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FORMATION OF COMPETENCIES IN APPLICANTS OF THE BACHELOR'S DEGREE OF FOREIGN ORIGIN IN DISTANCE LEARNING IN THE «DATABASE» DISCIPLINE

ФОРМУВАННЯ КОМПЕТЕНТНОСТЕЙ У ЗДОБУВАЧІВ СТУПЕНЯ «БАКАЛАВР» ІНОЗЕМНОГО ПОХОДЖЕННЯ ПРИ ДИСТАНЦІЙНОМУ НАВЧАННІ З ДИСЦИПЛІНИ «БАЗИ ДАНИХ»

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Abstract. *The «ForeignDistLearnDB» methodology on the formation of competencies of applicants for foreign origin «Bachelor» in «Computer Engineering» in distance learning in the «Databases» discipline, consisting of the following stages: 1) familiarization with the basic models of data representation (during lectures); 2) study of DDL, DML and DQL constructs that form the basis of SQL (during laboratory work); 3) designing a relational database using the «Normal Forms» and «Essence-Relation» methods (during the individual task); 4) analysis of the process and results of database design by different methods (mathematical and graphical); 5) elaboration of theoretical material with the use of lecturer presentations and modular testing in the «Lider» system.*

Key words: *competence, database, relational model, binary link, foreign key, dependency, normal form, ER-type diagram, design, SQL.*

Introduction

Formulation of the problem. The current situation in the world related to the spread of COVID-19 caused by the coronavirus SARS-CoV-2 has led to the use of distance learning, in particular in the discipline «Databases» and the formation of relevant competencies in first-degree applicants under such difficult conditions that confirms the relevance of the topic.

Analysis of recent research. Assessment of competencies is the subject of research of such scientists as: Bykov V. Yu., Gurevich R. S., Gurzhiy A. M., Morse N. V., Ovcharuk O. V., Spirin O. M., Sysoeva S. O., Zhaldak M. I. and others. It is important to identify, analyze and summarize the experience of EU countries, major international organizations and initiatives (UNESCO, ECDL, MICROSOFT, INTEL, etc.), as well as comparability for modern Ukrainian education in international research on education quality (PISA, TIMSS, PEARLS) [1]. The analysis of recent research and publications [1-4] revealed the following: 1) the lack of common information and communication technologies in the discipline «Database»; 2) ubiquitous use at the present stage of relational databases; 3) the existence of a wide range of software applications for creating and processing relational databases; 4) features of generation Z; 5) the need for distance learning in the current situation in the world, and became the basis for the development of its own methodology «ForeignDistLearnDB».

The aim of the article is to develop a methodology for the formation of competencies in applicants of foreign origin with a bachelor's degree in «Computer Engineering» in distance learning in the «Databases» discipline.

1. Formation of subject competencies during lectures

According to the «ForeignDistLearnDB» methodology during the lectures the students are acquainted with the models of data presentation: hierarchical; network; relational; postrelational; multidimensional and object-oriented, the most practical of which is the relational model. As a learning outcome, the implementation of binary linking of the tables underlying the relational model using a foreign key. As an example, create a binary link 1:M «STUDENTS» table and «HOBBY» table (Fig. 1). In the main (parent) table the primary key (*) is simple (Full_name); in the additional (child) table the primary key is composite (Full_name and Hobby); the Full_name attribute is link key (+). In the child table the Full_name attribute is a foreign key.

