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AUTOMATION OF THE GROUP FORMATION PROCESS FOR EDUCATION APPLICANTS TO STUDY ELECTIVE EDUCATIONAL COMPONENTS

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The paper analyzes the main provisions on the formation of an individual educational trajectory of education applicants, identifies the main functional requirements for a software tool designed to automate the process of forming groups of education applicants according to their choice of educational components. The structure and algorithm of the software tool were developed. The data to be stored are determined and the structure of the database is developed. The developed software tool allows you to keep records of selected elective disciplines and generate reporting forms.

Introduction

Education is the basis of intellectual, spiritual, physical and cultural development of an individual, his or her successful socialization, economic well-being, and the key to the development of a society united by common values and culture, and the state [1].

The purpose of education is the comprehensive development of a person as an individual and the highest value of society, his or her talents, intellectual, creative and physical abilities, the formation of values and competencies necessary for successful self-realization, the education of responsible citizens capable of making conscious social choices and directing their activities to benefit other people and society, enriching on this basis the intellectual, economic, creative, cultural potential of the Ukrainian people, raising the educational level of citizens to ensure sustainable development of the country.

Social relations arising in the process of realization of the constitutional human right to education, rights and obligations of individuals and legal entities involved in the realization of this right are regulated by the Law of Ukraine "On Education". The Law of Ukraine "On Higher Education" provides for the right of higher education applicants to choose academic disciplines within the limits provided for by the relevant educational program and curriculum in the amount of not less than 25 percent of the total number of ECTS credits provided for this level of higher education [2–4].

Elective components (elective disciplines or elective courses) of a higher education program are disciplines offered to higher education applicants by a higher education institution to better meet their educational and qualification needs and to effectively use the capabilities of the institution, etc. The choice of disciplines of a particular educational program is made by the applicant in the process of forming an individual educational trajectory.

Implementation of the principles of the law on higher education requires IT support. Specific procedures and algorithms can be implemented more efficiently using the functions of an integrated university management information system.

In the process of studying, students choose the disciplines of a particular educational program in the course of forming their individual educational trajectory. The task of processing the submitted data is extremely complex and important.

In this paper, we propose to automate the process of forming groups for studying selective components using the developed software tool. The use of this information system will allow to build an individual learning trajectory by automating the procedure for selecting disciplines [2].

1 Stages of the group formation process for studying selective components

The process of selecting elective components (disciplines) by educational applicants is quite long and complicated in terms of organizing the collection and processing of information, as well as its further use in the educational process. Currently, Ukraine has not implemented centralized systems or tools that would facilitate and speed up this process. The selection procedure is organized by the dean's office, usually through an online survey of students, summarizing the results by faculty in conjunction with the academic department. The mechanism of realization of the students' right to choose disciplines includes the stages shown in Fig. 1.

Students choose disciplines from the list of elective disciplines of the educational program by forming an individual list within the specified period. The selection process is controlled by group supervisors to ensure that all applicants participate in the selection procedure. The data on students' choice is processed by the dean's office and within the specified timeframe, it submits to the academic department generalized information on the number of students who have chosen the appropriate elective discipline in each academic group and includes it in the working curricula.

