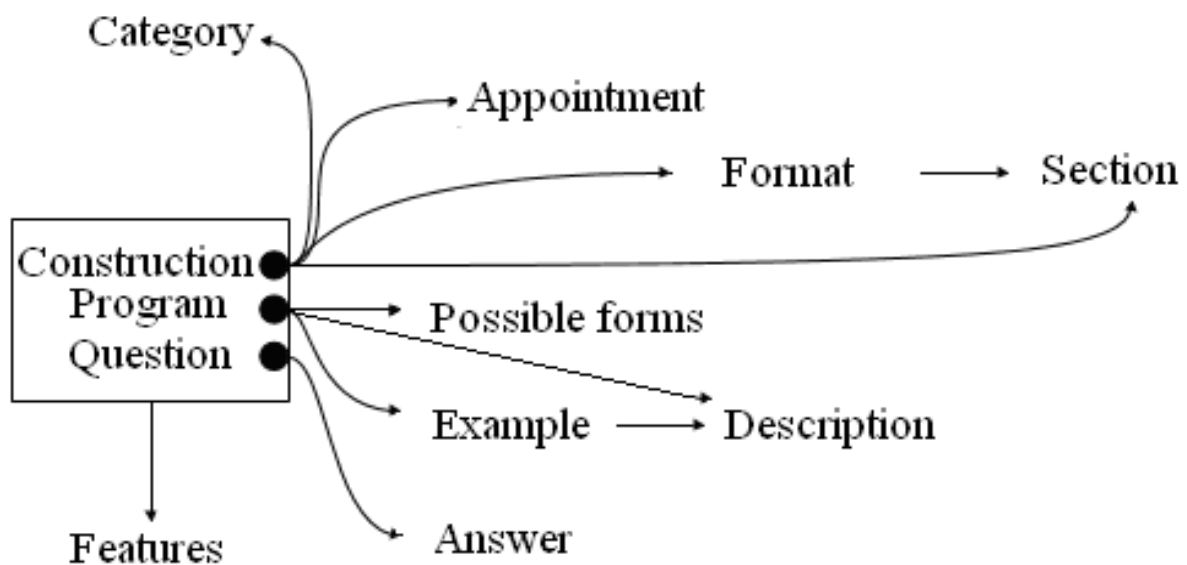

Figure 1 – Dependencies between attributes of the original relation

A source: [11]

The general structure of the designed database using the method of Normal Form is presented in Figure 2 [11].
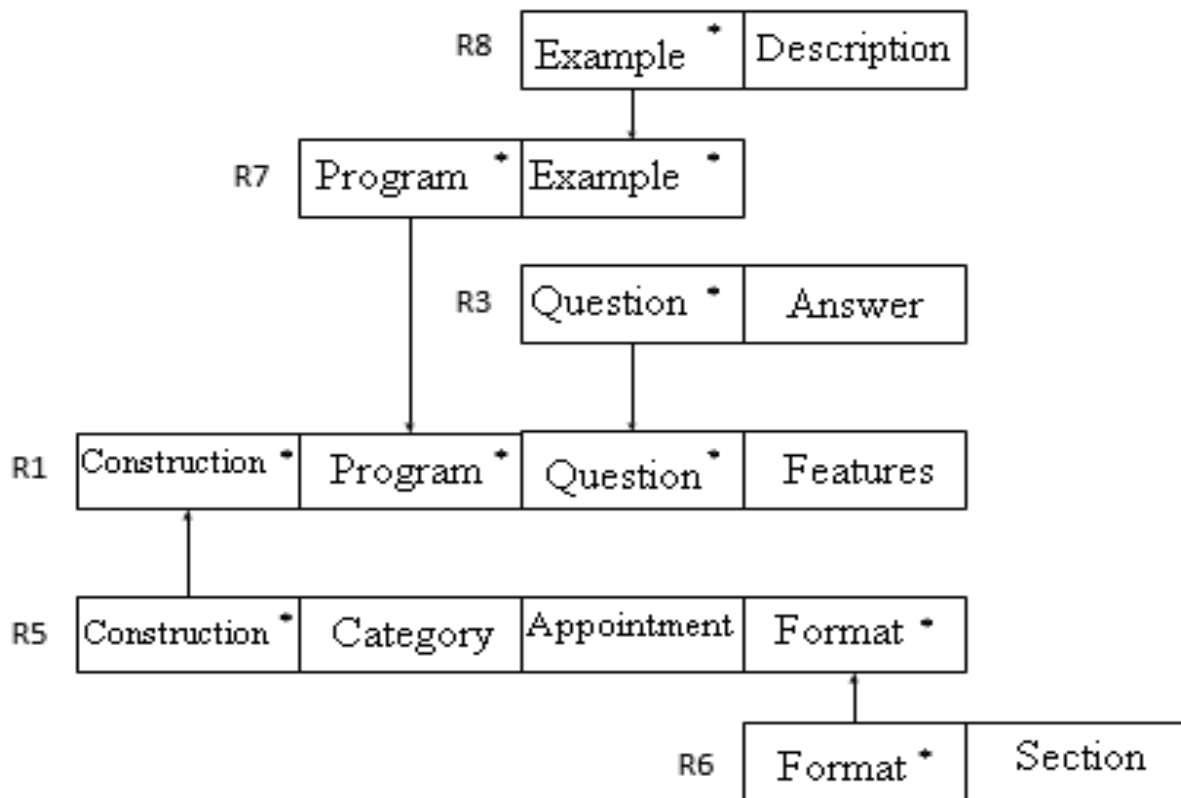
Figure 2 – Structure of the designed database of SQL constructs

