Logic Puzzles

January 13, 2018

Warm-Up

1. Sabrina's mom said: "All champions are good at math." Sabrina says: "I am good at math. Therefore, I am a champion!" Is her logic right or wrong?

2. You are shown a set of four cards placed on a table, each of which has a number on one side and a letter on the other side. The visible faces of the cards show 3, 8, A and M. Which card(s) must you turn over in order to determine the truth of the statement: "If a card shows an even number on one face, then it has a vowel on the other side"?

Warm-Up

1. Sabrina's mom said: "All champions are good at math." Sabrina says: "I am good at math. Therefore, I am a champion!" Is her logic right or wrong?

2. You are shown a set of four cards placed on a table, each of which has a number on one side and a letter on the other side. The visible faces of the cards show 3, 8, A and M. Which card(s) must you turn over in order to determine the truth of the statement: "If a card shows an even number on one face, then it has a vowel on the other side"?

Colored hats, balls, and pencils

1. There are three boxes containing balls: the first one contains two white balls, the second – two black balls, and the third – a white ball and a black ball. The labels WW, BB, and WB were glued to the boxes so that none of the boxes has a correct label. Is it possible to choose one box so that after pulling one ball out of it, it is always possible to determine the contents of each box?[1]

2. Three friends – sculptor White, violinist Black, and artist Red – met in a cafeteria. "It is remarkable that one of us has white hair, another one has black hair, and the third has red hair, though no one's name gives the color of their hair," said the black-haired person. "You are right, " answered White. What color is the artist's hair?

3. In a box, there are pencils of at least two different colors, and of two different sizes. Prove that there are two pencils that differ both in color and in size.

Extra problems

4. Three people – A, B, and C – are sitting in a row in such a way that A sees B and C, B sees only C, and C sees nobody. They were shown 5 caps – 3 red and 2 white. They were blindfolded, and three caps were put on their heads. Then the blindfolds were taken away and each of the people was asked if they could determine the color of their caps. After A, and then B, answered negatively ("no, I can't tell what color my hat is", C replied affirmatively "yes, I know what color my hat is". How was that possible?

5. During a trial in Wonderland, the March Hare claimed that the cookies were stolen by the Mad Hatter. Then the Mad Hatter and the Dormouse gave testimonies which, for some reason, were not recorded. Later on in the trial, it was found out that the cookies were stolen by only one of these three defendants, and, moreover, only the guilty one gave true testimony. Who stole the cookies?

[1]These problems are from *Mathematical Circles: the Russian Experience*

Knights and Knaves

On Knights and Knaves Island, all the inhabitants are either "knights", who always tell the truth, or "knaves" who always lie. [2]

1. Abe says, "I am a liar." Is he an inhabitant of Knights and Knaves Island?

2. An islander A, in the presence of another islander B, said: "At least one of us is a knave." Is A a knight or a knave? What about B?

3. There are three people, A, B, and C. Among them is a knight, a knave, and a stranger (a normal person), who sometimes tells the truth and sometimes lies.

   A said: "I am a normal person." B said: "A and C sometimes tell the truth." C said: "B is a normal person."

   Who among them is a knight, who is a knave, and who is a normal person?

4. Several islanders met at a conference, and each of them told the others: "You are all knaves." How many knights might there be at that conference?

Extra hard, extra problems

5. What one question might be asked of an islander to find out where a road leads – to the city of knights or to the city of knaves?

6. What one question might be asked of an islander to find out whether she has a pet crocodile?

7. Assume that in the language of the island, the words "yes" and "no" sound like "flip" and "flop", but we do not know which is which. What one question might be asked of an islander to find out whether he is a knight or a knave?

[2] These problems are from *Mathematical Circles: the Russian Experience*