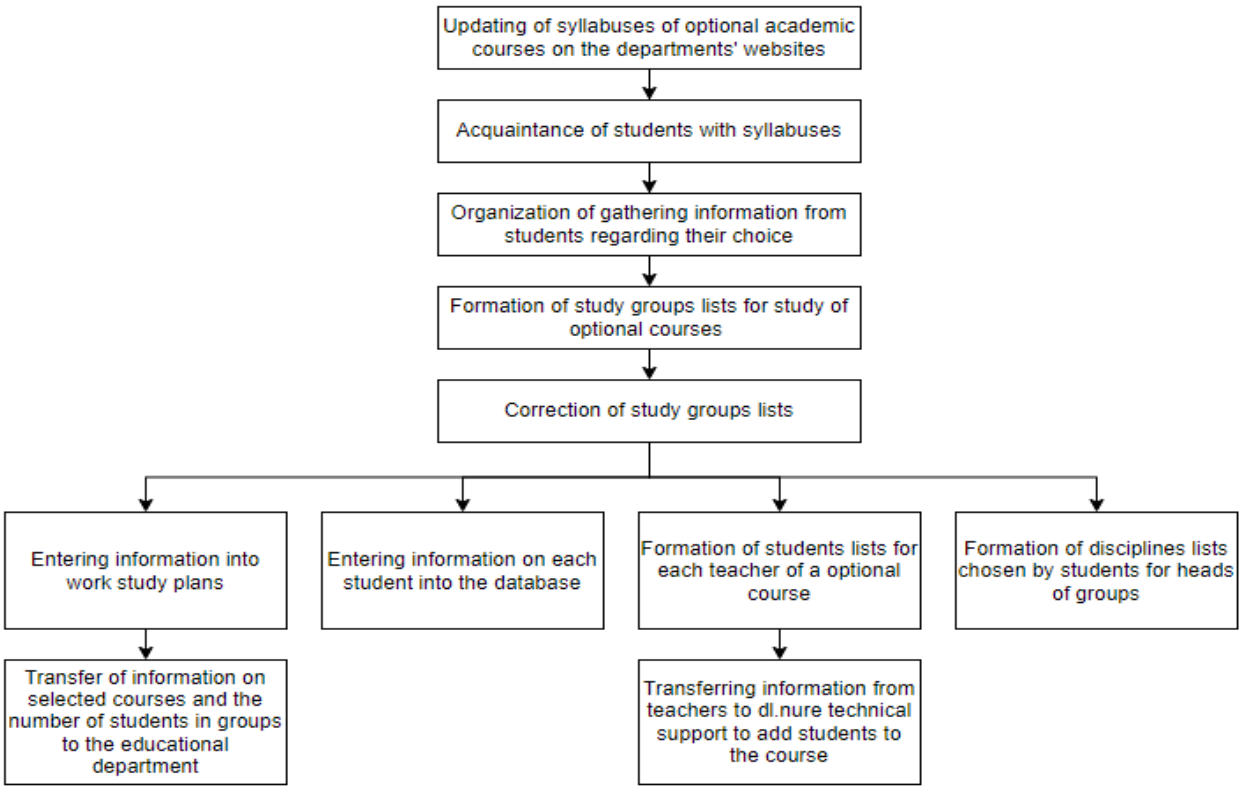


Fig. 1. Stages of group formation for studying elective disciplines

2 Description of the software structure

The software modules included in the group formation automation software for studying elective components are shown in Fig. 2.

