

ON MULTIPLE CHOICE EXAMINATION

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1 Introduction

Using multiple choice tests (grille-test) is one of the methods for checking the knowledge. It consists in the choice of the only correct answer from the given ones, for each of the n questions. On an additional sheet of paper with the following rubrics

| | a | b | c | k |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| | | | | |
| | | | | |
| n | | | | |

the examined person is to cross the squares which, in his opinion, correspond to the true answers. For example, if the second problem has the correct answer C , he will cross the square of the second line and column C .

The examiner uses an identical sheet, but transparent in the positions where the correct answers are. The good answers are counted.

For each correct answer a preestablished score is given and the sum of the obtained points is transformed in a grade.

For example, at the entrance exam of the Engineering Faculty of the North University of Baia Mare, in the summer of 2002, a multiple choice test was used. Each candidate got 15 questions, each with 5 possible answers: a, b, c, d, e . The neighbours in the course room were supposed to answer the same questions, but in a different order. For each correct answer 6 points were allotted. Thus, a candidate who succeeded to give valid answers to all the 15 questions, got $6 \cdot 15 = 90$ points, plus other 10 points ex officio. The final grade was equal to the total number of points divided by 10.

For instance, if a candidate answered correctly 7 questions, he got the grade

$$N_7 = \frac{6 \cdot 7 + 10}{10} = 5,20,$$

and for 6 correct answers

$$N_6 = \frac{6 \cdot 6 + 10}{10} = 4,60.$$

We can notice that for a passing grade at least 7 correct answers were required.

2 What chances has a candidate to get a passing grade?

Let us denote by A the event of obtaining a passing grade and with \bar{A} the contrary of this event. Be it $p_i(A)$ the probability that a candidate who knows for sure i answers of n and answers at random the other $(n - i)$ questions should get a passing grade. The event that out of $(n - i)$ aleatory answers a should be correct and b incorrect,

$$a + b = n - i,$$

will be denoted by (a, b) .

The probability that a candidate who doesn't know anything at all should get a passing mark would be:

$$\begin{aligned} p_0(A) &= p[(7, 8) \cup (8, 7) \cup (9, 6) \cup \dots \cup (15, 0)] \\ &= p(7, 8) + p(8, 7) + \dots + p(15, 0) \end{aligned}$$

Denoting by p the probability that a correct answer should be given to a problem and with $q = 1 - p$ the probability of the contrary event, we have,

$$p = \frac{1}{5} \quad \text{and} \quad q = \frac{4}{5}.$$

Thus we will have

$$p_0(A) = C_{15}^7 p^7 q^8 + C_{15}^8 p^8 q^7 + \dots + C_{15}^{15} p^{15} q^0 = 0,018058802 \dots$$

that is

$$p_0(A) \approx 1,8\%,$$

which shows that out of 100 candidates approximately 2 will pass, even if they don't know anything, crossing at random.

A candidate who knows for sure the answer of only one of the given problems and answers at random the other questions will get a passing grade with the probability

$$\begin{aligned} p_1(A) &= p(6, 8) + p(7, 7) + \dots + p(14, 0) = \\ &= C_{14}^6 p^6 q^8 + C_{14}^7 p^7 q^7 + \dots + C_{14}^{14} p^{14} q^0, \\ p_1(A) &= 0,04385438 \dots \approx 4,4\%. \end{aligned}$$

Therefore, out of 100 candidates, who normally should have get the grade 1,60, 4 candidates will be able to get a grade above 5.

Noting with N_i the deserved grade and with $p_i(A)$ the probability of the possibility of the same candidate getting a passing grade through the multiple choice test with 15 problems of 5 answers each, we get the following chart:

| N_i | 1 | 1,6 | 2,2 | 2,8 | 3,4 | 4 | 4,6 |
|--------------|-----|-----|-----|------|------|------|------|
| $[p_i(A)]\%$ | 1,8 | 4,4 | 9,9 | 20,5 | 38,2 | 62,4 | 86,5 |

3 Conclusions

This chart shows that the multiple choice test examination is not efficient, although convenient and rapid. This method can be improved by increasing the number n of the given problems, but especially by increasing the number k of possible answers.

The multiple choice tests can be useful for a pre-selection of the candidates, if their number is very large, and this should be followed by a profound examination.

References

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Abstract. This article approaches the study of the efficiency of the multiple choice tests in checking the knowledge. It is proved that this method, although very easy, is not efficient. It can be used only for the pre-selection of the candidates at contest examinations, provided their number is very large.

The pre-selection is to be followed by a thorough examination.

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