

# Method of constructing objective multiple-choice questions in Statistical Probability from the original Statistical Probability in the form of an essay

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**Abstract:** The article "Methods for constructing objective multiple-choice questions with multiple options for Statistical Probability from the original Statistical Probability problem in the form of essay". From designing a "matrix" to distributing the number of questions of the quiz to setting goals, building typical content covering subjective knowledge, weighting multiple-choice questions from easy to difficult, analyzing possible options to serve as a "bait" for learners, requires compilers to have logical thinking, patience, and a high sense of responsibility. From there, it helps learners deeply understand the root of the multiple-choice problem so that they can easily pass the assessment at the end of the university course.

**Keywords:** Original problem, lecturer, essay, multiple-choice, Statistical Probability

## 1. Introduction

Objective testing in Mathematics in general and Statistical Probability in particular is a form of testing and evaluation that universities have recently put into use to evaluate the end of student's modules in the spirit of the Ministry of Education and Training in order to "digitize" subjects at the university level. Cao Huu Hoa (2012) said that: "Planning a learning outcomes test envisages a rational distribution of the quiz questions according to the objectives and content of the subject that it can accurately measure the abilities that one can measure". That mean, we can set up multiple-choice questions from easy to difficult and analyze possible options to serve as "bait" students from the original problems. In this way, it helps learners deeply understand the root of the multiple-choice problem so that they can easily pass the assessment at the end of the university course.

## 2. Content

### 2.1. Preliminaries multiple-choice questions

#### 2.1.1. Objective test

Objective test is often shortened to multiple-choice, which is a form of test in which each question is accompanied by Pre-answered options

Objective testing provides students with part or all of the necessary information, requiring them to choose an option to answer or just fill in a few more words (closed-ended question type)

Duong Thieu Tong (2005) introduced the

following forms of multiple-choice: true-false multiple-choice type, double-choice type, defective multiple-choice type, multiple-choice type with many options.

#### 2.1.2. Purpose of the quiz

Duong Thieu Tong (2005) argues: a quiz can serve many purposes. It is most useful and effective when it is designed to serve a specific purpose.

Example: If the quiz is a end-of-semester test for grading and ranking students, the questions must be drafted so that the grades are spread out quite widely.

Conversely, if the quiz is a routine test that tests the minimum understanding of an ant part of the syllabus, then we will compose the questions so that most students get the maximum score.

#### 2.1.3. Multiple-choice sentence structure: consist of two parts

**Part 1:** Basic statements are also called lead sentences or questions

- Lead sentences have functions: Ask questions, situations, problems for learners to do.

- Basic requirements: The content of the lead sentence must be clear, the vocabulary describes enough ideas, easy to understand. The Probability subject must have sufficient data, from qualitative, quantitative, action required by the problem,...

**Part 2:** The interference plan and the correct one

- Main function of the noise option: A reasonable but incorrect answer to the question or problem raised in the lead sentence

-The right option, the best option: Demonstrates the learner's understanding and the best choice for the question or problem that the lead sentence requires

## 2.2. The study

### 2.2.1. Research methodology

Theoretical research on methods of testing, evaluation, building objective multiple-choice questions with many options, referring to relevant published research topics. Study the content of textbook programs, workbooks and reference materials in Statistical Probability for students at Tra Vinh University.

### 2.2.2. Analysis of subject content results

Cao Huu Hoa (2012) said that analyzing subject content is mainly the work of reviewing and distinguishing four types of learning

- Eventful information that students must remember or recognize,
- Concepts and ideas that must be explained or illustrated,
- Complex ideas that need to be analyzed or illustrated,
- Information, ideas and skills that need to be applied or translated into a new situation or problem.

### 2.2.3. Set up a quiz outline

One of the common methods is to construct a two-dimensional "matrix" structure table. Vertical indicates the knowledge to be tested. Horizontal row indicates the capacity to be checked. So, the editor must identify the competency group to check and what is the content group to check?

- The competencies to be tested are cognitive levels according to Bloom's scale-level classification from high to low: Evaluation, Synthesis, Analysis, Application, Comprehension, Knowledge.

- The group of content to be checked are the levels of awareness that the proposer requires of students

The two-dimensional matrix structure table combines the above two groups of targets together, which determining the "weight" of each "zone" in the structure of the test. The "weight" indicated by the cells on the table will allow us to determine the proportion of questions that will be written for that area.

Example: Planning the structure for the test: Probabilities of events

*Purpose of assessment:* Students' comprehension and application capacity (periodic assessment).

*Test objective:*

- + Competence: Recall definitions, concepts

symbols, probability formulas of events

- + Level: Understanding and Applying.

*Content group:* Definition, what is probability?  
Symbol:  $p(A)=?$ ; The Probability Formula of the event.