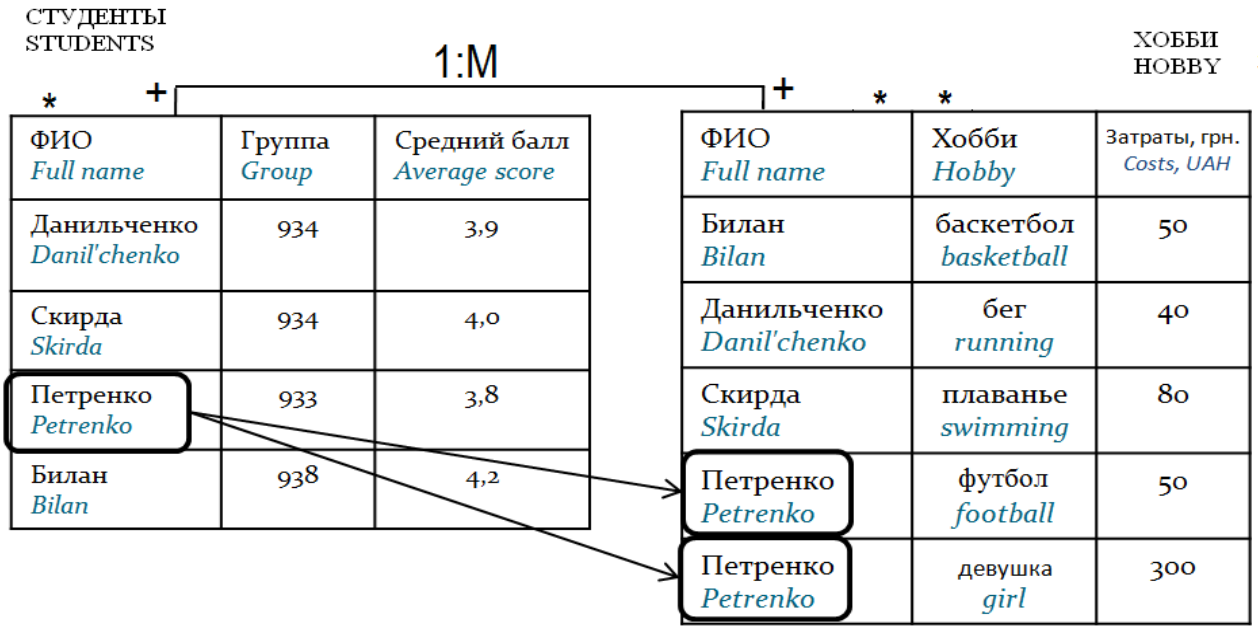

Figure 1 – The example of binary link 1:M:
«STUDENTS» is parent table; «HOBBY» is child table

Elaboration of theoretical material based on lecturer presentations and modular testing are carried out using the «Lider» system [3].

2. Formation of subject competencies during laboratory classes

According to the «ForeignDistLearnDB» methodology during the laboratory works the applicant acquires practical skills in using SQL (Structured Query Language): to create and edit the structure of a relational database based on constructions «Create table», «Alter table», «Drop table» from DDL (Data Definition Language); to create and edit the body relation based on constructions «Insert», «Update», «Delete» from DML (Data Manipulation Language); to create queries to the database based on the multifunctional construction «Select» from DQL (Data Query Language).

3. Formation of competencies during the individual task

According to the «ForeignDistLearnDB» methodology during the individual task of database design using the «Normal Forms» method [5]. As a program learning outcome, the applicant determines the functional dependencies between attributes and performs the main stages of normalization of the relation: the first stage (translation of the relation from 1NF to 2NF), which aims to get rid of partial dependence; the second stage (translation of the relation from 2NF to 3NF), which aims to eliminate transitive dependence. So, for example, for the «TEACHER» relation we will allocate dependences between attributes (fig. 2). Initially, the primary key is composite (Full_name, Subject, Group).