A source: [1]

2. Organization of binary linking.

In practice the most widespread binary linking of tables (linking between the two tables). When a binary linking of tables stand out the main (basic or parent) table and additional (slave or child) table. The logical linking of tables is performed using a link key. The link key can be simple or composite. In practice the binary linking 1:M (one : many) has received the most widespread. The binary linking 1:M is established in the case when one cortege of left table corresponds to multiple corteges of right table.

As an example, consider the linking ARTIST RELEASES ALBUM (Figure 3) [5]. The table ARTIST is parent table, where ID_artist is simple primary key; the table ALBUM – child table, where (ID_artist, ID_alnum) is composite primary key. Logical linking of tables is performed using a link key: ID_artist. In table ALBUM the attribute ID_artist is foreign key.

The binary linking M:1 (many : one) is the mirror image binary linking M:1. As an example, consider the linking ALBUM BELONGS TO THE GENRE (Figure 4) [5]. The table GENRE is parent table, where ID_genre is simple primary key; the table ALBUM – child table, where (ID_artist, ID_genre) is composite primary key.

The logical linking of tables is performed using a link key: ID_genre. In table ALBUM the attribute ID_genre is foreign key.
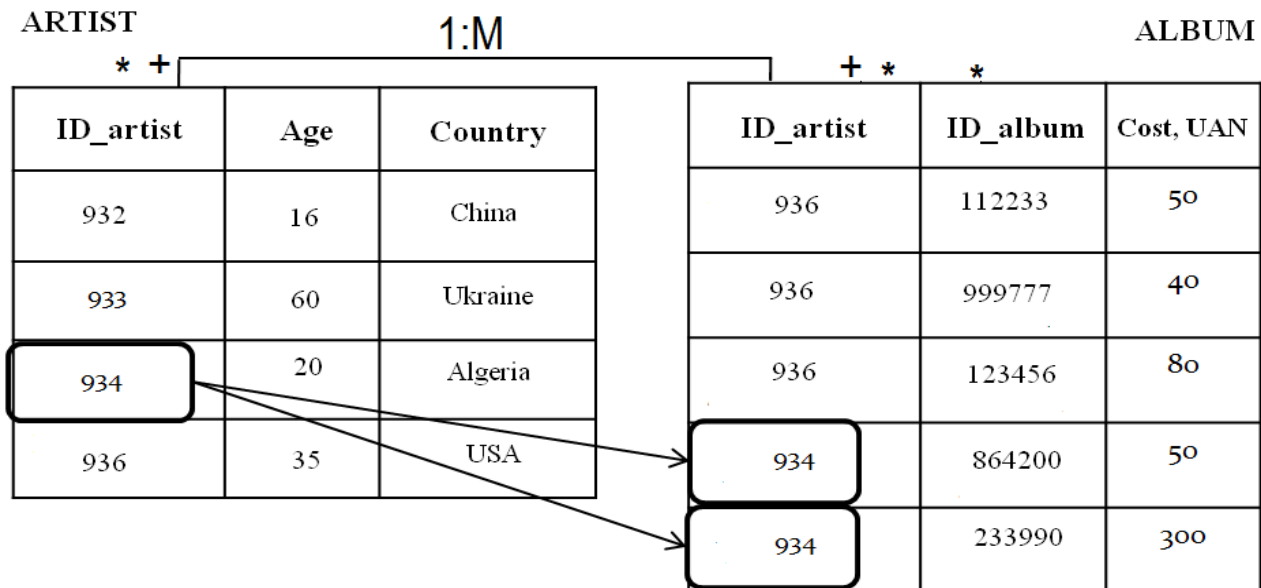
ARTIST   1:M   ALBUM

