Automated Information System "ABITURIYENT".
Designed solution of problems of maintenance of examination security.

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1. Introduction

The most important factor in a person's development is knowledge. Azerbaijan is a state rich in oil and gas. But these resources are non-restorable resources. The government of our republic is well aware of it and pays great attention to the development of non-oil sector of economy. Education is one of the priorities of our government and our Republic does its best to change black gold into human gold. Enhancement of ICT access in education is one of the indicators showing the development in the process of building informational society in our country.

Since 1992, admission to higher and secondary specialized educational institutions in Azerbaijan has been conducted by the State Students Admission Commission (SSAC) in centralized order on the basis of test examinations. Conducting of examinations in centralized order predetermines its mass character, difficulty and requires utilization of lots of material and human resources in this process.

Table 1

General information about admission examinations to higher educational institutions of the Azerbaijan Republic

Number of exam	Number of exam buildings	Number of exam rooms	Number of invigilators in exam rooms	Number of exam managers	Number of applicants
1	72	1428	2861	265	41252
2	60	1239	2405	232	33028
3	29	615	1206	121	17971
4	22	493	980	85	14095
Total	183	3775	7452	703	106346

Table 1 includes information about the examinations held by SSAC in 2007 for admission of students to higher educational institutions of our Republic.

As it seen from the table, on the first day 41252 applicants took part in the examination. 72 buildings and 1428 halls were used to hold the examination. The control in these halls was implemented by 2861 invigilators. 265 people managed the examination. The information indicated in this table visually demonstrates the difficulties concerning projection, organization, management and administration of the exam. Design and realization of procedures directed to the security of examination as a whole is of vital importance here.

2. The conditions affecting the security of examination

One of the main issues during testing is the security of examination. The process of testing is regulated in accordance with the 10th Standard of the Educational Testing Service (Assessment Administration). These Standards basically include such matters as the organization of admittance of applicants to the examination, the maintenance of exam regulations by them, the delivery of examination materials to the place of testing, the prevention of copying (cribbing), etc.

All these issues are very important and their solution is directed to ensure security of examination. It should be stated that they are totally solved in our system.

As one of the former Soviet republics, Azerbaijan still has some negative moments regarding the access to education, there still remain certain negative moments related to access to education which are natural for the country that is in transitional period of its development.

That is why there are certain differences in our approaches to the issue of exam security as compared with the USA and other advanced European countries. This imposes additional requirements on the issues of security of exam in our country.

It should be taken into consideration that the fate of a test taker is determined in the examination hall. In such case the success at test exam depends on many factors which are determined with the conditions of the exam and may negatively affect the results of assessment. This includes:

- The convenience of the hall (illumination, presence of appropriate furniture) for the conducting of the examination;
- General environment of testing in the hall;
- The possibility of influence of test takers on one another;
- Eensuring the due level of the control of testing process, etc.

Availability of buildings and rooms is determined by their monitoring during the year.

The situations when positive results can be obtained by cheating must be prevented.

Our experience of several years shows that it is more expedient to solve security problems before the exams, on system level by applying special algorithms and procedures in program software. They are used in attaining the main purpose of the organization and examinations, which is to provide every participant with favourable and comfortable conditions on which he/she can demonstrate his/her knowledge as much as possible.

3. Seating of the exam participants in examination rooms.

In most countries there is not such a problem. At best, the exam participants are seated by using the generator of casual digits.

In the first years of examinations we also did not pay much attention to this point and thought that by seating the exam participants casually we provide each of them with equal conditions.

But analysis showed that this problem is not so simple and requires more attention. It was determined that while seating not controlled by programming, the graduates of the same class, moreover, in some cases, all of them or most of them can be found in the same room and occasionally have the same variant of test. In such cases controlling the behaviour of tested participants is very difficult. In relatively poor control, distortion of the marks of tested participants can take place.

On the basis of analysis and experience gained, factors that negatively affect the exam environment, totally, the ecology of the applicants, and that appear to be real risk factors in examination rooms, were determined:

- presence of graduates of the same school in the examination rooms (this category of participants have a higher index of unity, and as the experience shows, it works against them);
- uneven distribution of test variants among them (this increases the risk of copying (cribbing);
- presence of the persons that are close relatives (such as brother & sister, brothers & sisters) in the rooms (as the needed information is not mentioned in application forms, it is impossible to determine this category of participants, so we can only talk about participants that are probably close relatives);
- presence of the graduates of schools that are in the same region (usually graduates of schools of regions with a few schools appear to know one another);
- presence of exam participants with different levels of potential knowledge (there is a risk of copying);

- presence of exam participants of different ages (there is a risk of pressure of older ones on younger);
- taking exam in participant's own school (it gives certain advantage to the applicant and the principle of equal conditions for everybody is being violated), etc.

Taking into account the information, problem of seating can be formulated in this way:

Participants in examination rooms should be seated in such a way that:

1) It is not allowed to seat the applicants with different potential of knowledge in the same hall.
2) It is not allowed to seat the applicants of different ages in the same hall.
3) The number of graduates from the same schools in the same hall should be minimal. It is not allowed to seat them close to one another.
4) The random distribution of the same variant of the test among them should be minimal;
5) The number of the related individuals should be minimal. They are not allowed to sit close to one another;
6) Number of the graduates from the schools of the same region should be minimum. They are not allowed to sit close to one another;
7) It is not allowed to let the applicants to take exam in his/her school.
8) The applicants answering the test questions prepared only in one variant should be placed at possible maximum distance from one another.

