METHODS FOR SOLVING LOGICAL PROBLEMS

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Abstract: This article is about logic - the science of laws and forms of thinking that allow reasoning to be justified and expressed in words. Logic defines requirements that enable consistent and demonstrative reasoning.

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The word "logic" derives from the ancient Greek "logos" - knowledge. Logic is the science of laws and forms of thinking that allow reasoning to be justified and expressed in words. Logic defines requirements that enable consistent and demonstrative reasoning.

A text-based logical problem can be described as a problem that requires the application of logic to solve.

At the initial stage of education, it is important to create conditions for children that organically combine both playful and educational activities. It is necessary to organize a kind of complementary activity for children that is playful in form, familiar and attractive to the child, but educational in its focus. Such activities should involve achieving goals related to the child's adoption of a new educational-play experience.

Logical problems possess great potential. They contribute to the cultivation of critical thinking, encourage analysis of perceived information, and increase interest in mathematics. Logical problems promote the development of reasoning skills and the acquisition of methods for proper reasoning. Since their solutions do not rely on specialized knowledge, the focus during the process of solving them is on reasoning techniques. Information from which conclusions must be drawn is provided through text describing ordinary situations. Solving such problems teaches how to invent unfamiliar situations to the end, not to retreat in the face of difficulties, and instills confidence in one's abilities.

However, what is often observed in practice? Students are given a problem, they become familiar with it, analyze the conditions with the teacher, and solve it together. But does this approach maximize the benefits? No. If the same problem is presented again a day or two later, some students may still struggle with solving it.

In order for a younger student to be active in the learning process, it is necessary: firstly, to provide ample opportunities for independent work; secondly, to teach them methods and techniques of independent work; thirdly, to awaken in them a desire for independence, creating motivation for their own creative approach to solving educational problems.

The variety of logical problems is vast. Text-based logical problems can be conventionally divided into the following types:

1) all statements are true;

2) not all statements are true;

3) problems about truth-tellers and liars.

There are also primary operations on logical statements:

Negation of a logical statement - a logical statement that takes the value "true" if the original statement is false, and vice versa.

Conjunction of two logical statements - a logical statement that is true only when they are both true simultaneously.

Disjunction of two logical statements - a logical statement that is true only when at least one of them is true.

Implication of two logical statements A and B - a logical statement that is false only when B is false and A is true.

Equivalence of two logical statements - a logical statement that is true only when they are both true or both false.

Quantifier logical statement with a universal quantifier () - a logical statement that is true only when statement A(x) is true for every object x from a given set.

Quantifier logical statement with an existential quantifier () - a logical statement that is true only when there exists an object x in the given set such that statement A(x) is true.

Logical problems are connected with reasoning. The key to solving logical problems is mastering various methods.

Methods for Solving Logical Problems.

Method (from ancient Greek μέθοδος - path) is a systematic set of steps and actions that need to be taken to solve a specific problem or achieve a certain goal.

Method of reasoning. The method of reasoning is the most primitive method. It is used to solve the simplest logical problems. The idea behind this method is that we reason using all the conditions of the problem sequentially and come to a conclusion that will be the answer to the problem. This method is usually used to solve straightforward logical problems.

Problem 1. Vadim, Sergey, and Mikhail study different foreign languages: Chinese, Japanese, and Arabic. In response to the question of which language each of them is studying, one of them said, "Vadim studies Chinese, Sergey does not study Chinese, and Mikhail does not study Arabic." Later it was found that in this answer only one statement is true, and the other two are false. Which language is each young man studying?

Solution. There are three statements. If the first statement is true, then the second one is true as well, since the young men study different languages. This contradicts the conditions of the problem, so the first statement is false. If the second statement is true, then the first and third statements must be false. In this case, it turns out that nobody is studying Chinese. This contradicts the conditions, so the second statement is also false. Therefore, we conclude that the third statement is true, and the first and second statements are false. Thus, Sergey is studying Chinese, Mikhail is studying Japanese, and Vadim is studying Arabic.

Answer: Sergey is studying Chinese, Mikhail is studying Japanese, and Vadim is studying Arabic.

Problem 2. During a trip, five friends - Anton, Boris, Vadim, Dima, and Grisha - met a female fellow traveler. They asked her to guess their surnames, with each of them making one true and one false statement:

Dima said: "My surname is Mishin, and Boris's surname is Khokhlov." Anton said: "Mishin is my surname, and Vadim's surname is Belkin." Boris said: "Vadim's surname is Tikhonov, and my surname is Mishin." Vadim said: "My surname is Belkin, and Grisha's surname is Chekhov." Grisha said: "Yes, my surname is Chekhov, and Anton's surname is Tikhonov."

What is the surname of each friend?

Solution: Let's denote "a young man named A has the surname B" as AB, where the letters A and B correspond to the initials of the name and surname.

Let's fix the statements of each friend:

- DM and BH;

- AM and VB;

- VT and BM;

- VB and GC;

- GC and AT.

Let's first assume that DM is true. However, if DM is true, then Anton and Boris must have different surnames, which means AM and BM are false. But if AM and BM are false, then VB and VT must be true, but VB and VT cannot be simultaneously true.

Therefore, another case remains: BH is true. This case leads to a chain of conclusions: BH is true, BM is true, VT is false, AT is false, GC is true, VB is false, and AM is true.

Answer: Boris - Khokhlov, Vadim - Tikhonov, Grisha - Chekhov, Anton - Mishin, Dima - Belkin.

Method of tables.

The main technique used in solving text-based logical problems is constructing tables. Tables not only visually represent the problem's conditions or its solution, but also significantly aid in making correct logical conclusions during the problem-solving process. Tables are also used to solve problems with four, five, or more pairs of elements, when using diagrams is inconvenient due to excessive complexity.

Problem 1. Three musicians - Brown, Smith, and Wesson - who can play the violin, flute, viola, clarinet, oboe, and trumpet, were hired for a symphony orchestra.

We know that:

1. Smith is the tallest;

2. The violinist is shorter than the flutist;

3. Those who play the violin and the flute, as well as Brown, like pizza;

4. When a conflict arises between the violist and the trumpeter, Smith resolves it;

5. Brown cannot play the trumpet or oboe.

On which instruments does each musician play, if each of them plays two instruments?

Solution: We'll construct a table and reflect the problem's conditions in it, filling in the corresponding cells with the letters T (true) and F (false), depending on whether the statement is true or false.

Since there are three musicians, six instruments, and each musician can play only two instruments, each musician plays instruments that the others don't.

From condition 4, it follows that Smith doesn't play viola or trumpet, and from conditions 3 and 5, it follows that Brown cannot play the violin, flute, trumpet, or oboe. Therefore, Brown's instruments are viola and clarinet. We'll add this information to the table, and fill in the remaining cells of the "viola" and "clarinet" columns with "F".

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