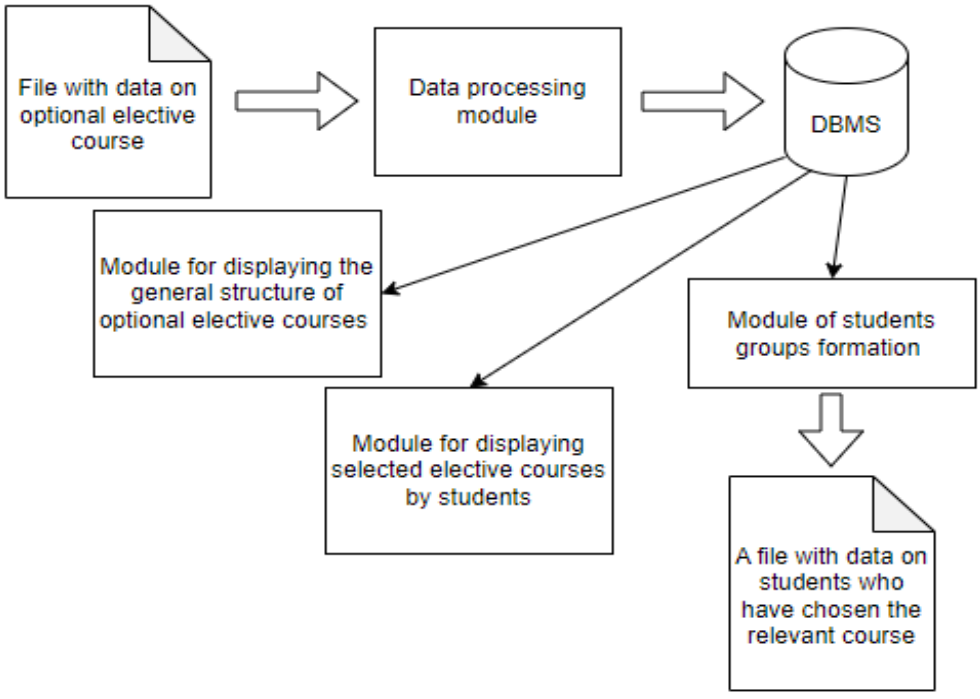


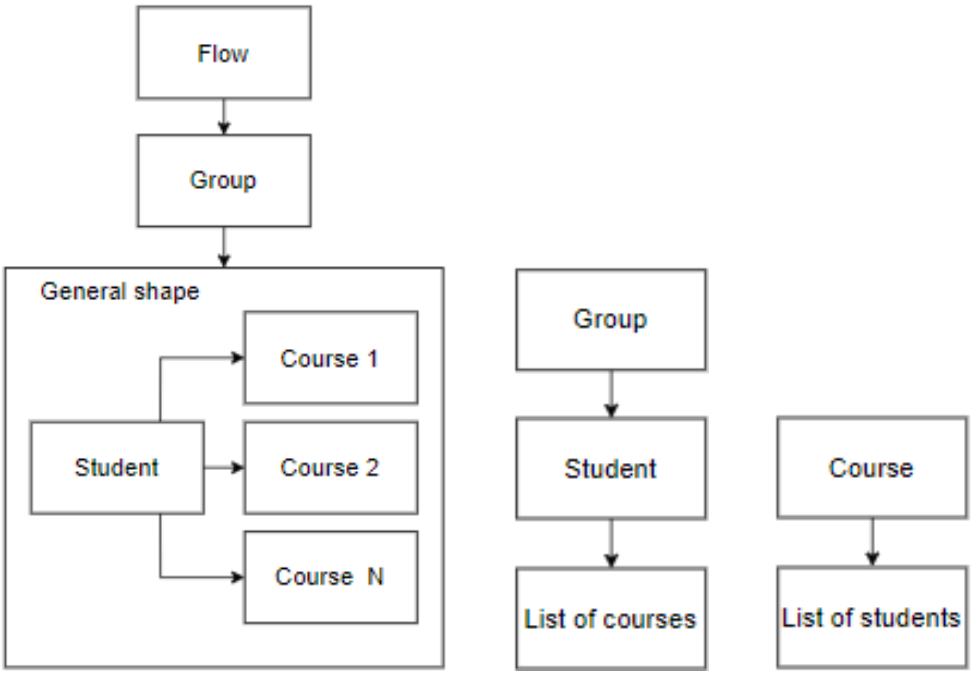
Fig. 2. Program modules included in the software

The file with data on the selected elective disciplines is sent to the data processing module. The file contains tables of education applicants and selection results in Microsoft Exel format.

The data processing module processes the Excel file and stores the information in a database table. It is designed to automate the process of processing information received from education applicants and storing this data in a database table. With this module, you can increase productivity and reduce the time required to process large amounts of data.

The module provides automatic processing of data from an Excel file and saving it in a database table without the need to manually copy and paste information rows. This allows you to use time efficiently and reduce the possibility of errors when entering data manually. In addition, the data processing module allows you to regularly process data from an Excel file and automatically update the information in the database table in case of information changes.

After analyzing the input information, the data is distributed to the appropriate tables and saved to the database. With the collected data structure, the module for displaying the general structure of the selected elective disciplines allows the operator to generate a report in the form of a relationship, as shown in Fig. 3.



а) б) в)

Fig. 3. Relationships:
a) "Flow-Group-Student-General choice";
b) "Group-Student-List of disciplines";
c) "Discipline-List of students"

In this form, you can analyze general information for each student in the group. In the reporting table, you need to display a list of selected disciplines for each student in the group. Moving between group streams allows you to group information in relation to each academic group in the selected stream. Each student can be assigned several disciplines that he or she chooses in the process of forming elective components. Therefore, this way of presenting information makes it possible to assess the overall result of curriculum development.

To perform the operational tasks of providing information services, to present a list of selected disciplines by a particular student, it is necessary to develop another program module – "Module for displaying selected elective disciplines by students", which will implement the relationship "Student – List of disciplines" (Fig. 3, b). Each block in the figure shows a separate type of information that the program should provide when sequentially reproducing the specified relationship.

For example, the "Group" block should provide the user with a list of academic groups available for work. After selecting a particular group, the "Student" block is formed. This block is responsible for displaying students who are members of the academic group. The last block "List of disciplines" provides information about the elective disciplines chosen by the student.

The next program module "Group formation of students" implements the relationship "Discipline – list of students" (Fig. 3, c).

This model is designed to perform the main function – group formation of students for elective components. As a result of this module, a list of students who have chosen a particular discipline is formed.

In accordance with the structure of the program modules, it is necessary to implement the function of exporting the generated list to a new file in Microsoft Excel format for transfer, for example, to the distance learning management department to create a corresponding group in the DL cloud environment.

3 Development of the program operation algorithm

The program operation algorithm is shown in Fig. 4. The program consists of several modules, according to the structure shown in Fig. 2. At the first stage of the program, the Microsoft Excel file is opened, which contains data on all students of academic groups participating in the selection of elective components. If the file is selected correctly, the file structure analysis function is launched. If you select an incorrect file, you need to return to the previous step of selecting the information source.