### 2.3. Build objective multiple-choice questions with many options to choose from the original probability problem in the form of essays through examples

*Example 1:* On the basis of the original problem: There are two doctors diagnosing the same patient independently. The likelihood of diagnosing the first doctor correctly is 90%, the second doctor correctly is 70%.

Calculate the probability:

- Both doctors correctly diagnose the disease.
- Have a doctor accurately diagnose the disease.
- The patient is correctly diagnosed with the disease.

The teacher can orient the suggestion for the solution to set up multiple-choice questions as follows:

- When are two events called independent?
- Definition of two conflicting events?
- If A and B are two independent events, then the probability  $p(A.B) = ?$
- If A and B are two conflicting events, then the probability  $p(\underline{A+B}) = ?$
- If A and  $\bar{A}$  are two opposing events, then the probability  $p(A) + p(\bar{A}) = ?$

### 2.3.1. Use symbols to identify formulas:

*Question 1: (Formula awareness level)*

There are two doctors who diagnose the same patient independently. Let B and C as the first doctor and second doctors, respectively, diagnose the correct disease. Let A is an event when both doctors diagnose the accurate disease, then the probability  $p(A) =$

- $p(B) + p(C)$
- $p(B). p(C)$
- $p(B) + p(C) - p(B.C)$
- $p(B.C)$

Analysis of the wrong option:

- Understand the probability of the sum of two conflicting events.
- Understand the probability of the sum of any two events
- Mistake when learners have not exploited to the results.

### 2.3.2. Digitize the problem and use opposites

*Question 2: (Comprehension level)*

There are two doctors who diagnose the same

patient independently. The test of the first doctor uncorrectly is 10%, the second doctor correctly is 70%. At that time, the probability that both doctors will diagnose the correct disease is:

- a. 0,16      b. 0,12      c. 0,63      d. 0,07

Analysis of the wrong option:

- a. Understand the probability of the sum of two conflicting events.  
b. Do not understand the oppositeness of the event when taking the data.  
d. Do not understand the subject.

### 2.3.3. Use negative questions

*Question 3: (Low level application)*

There are two doctors who diagnose the same patient independently. The test of the first doctor uncorrectly is 10%, the second doctor uncorrectly is 30%. Then, the probability of having a doctor diagnose the correct disease is

- a. 0,9      b. 0,34      c. 0,7      d. 0,3

Analysis of the wrong option:

- a. Learners do not understand the probability of properly diagnosis which doctor is highest.  
c. Do not understand the requirements of the lead sentence.  
d. Do not understand the oppositeness of the event when taking the data.

### 2.3.4. Using passive reasoning for events

*Question 4: (high-level application):*

The probability of independent diagnosis of the two doctors is 0,9 and 0,7, respectively, the probability of the patient being diagnosed correctly is:

- a. 0,9      b. 0,34      c. 0,97      d. 0,7

Analysis of the wrong option:

- a. Understand the result as those of the first doctor  
b. Learners do not understand the requirements of the lead sentence.  
d. Understand the result as those of the second doctor

By adding the hypothesis from the original problem, we can establish more multiple-choice questions by exploiting Bayers' consequential formula.

*Example 2: (New Original Essay Problem)*

There are two doctors who diagnose the same patient independently. The diagnose of the first doctor correctly is 90%, the second doctor correctly is 70%. If there is a doctor who diagnoses the correct disease, What is the probability that the first doctor diagnoses the correct disease?

### 2.3.5. Using Bayers' consequential formula

*Question 5: (high-level application):*

There are two doctors who diagnose the same patient independently. The correct diagnosis of the disease by the first doctor is 90%, the second doctor is 70%. If there is a doctor who correctly diagnosis the disease, then the probability of correctly diagnosing the disease by the first doctor is

- a. 0,794      b. 0,34      c. 0,21      d. 0,63

Analysis of the wrong option:

- b. Learners haven't taken into account the final result.  
c. Taking the data of the second doctor instead of the first.  
d. Mistakes in understanding the independence of two events.

## 3. Conclusions

Objective tests can serve many purposes, and test writers must clearly know their purpose in order to draft a valid test. To some extent, the trick "Construct objective multiple-choice questions with multiple options for Statistical Probability problem in the form of essay" as presented. The author sees it feasible enough to meet some angle of the prolem of "digitizing" University modules. In the science of teaching is no exception, the test planning gives us practical results in terms of knowledge, avoiding the negativity that the law and everyone recognizes as sufficient. This research of the author is accumulate through the experience of the teaching process combined with multiple-choice (metrology) researchers' materials. The main problem is that we share together to find the most optimal solutions, join hands for our human cultivation career to become more and more complete.

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