Computer Adaptive Testing as an Automated Control of Students’ Level of Preparedness Taking into Account their Individual Characteristics

Authors:
- Kozmina Irina S.
- Lukyantsev Denis S.
- Musorina Olga S.

National Research University "MPEI"

Speaker’s
Denis
Lukyantsev

National Research University "MPEI"
Forms of computer testing

- A computer-based form for presenting variants of a blank test with a fixed set of tasks
- Automated compound of fixed-length test cases from a bank of calibrated tasks
- Computer adaptive testing with the generation of adaptive tests of varying lengths from a bank of calibrated tasks
Disadvantages arising from computer testing

- Negative psychological reactions of examinees to computer presentation of test
- Impact on students' results of previous computer experience
- The influence of the interface on the testing results
- The influence of restrictions with computer presentation of test on the reliability of its results
Basic components of the implementation of computer adaptive testing

- Theoretical basis
  - Principles
  - Methodologies

Computer Adaptive Testing

Control Performance Indicators

- Pedagogical basics
- Technological basis
Computer Adaptive Testing as an Automated Control of Students’ Level of Preparadness Taking into Account their Individual Characteristics

Special aspects of adaptive computer testing

- individualization of testing speed;
- individual approach to students with different level of training;
- the lack of possibility of cheating during test tasks;
- immediately reflection of the result of the test;
- minimization of the number of tasks and testing time;
- elimination of time, organizational and financial costs for standardization of tests norm.
The algorithm for implementing of two-step computer adaptive testing

three stage of testing process
- the first (fundamental) stage differentiates students according to the level of knowledge;
- the second and third stages carry out the adaptive testing process with the final interpretation of the results.

The first block of questions
Fundamental «Obligatory knowledge of the subject»

Test Results Evaluation Unit

The block of decision-making of the further selection of the testing level

The second block of questions
low level of difficulty

The second block of questions
medium level of difficulty

The second block of questions
high level of difficulty

Test Results Evaluation Unit

The block of decision-making of the further selection of the testing level

The third block of questions
low level of difficulty

The third block of questions
medium level of difficulty

The third block of questions
high level of difficulty

Test Results Evaluation Unit

Results of testing
### Initial data for modeling of test

<table>
<thead>
<tr>
<th>Initial data</th>
<th>In general</th>
<th>In the presented algorithm</th>
</tr>
</thead>
<tbody>
<tr>
<td>The number of stages</td>
<td>From 2 to N</td>
<td>3</td>
</tr>
<tr>
<td>The number of questions in each stage</td>
<td>From 5 to N</td>
<td>The 1st stage – 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The 2nd stage – 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The 3rd stage – 5</td>
</tr>
<tr>
<td>The number of difficulty levels of questions</td>
<td>From 2 to N</td>
<td>The 2,3 stages – (three difficulty levels)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>high</td>
</tr>
<tr>
<td>The number of points for the correct answers in</td>
<td>At the discretion of the</td>
<td>The 1st stage – 1 point</td>
</tr>
<tr>
<td>the test</td>
<td>educator</td>
<td>The 2,3 stages (2,3,5 points depending on the complexity of the question)</td>
</tr>
</tbody>
</table>
The scale of evaluating the results of testing

<table>
<thead>
<tr>
<th>%</th>
<th>Points</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>96-100</td>
<td>53-55</td>
<td>5</td>
</tr>
<tr>
<td>91-95</td>
<td>50-52</td>
<td>5</td>
</tr>
<tr>
<td>88-90</td>
<td>49</td>
<td>4</td>
</tr>
<tr>
<td>84-87</td>
<td>47-48</td>
<td>4</td>
</tr>
<tr>
<td>81-83</td>
<td>45,46</td>
<td>4</td>
</tr>
<tr>
<td>78-80</td>
<td>43,44</td>
<td>4</td>
</tr>
<tr>
<td>74-77</td>
<td>40-42</td>
<td>3</td>
</tr>
<tr>
<td>71-73</td>
<td>37-39</td>
<td>3</td>
</tr>
<tr>
<td>68-70</td>
<td>35-36</td>
<td>3</td>
</tr>
<tr>
<td>61-67</td>
<td>34</td>
<td>3</td>
</tr>
<tr>
<td>55-60</td>
<td>30-33</td>
<td>2</td>
</tr>
<tr>
<td>0-54</td>
<td>0-29</td>
<td>2</td>
</tr>
</tbody>
</table>
The scheme of the algorithm at the first stage of testing
The scheme of the algorithm at the second and the third stages of testing

0 1 L 2 3 4 5

0 1 M 2 3 4 5

0 1 H 2 3 4 5

The low level of difficulty

The medium level of difficulty

The high level of difficulty

The third stage of testing
Computer Adaptive Testing as an Automated Control of Students’ Level of Preparadness Taking into Account their Individual Characteristics

The conditions for starting testing

- the availability of tests with different size in a computer system;
- the initial level of testing is chosen;
- the number of questions required for the next level of complexity is defined.

Recommended settings

- if there is one topic in the test, then the number of questions at the difficulty level is N;
- if there are several topics in the test, but less than 5, then the number of questions is more than one and less than N;
- if there are more than 5 topics in the test, then the number of questions in each is n divided by the number of topics.
Psychological features of computer adaptive testing

- comprehensibility of tasks;
- adaptability of testing;
- autonomous character of accomplishment of tasks;
- the possibility of discussion of the test with educator;
- objectivity of assessment of student's knowledge.
Thank you for attention!

Speaker’s contacts:

Denis Lukyantsev
National Research University "MPEI"
LukyantsevDS@mpei.ru