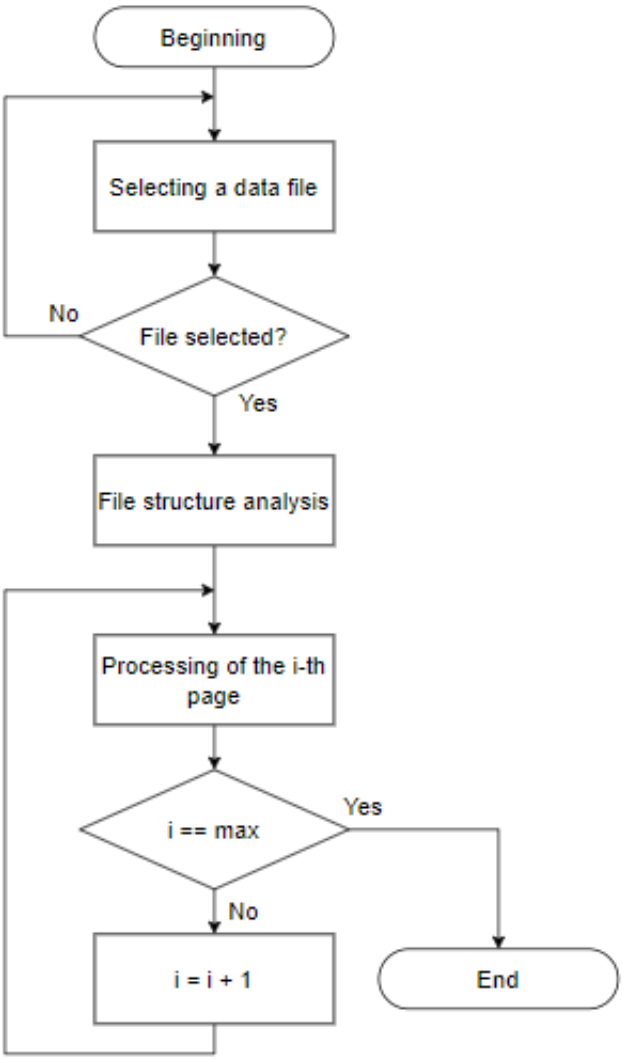


Fig. 4. Algorithm of the program operation

At this stage, a list of pages is created to perform a sequential analysis of each of them. The following information is collected on each page:

– student's email address;

– last name, first name and patronymic of the student;

– the code of the group in which the applicant is studying;

– names of disciplines by semester.

All data is collected sequentially for each student and each group [4, 5]. Also, the stream to which each group belongs is determined. The above functions are performed in the subroutine "Processing the i-th page of the file".

After processing each page, the maximum value of the available pages in the file is checked. If not all pages have been processed yet, the current index "i" is incremented by one and the above steps are repeated again. If all the pages are processed, the main algorithm for automating data collection and analysis is completed.

Figure 5 shows the algorithm of the subroutine "Processing the i-th page of the file".

