Table 1 – Authentication methods summary characteristics

Authentication method property	Basic authentication	Digest authentication	OAuth 2.0 authentication
Client is required to have access to user credentials	Yes	Yes	No
Server is required to store user password in reversible state	Yes	No	No
Plain text credential transferring	Yes	No	No
Fine-grained separation of access permissions	Partial	Partial	Yes
Client is required to be capable of interacting with the user-agent receiving incoming requests via redirection	No	No	Yes

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UDC 681.5

EVALUATION FUNCTION AS A KEY FACTOR IN SOLVING THE TASK OF UNIVERSITY SCHEDULE CREATION

ALEH TRAVKIN, DMITRY RUGOL
Polotsk State University, Belarus

The paper is devoted to further investigation of local evolutionary method for solving discrete optimization problems, namely, the applicability of this method to the problem of scheduling the university.

This problem is NP-hard and has a strong applied focus. It remains relevant, particularly, for universities in Belarus.[1]

Unsolved problems include the following:

a) effective restructuring of the schedule due to changes in the source data;

b) taking into account the specific constraints dictated by the organization of the process of scheduling in specific universities;

c) acceptable rate of the convergence of the optimization process of scheduling. [4]

The quality evaluation function plays the key role in the evaluation of the quality of the schedule and determining the limits of the optimization process.

The initial data for the drawing up of the educational schedule are:

$A=\{a_i\}$ – set of auditoriums;

$T=<t_i>$ – amount of time – arranged set of study time quanta (quantum – two academic hours);

$W=\{w_i\}$ – set of lecturers;

$P=\{p_i\}$ – set of classes;

$G=\{g_i\}$ – set of student groups;

$U=\{<p_i,g_i>\}PG$ – set of learning plans for student groups;

Thus, the task of drawing up of educational schedule is formulated in the search space

S:A*TWP*, (for Polotsk State University there are about 36 556 977 600 combinations. Using the brute force search it would take about 40 years to solve the problem).

Let us formulate the description of the task. Since the schedule is unacceptable if it contains at least one conflict to the teacher, or a group or audience, it is possible to formulate strict limits

For every $s_1=<a_1,t_1,w_1,p_1>$S and $s_2=<a_2,t_2,w_2,p_2>$S, for each $t_1=t_2$ is true

1. $a_1 a_2$;
2. $w_1 w_2$;
3. $U / \{p_1\}\ U / \{p_2\} =$;

It should be emphasized that the restriction #3 includes the right planning of streaming classes, claiming no intersection of streaming groups.

4. For classes, the duration of which is more than one quantum of scheduled time, it is necessary to introduce an additional constraint on the capturing of sequential quanta.

5. The schedule must be submitted to all scheduled classes from P – this is the requirement of the completeness of the schedule.

6. A pair (w, p) is usually assigned to every lecturer (See. source data). That's why (w,p) in schedule should also exist in the lecturer's N assignment plan.

The problem of the optimal schedule is to find a schedule with the lowest price. We propose to use as an evaluation function the following heuristic function of preferences:

$$Q(S)=(a_1 G_1+a_2 G_2+a_3 G_3+a_4 G_4+a_5 G_5)+(a_5 A_1+a_6 A_2)+(a_7 W_1+a_8 W_2+a_9 W_3)+a_{10} P_1.$$

Here:

G_1 – number of transitions among university buildings during the day for student groups (subgroups);

G_2 – number of gaps in student groups schedules;

G_3 – amount of diversity in classes during the day for students groups (subgroups);

G_4 – amount of deviations from the planning of classes;

G_5 – going beyond the recommended study time calendar;

A_1 – number of gaps in auditorium schedules;

A_2 – degree of utilization of auditoriums during a class;

W_1 – number of transitions among university buildings during the day for lecturers;

W_2 – going beyond the recommended lecturer's working calendar;

W_3 – number of gaps in lecturers' schedules;

P_1 – degree of learning plans coverage by the incomplete schedule;

$a_1, a_2, a_3, \ldots$ – scaling coefficients.

The selection of scaling coefficients can also be different. We have applied the method of expert assessment of the impact of various factors on the general idea of the correct schedule. Maximum penalties are applied for unacceptable violations of our idea of a good schedule .

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