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[1]S. P. Borsuk,
[2]A. V. Kusyk

CORRECTED ALGORITHMS FOR PILOTS TESTING SYSTEM BASED ON EDUCATION PROCESS LIMITATIONS

[1,2]Educational-Scientific Institute of Information Diagnostic Systems, National Aviation University, Kyiv, Ukraine
E-mails: [1]grey1s@yandex.ru, [2]alena11_95@mail.ru

Abstract—*The paper deals with the improvement of testing algorithms taking into account external limitations.The algorithms of intermediate and final testing are shown. Analysis of the external limitations are given. Proposed algorithms with time, accuracy and attempts limitations.*

Index terms—Algorithm; computer testing; knowledge control system; pilots knowledge control.

I. INTRODUCTION

Pilots work is the most difficult type of human activity, consequently training is difficult as well. The professional training process includes a wide variety of instruments and devices. The training level should mainly guarantee safety [1]. Accident analysis and preconditions shows that factors such as the mistakes in flight operations, omissions and deficiencies in the organization, management of flights and aircrew training methodology, errors in piloting technique and operation of aviation equipment determines the overall accident rate and the reasons for them, they are notorious for its repeatability. This causes the need to improve the organization and methodology of flight training for flight crews.

Aviation training process [2] consists of many elements, each of which has its own purpose. Simulator as part of the educational process and training plays an important role in training aviation specialists not only in the final training stages, but also for training, during training and test knowledge and skills.

Computer testing [3] is one of the stages to obtain a pilot license during theoretical knowledge check. This approach to the professional knowledge verification of future pilots save candidates time and excludes subjectivity at the evaluation. The candidates must demonstrate their knowledge and skills (for example, knowledge of the aeronautics laws, flight training, basic science application, engineering, physical or computer science, mathematics, technical management, and organizational principle etc.).

Knowledge testing can be the tool by which it is possible a comprehensive approach to the flight crews preparation, allowing to form skills, experience, professional qualities.

Computer testing of successfulness gives an opportunity to realize the main didactic control training principles. Well-ordered computer technology system allows to increase the training effectiveness and expands possibilities of presentation different kinds of educational information.

II. PROBLEM STATEMENT

The problems of specialists training quality increase are important, and it is necessary to search for new educational process forms and methods, the use of advanced learning technologies. This is especially urgent for the current stage of aviation education development, whose purpose is to prepare specialists in aviation area with high professionalism level, general and aviation professional culture, creating conditions for continuous professional and personal development.

Despite the fact that the initial flight training principles have not changed and remain sufficiently effective, modern conditions require modification of traditional flight personnel training approaches. There is a wide variety of testing knowledge algorithms, but they do not take into account all the details required for the future pilot, and this brings up training complications.

Thus the goal of this paper is to improve existing knowledge testing algorithms, basing on the pilots vindications.

III. KNOWLEDGE TESTING OF PILOTS

Admission to the activities of civil aviation is made in two stages. At the first stage the government inspects for compliance with the requirements of the candidate to perform the duties and gives a corresponding certificate.

At the second stage the admission directly to the performance of functions are made by the employer, previously carry out preparations, trainings and control provided by air law.

Knowledge verification is carried out during testing by the use of a personal computer or a tests printed on paper.

Quality of knowledge verification is ensured by testing on the approved questions and objective and personal control of knowledge verification process.

Tests are formed from questions on areas of knowledges provided by aviation regulations for holders of the relevant certificate types.

It is true that there are a lot of tests classifications. For ex., according to the goals they are divided on training and control, and according to the functions – on preliminary, current, intermediate and final along with open (for each question pilot should offer his answer, to add a word, phrase, sentence, sign, formula, etc.) and closed (each question is accompanied by prepared variant of answers, where it is necessary to select one or more correct answers).

Tests forms using a variety of computer-based tools from editors and various programs, to the presentations development and to the use of different programming languages by the help of which automated systems can be created. There are a lot of technical means which are designed to automate the testing and several software modules which are the part of the automated testing system.

A general knowledge testing algorithm [4] contains several general elements common for all kinds of testing. Due to this algorithm user may authorize or register and then begin to solve tasks. At the end of the test user can see the result on the screen.

During the development this algorithm may vary depending on the goals and desires of the developer. For example, intermediate testing (Fig. 1) is a set of training sessions in a simulation environment, or theoretical questions.

After each question, on which will be given the wrong answer, the listener has the opportunity to repeat the theoretical material on this theme in an electronic textbook, or look at an example of behavior in a simulated environment.

Final testing (Fig. 2) is represented by a certain number of final questions/simulator sessions. Each correct answer helps improve the assessment. As a result, after passing the test, the listener can see the final mark on the screen.