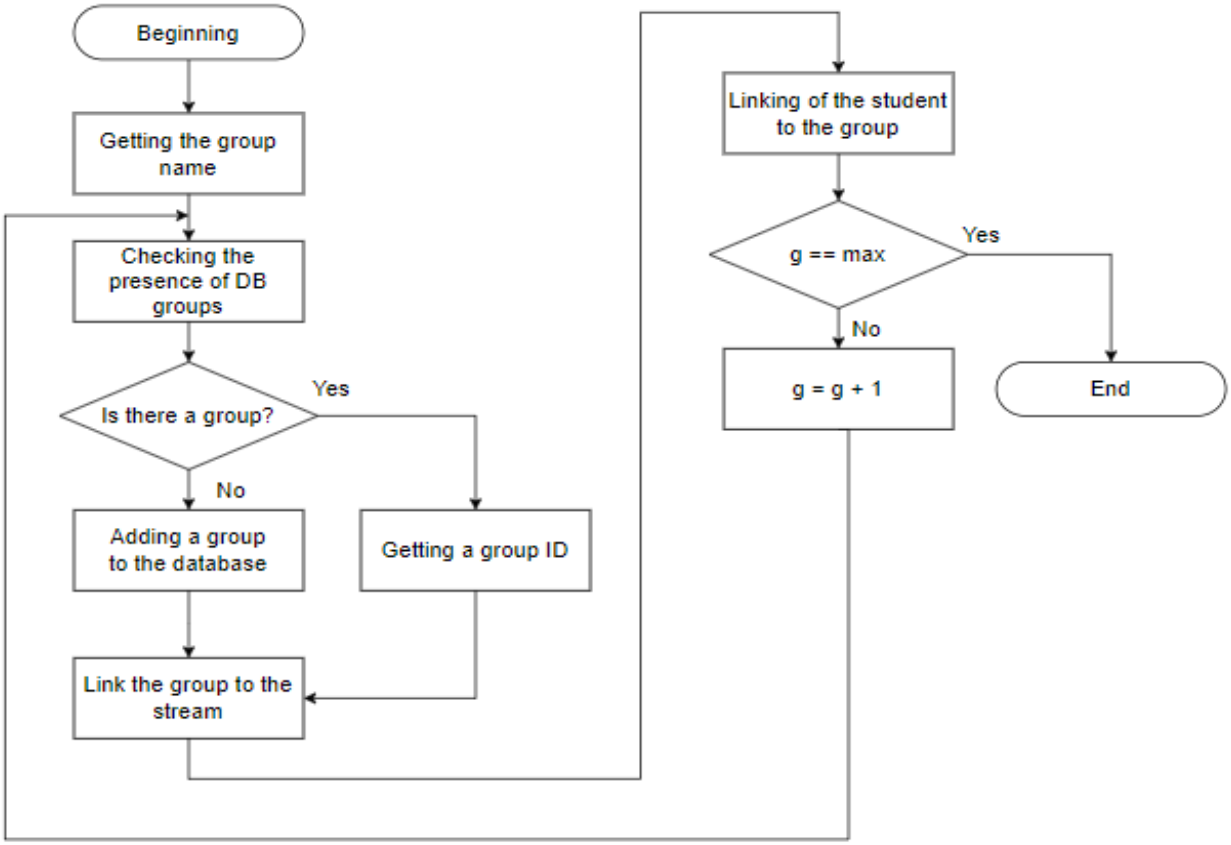


Fig. 5. Algorithm of the subroutine "Processing the i-th page of the file"

At the beginning of the subroutine, the first row of the table contained on the page to be processed is accessed. Each row contains information about the academic group and the name of the student who belongs to it.

After checking the availability of the current group in the database, one of the following actions is performed

– if the group is not found in the database, then such a group is added to the database and the identifier of the new group is obtained;

– if a group is found in the database, its identifier is obtained.

After receiving the group identifier, a certain student, whose information is found in the current row, is linked to the database. The group is also linked to the stream.

The next step is to check the current row number and determine whether we have reached the end of the table with the academic groups of education applicants. If all the rows of the table have been processed, the subroutine terminates, if there are still rows left, the next one is processed.

Figure 6 shows the algorithm of the subroutine for processing information about disciplines. This subroutine searches all the columns of the table to obtain data on the disciplines chosen by the higher education applicant.

The first step is to determine the number of columns containing the names of the disciplines. The number of disciplines may vary depending on the student's study stream and the semesters in which the elective disciplines are selected. Also, the set of certain disciplines depends on the curriculum.

Having received the first name of the discipline, we check its availability in the database. If the discipline is not found in the database, then such a discipline is added to the database and its identifier is obtained. If the discipline is found in the database, its identifier is obtained, after which the discipline is linked to a specific student by making the appropriate entry in the database. Next, it is checked whether there are any columns in the table that have not yet been processed. If so, the next column is processed. If all columns have been processed and all the disciplines selected by the student have been saved to the database, the subroutine is terminated.

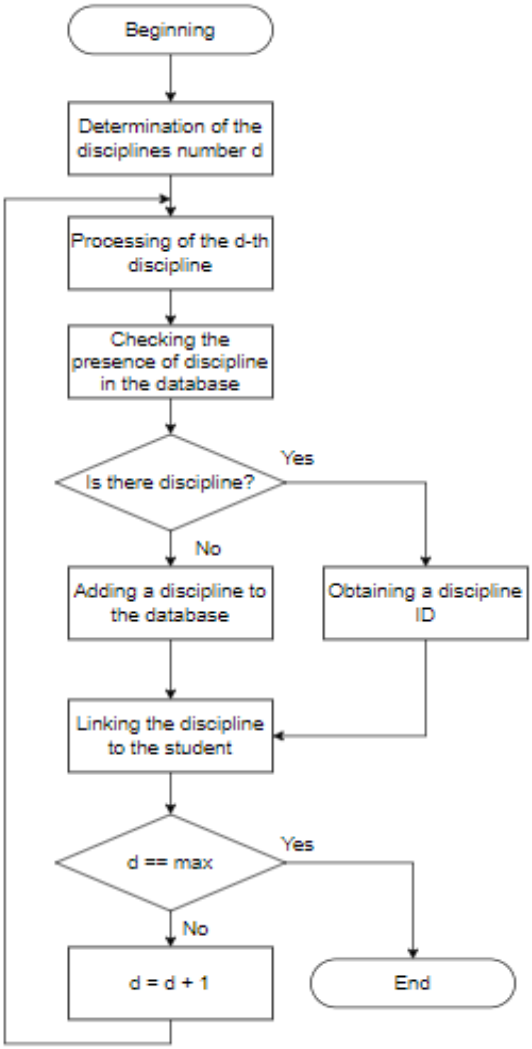


Fig. 6. Algorithm of the subroutine for processing information about disciplines

The general structure of the database is shown in Fig. 7. The connection between the tables is made by key fields. The main table is "Vybor" – the results of

the selection of educational applicants elective components. The "Vybor" table refers to the reference books: the list of students ("Student"), the list of disciplines ("Disciplina") and the list of flows ("Flow") by the corresponding key fields: ID_Student, ID_Disciplina, ID_Flow. The table with the list of students links each education applicant to the corresponding group using the ID_Group field. In turn, groups are associated with flows using a special GroupFlow table and the ID_Flow and ID_Group fields.