ID_artist	Age	Country
932	16	China
933	60	Ukraine
934	20	Algeria
936	35	USA

ID_artist	ID_album	Cost, UAN
936	112233	50
936	999777	40
936	123456	80
934	864200	50
934	233990	300

Figure 3 – ARTIST RELEASES ALBUM:

* primary key; + link key

A source: [5]

ALBUM   M:1   GENRY

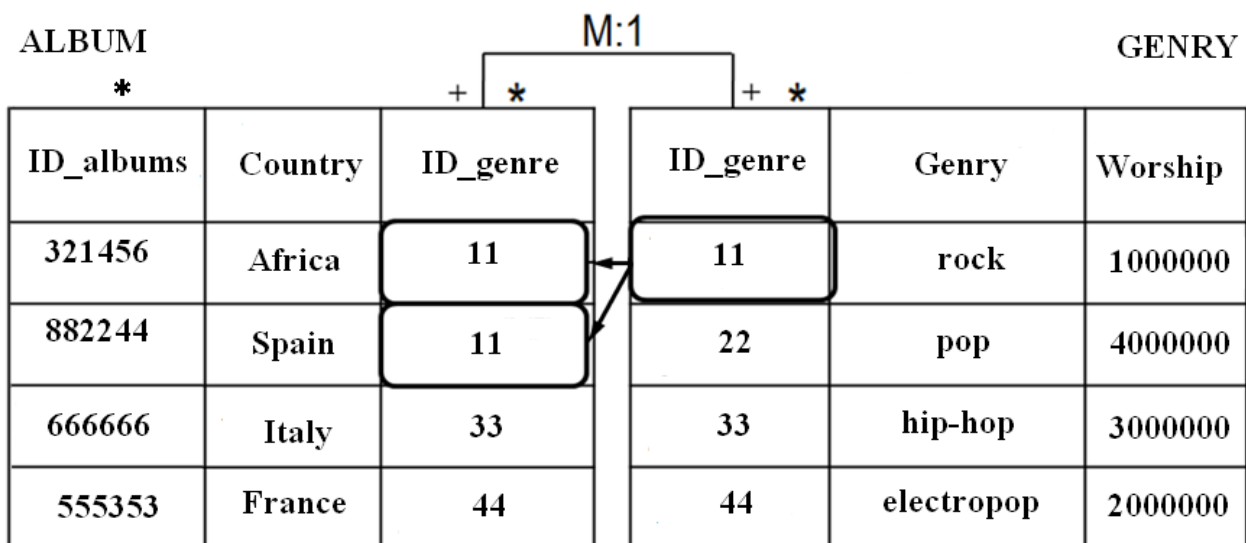| ID_albums	Country	ID_genre	ID_genre	Genry	Worship
321456	Africa	11	11	rock	1000000
882244	Spain	11	22	pop	4000000
666666	Italy	33	33	hip-hop	3000000
555353	France	44	44	electropop	2000000

Figure 4 – ALBUM BELONGS TO THE GENRE:

* primary key; + link key

A source: [5]

The relational model imposes on the foreign key constraint to ensure data integrity, called referential integrity. Each value of the foreign key must match the string in the bonding relations. The child tables are no records that have no parent records in the parent table.