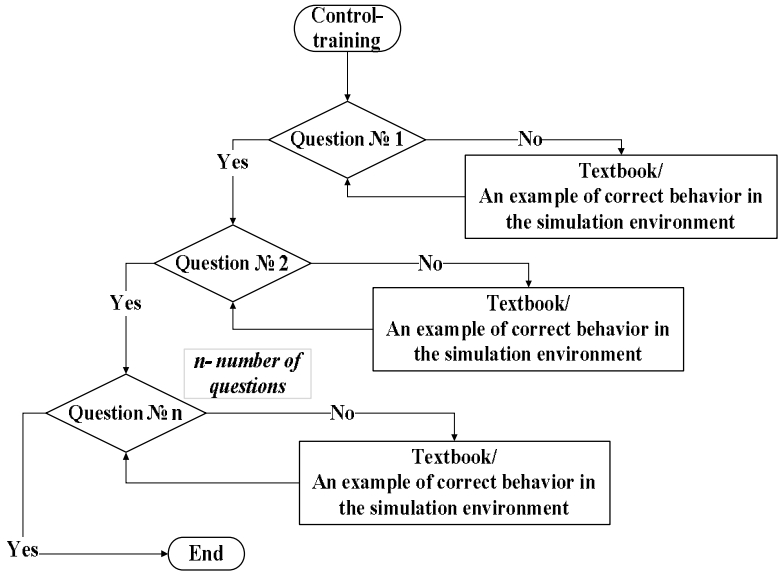

Fig. 1. Intermediate testing algorithm

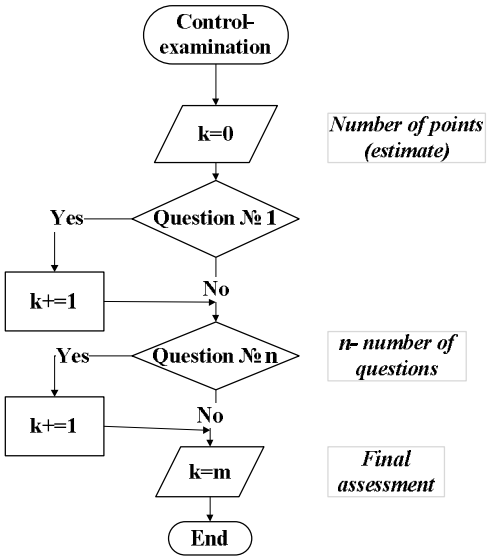

Fig. 2. Final testing algorithm

IV. Correction of Testing System According to the External Limitations

During knowledge testing are taken into account many factors [5], among them the various limitations that allow to form the testing system. Consider the fact that resources and time are not unlimited, examples of limitations in the test system are follows:

1. Time limit

Testing can be limited in time – for the whole test, and for each question. At the same moment, the amount of time allocated to each question can be different. The use of computer testing in terms of time limits allows to increase the amount of verifiable knowledge and significantly increase the objectivity of the assessment due to standardizing the tests and testing procedure.

2. Limit of working place number

According to the available amount of resources (computers, simulators) a predetermined number of candidates will be in turn in a few number of approaches to be tested.

3. Limitations according to the number of instructors

For a given number of instructors all candidates are distributed among them. With the increasing number of students, respectively, increases the waiting time of work with an instructor. To solve this problem, the number of candidates should be limited, which will increase the learning efficiency.

4. Limitations according to the amount of memory

The amount of memory depends on how much information should be stored. While preserving data about the flight simulation, video, biometrics data, etc. it is need a presence of servers, which is also limited.

5. Accuracy limitation

Testing accuracy depends on the type of the task. When checking the general theoretical information with imaginations of devices there is no need in minute detail to inspect, it is sufficient that the candidate can be oriented in information. On the other hand, when working with the simulator candidate must accurately determine the course, angles and to demonstrate a high flight training.

6. Bandwidth limitation of inter-element links within the system

Physical wire may transmit a limited amount of data. When the limit is reached, the data rate is reduced, which leads to the testing process inhibition. For this reason, the number of candidates executing testing at a specific time is limited.

7. Quality of using tools limitations

While working with the simulator a candidate is not able to work under real weather conditions, fog, clouds, etc. For this reason, the simulation model provides additional information to the pilot that he should get by himself from the environment, focusing on his senses.

8. Limitations according to the number of attempts

When passing the test in the training format, the candidate obtains right to make mistakes, repetition of the material and re-passing task. The number of attempts may be limited on the whole test or on every single question.

V. TESTING ALGORITHMS WITH LIMITATIONS

Taking into account analyzed limitation it is possible to correct the structural scheme of the algorithm. Examples of this approach is an algorithm of testing with a time limit on the test as a whole (Fig. 3(2)) and a time limit on a separate task of the test (Fig. 3(3)).