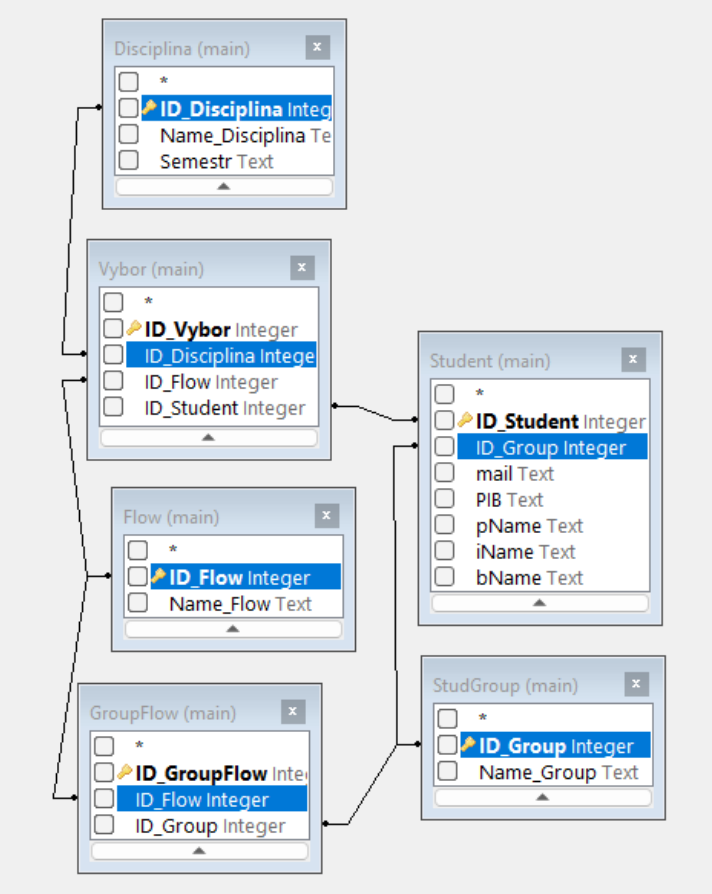


Fig. 7. General structure of the database

4 Description of the program's graphical interface

The program was developed using the C# programming language and the Visual Studio development environment from Microsoft.

The developed program has three tabs:

– general information on groups;

– disciplines chosen by students;

– students who have chosen a particular discipline.

Fig. 8 shows an example of the program interface for viewing general information on groups.

In this example, you can see the button for importing data from an MS Excel file and three workspaces:

– a list of streams

– a list of groups in the stream;

– a complete list of all disciplines chosen by students.

In Fig. 8 and the following, in order to protect the personal data of higher education applicants, the names of students and their mailing addresses are protected from viewing. For this purpose, a special software function has been developed that analyzes the input data and applies a mask before displaying it on the screen. Full information is available only to the dean's office staff.