Points #1) and #2) are realized while determining contingents for seating.

On the basis of experience all exam participants are divided into the contingents shown below:

- graduates of the current year, with the average school marks 4.5 -5.0;
- graduates of the current year, with the average school marks 4.0 – 4.4;
- applicants under 18 on the exam day;
- applicants at the age of 18 – 20 on the exam day;
- applicants who are above 20 on the exam day.

During the realization of the seating procedure priorities are appropriated to seating criteria and risk groups shown below are determined:

1) Participants with disabilities.
2) Graduates from the schools where the exam is held.
3) Participants taking the test prepared as one variant.
4) Other participants that are grouped by districts.

The seating task is carried out in two stages:

Stage 1: For every participant the exam room (building) is chosen automatically.

Stage 2: For every contingent the seating procedure is applied.

The algorithm of realization of procedure of seating consists of the following:

1. The risk groups are seated sequentially. The seating process begins from a risk group which has a highest priority.
2. Seats in a hall are ranged by distance of the place from the first place in the hall.
3. All halls are considered as uniform one-dimensional space of the same measured seats.
4. In every step of seating the number of the next place is calculated by the formula:

$$\mathbf{n = m + Int\ (s/k)}$$

Where m – number of the place occupied in the previous step

s – number of free places (readout begins on the place number m+1)

k – number of the individuals still not seated in the given risk group on the considered criteria.

During selection of a place for the applicant every criteria of the seating is checked, and if any criterion fails, then with the movement up (down) a “proper” place is determined.

For the seating of the applicants with physical disorders a hall is assigned on the lowermost floor, and with a bigger capacity. Experience shows that in this case more optimal favorable conditions are created for them.

Exams are held in few days (usually in 4 days) and each time the same exam rooms are used. That is why each time the order numbers of the rooms are encoded for security purposes. In the passing sheet for exam only the name and address of the building, code number of the room and participant’s place in it are written. It lacks information about the name and floor of the room.

4. Administration of the exam

Application of the described algorithms and procedures of seating exam participants prevent conditions that can cause risk for security. On the other hand, it is necessary to organise a control of exam participants` behaviour during the exam.

In our system the 3-stage system of control is applied:

Stage 1: For the control of maintenance of the rules of behavior at exam, one or two invigilators are appointed to every hall depending on the number of exam participants.

Stage 2: For the control of maintenance of the rules of conduct at exam, one exam manager is appointed to a group of 5 - 7 halls.

Stage 3: For the control of maintenance of the rules of conduct at exam one observer is appointed to the whole building.

Furthermore, by permitting the mass media representatives into the exam buildings to let them observe the exam procedure, public control is realized.

5. Distribution of the invigilators to exam rooms.

Invigilators are assigned to watch the discipline in the exam rooms. They should prevent any attempts of exam participants to break the exam rules.

In our country leading teachers of secondary schools are appointed as invigilators. They are chosen by recommendations of the school directors and they are trained and instructed during the year. While distributing the invigilators to exam rooms, following principles are applied:

1) It is not allowed to assign the invigilator to the hall, whose specialty is close to the main subject of the test,
2) It is not allowed to assign the invigilators working in the same organization to the same hall,
3) It is not allowed to assign the invigilator to the hall, if any of his/her children is taking the exam there.

6. Revelation of the copying cases.

Despite all the efforts at the stage of seating participants to guarantee normal conditions in examination rooms and minimization of the risk, there remains some risk of breach of the exam rules.

One of the most important factors in guaranteeing the security is revelation of the copying cases that took place in exam rooms and determining the invigilators who let this happen.

Analysis is conducted by comparing the answers of exam participants. Answers to items on all the subjects are compared. Answers of each participant are compared with the answers of all other participants that took exam in that building.

As a result, for each pair, the number of the same true answers (t), number of the same wrong answers (w) and number of the same items that remained unanswered (s) are determined. On the basis of some values the total number of coinciding

answers (n) and the percent of coincidence (T) and the percent of coincidence in false answers (F) are calculated:

$$n=t+w+s\ ;\ \ T=(n/k)*100\%\ ;\ F=(w/k)*100\ \%\ ,$$

where k is the number of questions in examination subject.

Obtained values of T and F are compared with their critical values determined by expert ways and the leadership decides whether to acknowledge the case of revelation of copying or not.

7. Conclusions

- ***One of the main issues during testing is the security of examination.***
- ***Our long-term experience shows that some problems of security are likely to be solved before examinations on system level by application of special algorithms and procedures.***
- ***They are directed to ensure the main aim of examination projection, which includes creation of such convenient and comfortable conditions for all participants of the examination, in which they can fully demonstrate their knowledge.***
- ***The use of procedures proposed in the report for seating of examinees in exam rooms and right selection of invigilators and their distribution to the exam rooms prevent the conditions which can cause risks for security of exams.***
- ***Analysis for the revelation of facts of cheating lets to prevent fixed errors by annulling the results.***