Below is a testing algorithm with a time limit of the test as a whole. It works in following manner: at the start of the test user is logged (or open his account), select the topic on which he wants to be tested. At this moment forms an array of issues, and set a time for test execution, and the candidate can start his work. It makes it possible to move on to the next question, and then return to the previous.

Throughout the testing takes place check of time. If there is enough time, the candidate continues his work. If the timer is shut down, automatically stops the testing program and user has the opportunity to view his results. If student have answered on all the questions of the test in the allotted time, the percentage of correct answers is taken into account in the final mark. At the same time there is the possibility of accounting complexity of the task. If the student did not answer on all test questions, and the time allotted for testing is over, the questions that were not answered are equal to the questions on which was given an answer with an error.

In the case of a time limit on a separate task of the test the calculation of results is the same. But in this limitation taken into account time of each question and if the candidate is not kept within the specified time, the wrong answer to the question is set, and the program automatically switches to the next task.

Another testing method based on the external factor is the testing algorithm with accuracy limitation (Fig. 3(4)).

While passing the test is formed an array of questions [6] that are sorted by themes. Also is set the value of accuracy, which candidate could achieve with the passage of the test. Accuracy of the answer may be a binary (know / do not know), the accuracy of up to tenths (10% ... 20%), the accuracy of up to 5% (5%, 10%, 15%), the accuracy of up to 3% (3%, 6 %..) etc.

Given accuracy is divided on all questions so that each task has its own value of accuracy (depending on type). In consequence of this, after each correct answer is checked the achieved value and compared with a predetermined value. While accuracy will not match the desired result, the candidate will receive the following question. Upon reaching the required accuracy the test on a given topic ends and begin new questions on a new topic. This continues for as long as there will not be passed all the themes.

In addition, in the test is often used testing algorithm with a limited number of attempts. It works as follows: after the user registration and login in the personal cabinet, candidate selects the topic of testing and starts to work. When the test results are unsatisfactory, depending on the number of given attempts, the pilot has the ability to take the test again (or several times) until all attempts have been exhausted. After that, if a candidate failed to achieve the desired result, he gets a “fail” and goes for re-training.