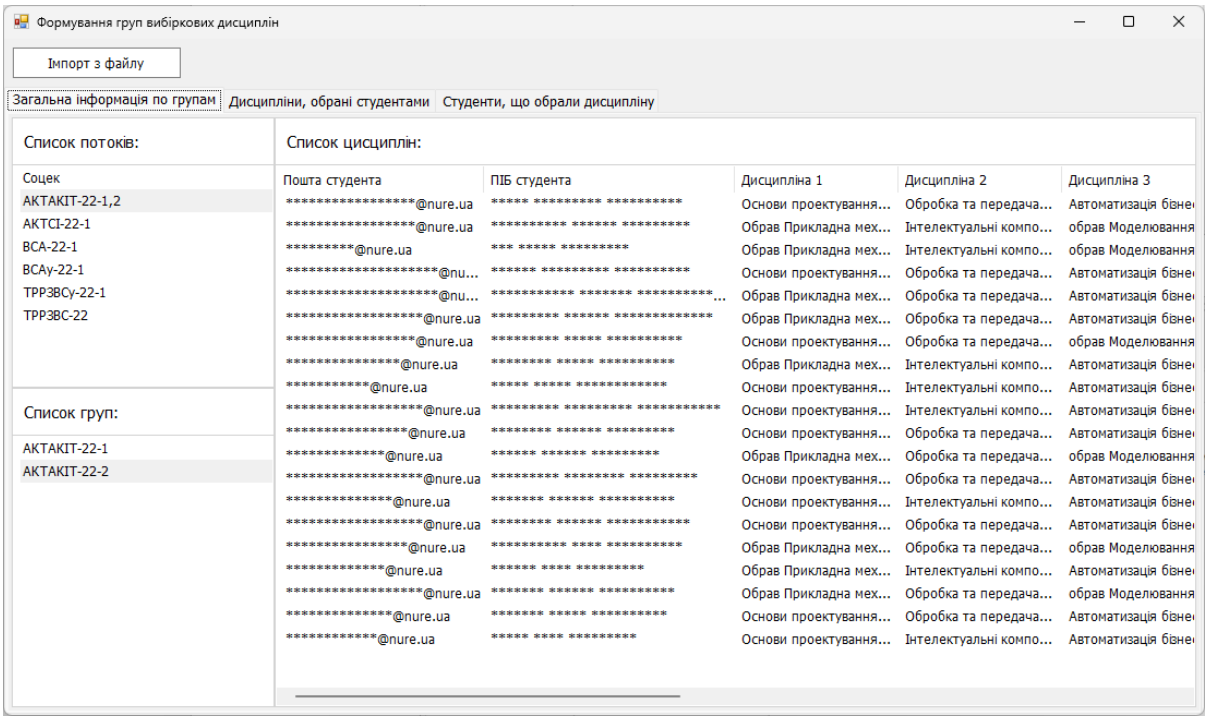


Fig. 8. An example of the program interface
for viewing general information on groups

Fig. 9 shows the program interface in the mode of viewing selected disciplines by a particular student.

In this interface, you can also select three work areas:

– a list of all registered academic groups;

– list of students in the selected group;

– a list of disciplines selected by the specified student.

In this mode, it is possible to select any student from the list and find out information about his or her choice in a convenient data presentation format.

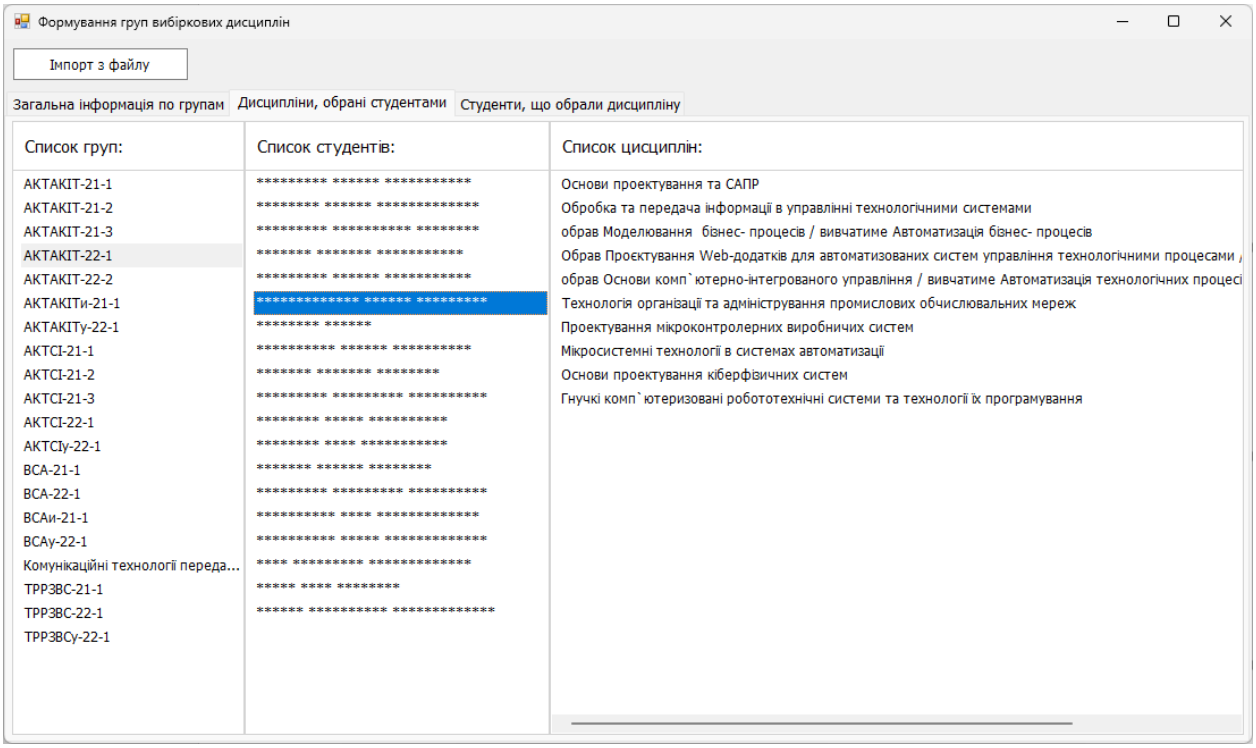


Fig. 9. The program interface in the mode of viewing selected disciplines by a particular student

Fig. 10 shows an example of the program interface in the mode of viewing lists of students who have chosen a particular discipline.