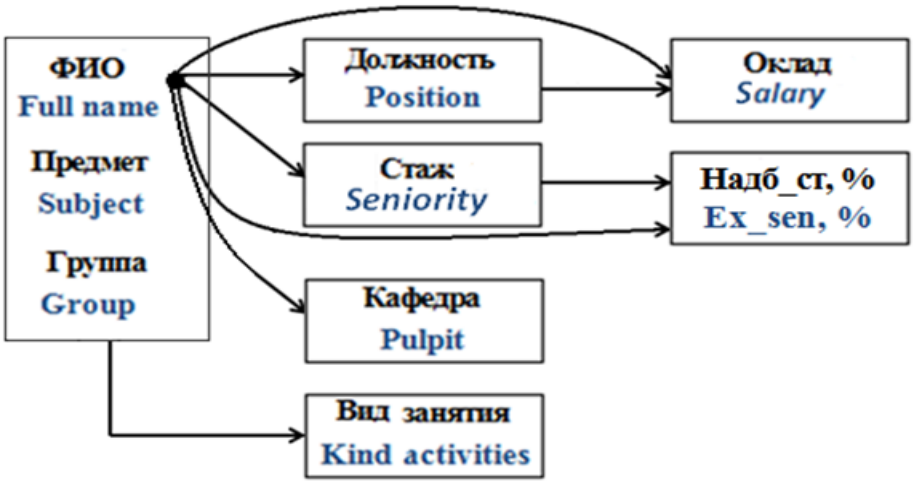

Figure 2 – Dependencies between the attributes of the original relation

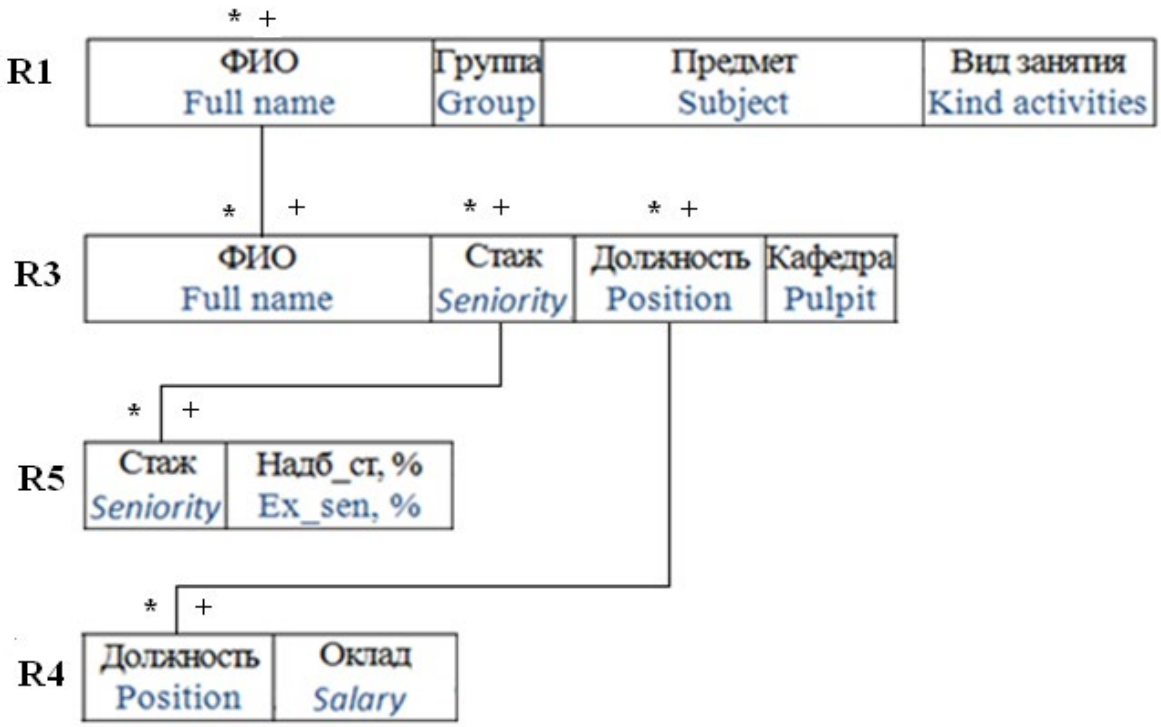

Figure 3 – The structure of the designed database:
(*) – primary key; (+) – link key

In the original relation there is redundant duplication of data, which are the cause of the anomalies editing. Evident redundancy in the relation: the corteges to the data about teachers are repeated. Non-evident redundancy in the relation: the same salary of one position and the same additions to the salary for the same seniority. The result of the design is a database (Fig. 3), consisting of the relations R1, R3, R4 and R5, each of which meets the requirements of the Boyce-Codd Normal Form (BCNF).

4. Using a research approach in distance learning

Hrynevych L. M., Morse N. V. and Boyko M. A. emphasize that research and cognitive method should become the most important component of the scientific program at all levels and in all branches of science [2]. According to the «ForeignDistLearnDB» methodology when performing an individual task, the applicant uses not only the mathematical method, but also the graphical method [5]. So, for example, when designing a database by the «Essence-Relation» method created ER-type diagram, taking into account all the essences and relations between them (Fig. 4), based on which the resulting relations are formed. The structure of the designed database by the «Essence-Relation» method exactly coincides with the structure of the designed database by the «Normal Forms» method. As a program learning outcome, the applicant must compare the processes and results of database design using different methods: «Normal Forms» and «Essence-Relation».