3. The creation of designed database and its protection.

For implementation, there are the following software: Oracle and Microsoft Access; FoxPro and FoxBase; Paradox and Clarion; MySQL and HeidiSQL; and many others. As an example, a link scheme created in Microsoft Access that underlies a database of neural models for the detection of network attacks is given (Figure 5) [2].
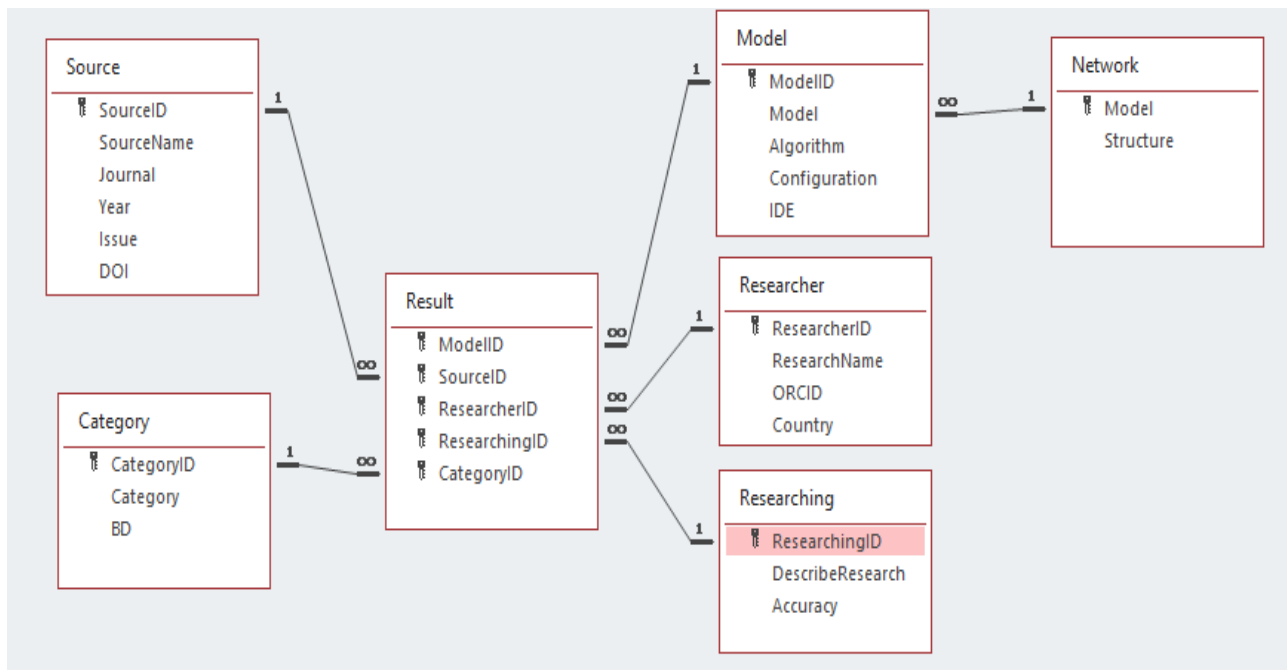

Figure 5 – The creating a database of neural models for detecting attacks

A source: [2]

4. Optimization and performance improvement of the created database. Optimization of the database itself is achieved using the method of normal forms, but optimization of software constructs for database processing is also important [10]. In addition, the presence or absence of indexes (simple or composite) can significantly improve the performance of a database [10]. However, these questions require additional research.

5. The recommendations for the use of created databases. The databases designed by applicants can be used in various areas: as additional reference books both for use in the educational process in the relevant disciplines [2, 4, 11], and for use at the department [1, 3, 6].

Conclusions

1. The «BachelorDesignDB» methodology for the formation of applicants competencies for a bachelor's degree in the specialties «Computer Engineering» and

«Cybersecurity» in the database design during the writing of a qualification work using a research approach is proposed.

2. Based on the use of the proposed «BachelorDesignDB» methodology, the applicant for a bachelor's degree: firstly, acquires professional competencies (designed and protected databases for practical use in various areas); secondly, acquires practical skills in scientific activities (organization and conduct of research to optimize and increase the productivity of the created database).

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