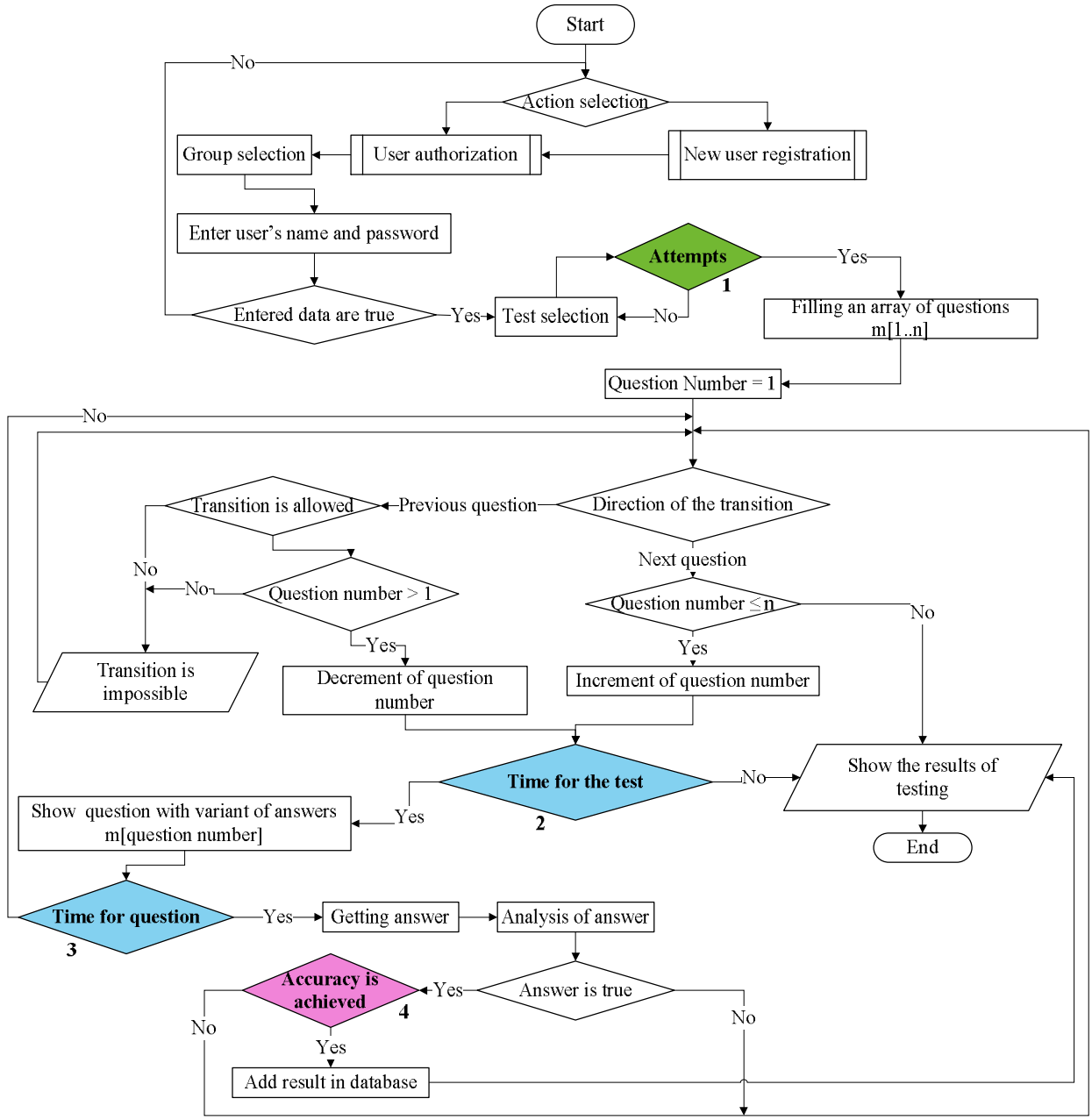

Fig. 3. Algorithm of testing with attempts limitation (1), a time limit on the test as a whole (2) and a time limit on a separate task of the test (3), accuracy limitation (4)

VI. CONCLUSION

In this paper pilots oriented knowledge control limitation analysis based on their professional activity peculiarities was proposed.

Standard algorithm of intermediate and final testing applicable for pilots was represented and taken as basic.

Testing algorithm correction according to the analyzed limitations including time, accuracy and attempts is suggested.

In further researches corrected algorithms for simulation part of knowledge verification and learning components of general pilots education process may be observed along with wider description of more limitations and their determination for each pilot in person.

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Borsuk Sergiy. Candidate of Technical Science. The associate professor.
Education-Scientific Institute of Information Diagnostic Systems, National Aviation University, Kyiv, Ukraine.
Education: National Aviation University, Kyiv, Ukraine. (2007)
Research interests: aviation simulators, human factor.
Publications: 82
E-mail: grey1s@yandex.ru

Kusyk Alona. Bachelor.
Education-Scientific Institute of Information Diagnostic Systems, National Aviation University, Kyiv, Ukraine.
Education: National Aviation University, Kyiv, Ukraine. (2016)
Research interests: knowledg control.

С. П. Борсук, А. В. Кусик. Скореговані алгоритми для системи тестування пілотів на основі обмежень процесу навчання

Розглянуто питання вдосконалення алгоритмів тестування з урахуванням зовнішніх обмежень. Надано алгоритми проміжного і підсумкового тестування. Проведено аналіз зовнішніх обмежень. Запропоновано алгоритми з обмеженням часу, точності та кількості спроб.

Ключові слова: алгоритм; комп'ютерне тестування; система контролю знань; контроль знань пілотів.

Борсук Сергій Павлович. Кандидат технічних наук. Доцент.
Навчально-науковий інститут інформаційно-діагностичних систем, Національний авіаційний університет, Київ, Україна.
Освіта: Національний авіаційний університет, Київ, Україна (2007).
Напрям наукової діяльності: авіаційні тренажери, людський чинник.
Кількість публікацій: 82.
E-mail: grey1s@yandex.ru

Кусик Альона Вікторівна. Бакалавр.
Навчально-науковий інститут інформаційно-діагностичних систем, Національний авіаційний університет, Київ, Україна.
Освіта: Нацональний авіаційний університет, Київ, Україна (2016).
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С. П. Борсук, А. В. Кусик. Скорректированные алгоритмы для системы тестирования пилотов на основе ограничений процесса обучения

Рассмотрены вопросы усовершенствования алгоритмов тестирования с учетом внешних ограничений. Показаны алгоритмы промежуточного и итогового тестирования. Проведен анализ внешних ограничений. Предложенны алгоритмы с ограничением времени, точности и количества попыток.

Ключевые слова: алгоритм; компьютерное тестирование; система контроля знаний; контроль знаний пилотов.

Борсук Сергей Павлович. Кандидат технических наук. Доцент.
Учебно-научный институт информационно-диагностических систем, Национальный авиационный университет, Киев, Украина.
Образование: Национальный авиационный университет, Киев, Украина (2007).
Направление научной деятельности: авиационные тренажеры, человесческий фактор.
Количество публикаций: 82.
E-mail: grey1s@yandex.ru

Кусик Алена Викторовна. Бакалавр.
Учебно-научный институт информационно-диагностических систем, Национальный авиационный университет, Киев, Украина.
Образование: Национальный авиационный университет, Киев, Украина (2016).
Направление научной деятельности: контроль знаний.