Logic Puzzles (continued)

Question 1. There are three boxes on a table. One of them is labeled APPLES, one is labeled ORANGES, and one is labeled APPLES AND ORANGES. Unfortunately, each of the boxes is mislabeled. You can reach into each of the boxes, but you cannot see what is inside any of them. Is it possible to pick ONE piece of fruit from ONE of the boxes and then correctly relabel all of the boxes?

Question 2. This puzzle takes place in Transylvania. I will give you a dialogue between some logicians who visited Transylvania, but I will leave out some of what they said. It is your job to solve the puzzle with the missing information.

Three logicians were once discussing their separate trips to Transylvania.

"When I was there," said the first logician, "I met a Transylvanian named Igor. I asked him whether he was a sane human. Igor answered me [yes or no], but I couldn't tell from his answer what he was."

"That's a surprising coincidence," said the second logician, "I met that same Igor on my visit. I asked him whether he was a sane vampire and he answered me [yes or no], and I couldn't figure out what he was!"

"This is a double coincidence!" exclaimed the third logician. "I also met Igor and asked him whether he was an insane vampire and he answered me [yes or no], but I couldn't deduce what he was either."

Is Igor sane or insane? Is he human or vampire?

Question 3. A farmer is out on a walk with his pets: a dog, a cat, and a bird. He comes to a river, and there is a raft that he can use to get across the river. Unfortunately, there is only enough in the raft for the farmer and one of his pets. He cannot leave his dog and cat alone because they will fight, and he cannot leave the cat alone with the bird because the cat will eat the bird. If the farmer can take the raft back and forth across the river as many times as he wants, can he safely bring all three of his pets across the river?

Question 4. Three very smart women are standing in a line, and all of them are facing the same direction. The Mad Hatter has three blue hats and two red hats and he randomly puts one hat on each woman's head. The women knew that the Mad Hatter started with three blue hats and two red hats, but they do not know which two hats were left over. The woman in the back of the line can see the hats of the two women in front of her, but she cannot see her own hat. The second woman in line can see the hat of the woman in front of her, but she cannot see her own hat or the hat of the woman behind her. The woman in front of the line cannot see any hats.

First, the woman in the back of the line was asked if she could determine what color hat she was wearing, and she said he could not. Next, the second woman in line was asked if she could determine what color hat she was wearing, and she also said she could not. Finally, the woman in the front of the line, who had heard what the last two women had said, said that she knew what color hat she was wearing. What color was it and how did she know?

Question 5. Using a scissors, cut a hole in an ordinary piece of paper ($8.5" \times 11"$) through which any one of your classmates could walk through.

Question 6 (Euclid, 300 BC)**.** Show that there are an infinite number of prime numbers.

Question 7 (Bertrand Russell, 1901)**.** Show that there is no set of all sets.