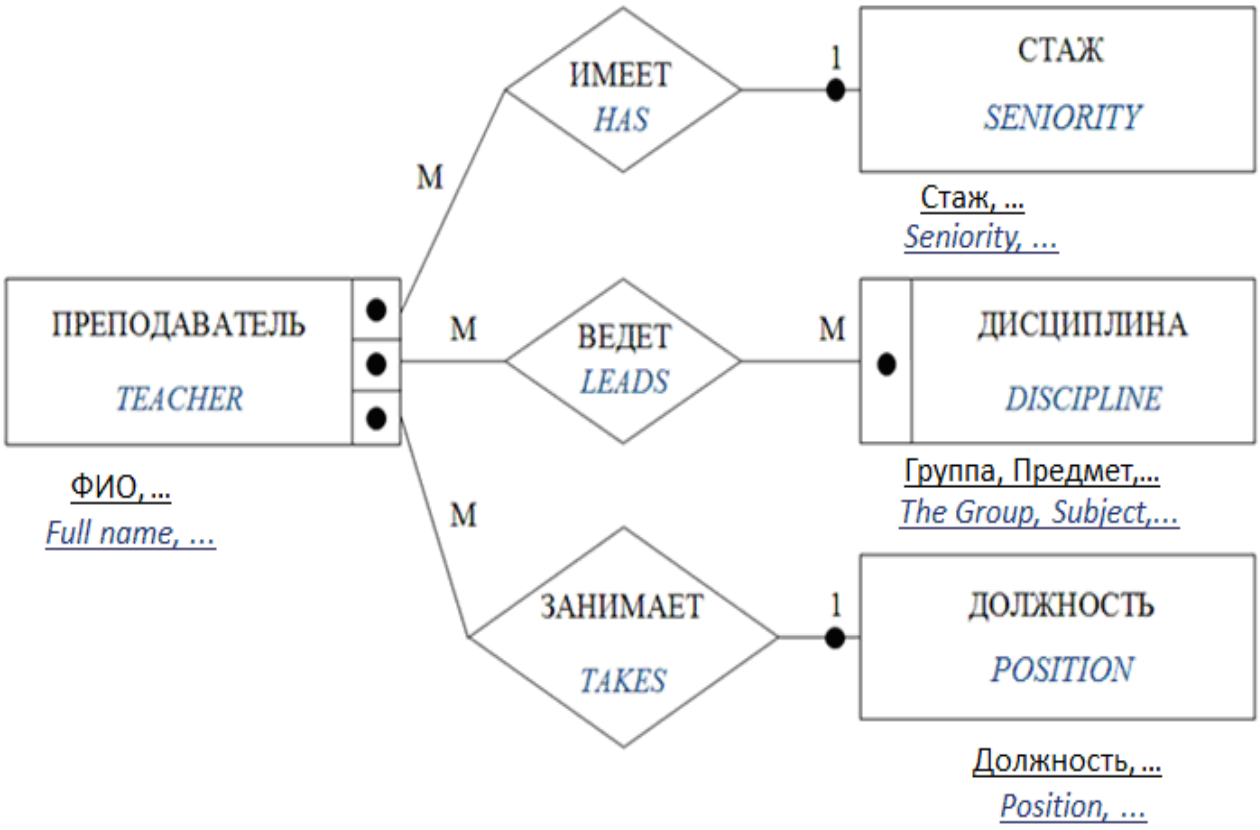

Figure 4 – ER-type diagram

Peculiarities of Generation Z and peculiarities of training of applicants of foreign origin require the introduction of new methods in the conditions of distance learning and the use of interactive teaching methods. For example, according to the

«Teaching-Learning» method, a first-degree student of foreign origin, having received a general structure of a relational database with the definition of outcome keys and communication keys, must be able to assess the degree of normalization and denormalization of relations.

Conclusions

1. The proposed «ForeignDistLearnDB» method for the formation of competencies of applicants for foreign origin «Bachelor» specialties «Computer Engineering» in distance learning in the «Databases» discipline based on the «Lider» system during lectures and laboratory classes, as well as performing an individual task using a research approach.

2. Based on the use of the proposed «ForeignDistLearnDB» method applicant of foreign origin degree «Bachelor»: first, masters the subject competencies in the «Databases» discipline; secondly, acquires practical skills in scientific activities in the organization and conduct of research in the design of the database by different methods: «Normal forms» and «Essence-Relation».

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Анотація. *Запропонована методика «ForeignDistLearnDB» щодо формування компетентностей здобувачів іноземного походження ступеня «бакалавр» спеціальностей «Комп'ютерна інженерія» при дистанційному навчанні з дисципліни «Бази даних», що складається із наступних етапів: 1) ознайомлення з основними моделями представлення даних (під час лекційних занять); 2) вивчення конструкцій DDL, DML і DQL, що складають основу SQL (під час лабораторних робіт); 3) проектування реляційної бази даних за методами «Нормальних форм» і «Сутність-зв'язок» (під час виконання індивідуального завдання); 4) аналіз процесу та результатів проектування бази даних за різними методами (математичним та графічним); 5) опрацювання теоретичного матеріалу з використанням презентацій лектора та модульного тестування в системі «Лідер».*

Ключові слова: *компетентність, база даних, реляційна модель, бінарний зв'язок, зовнішній ключ, залежність, нормальна форма, діаграма ER-типу, проектування, SQL.*