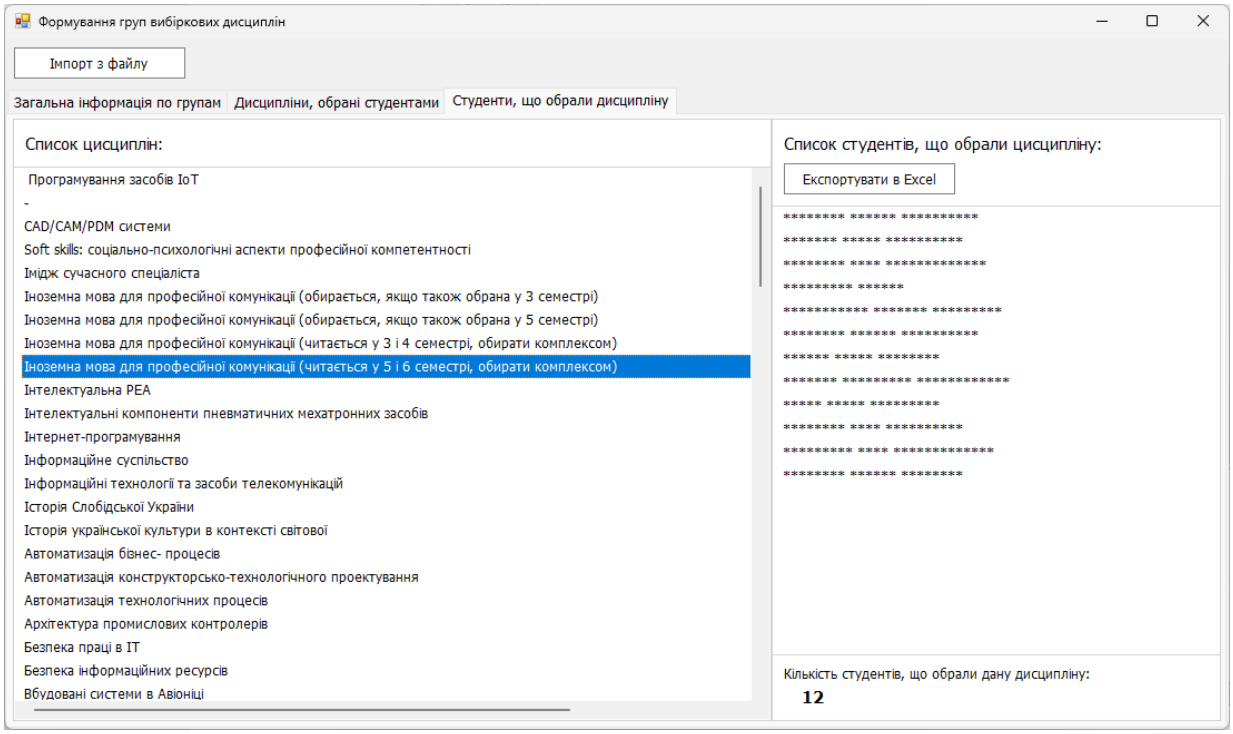


Fig. 10. An example of the program interface in the mode of viewing lists of students who have chosen a particular discipline

The graphical interface in this mode has two working areas:

– a list of disciplines that participated in the selection;

– a list of students who have chosen the specified discipline.

In this mode it is very convenient to analyze the lists of students who have chosen each of the disciplines.

The possibility of automated generation of a statement with a list of students who will study the selected discipline is also implemented. This list can be sent to the teacher or to the department that organizes distance learning.

Conclusions

Thus, the developed software tool for automating the process of group formation of elective components of education applicants helps to solve organizational problems that arise when building individual educational trajectories of students.

An in-depth analysis of the subject area allowed us to identify the stages of the group formation process for studying elective components. An analysis of the main provisions on the formation of an individual student's educational trajectory was carried out, during which the main functionality of the software tool was determined.

The algorithm of the software and the structure of the database are developed. The data to be stored are determined, namely: information about elective disciplines; information about the flows of groups of educational directions; information about academic groups; information about students; information about the choice of elective disciplines made by students.

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