



Problem of the Week

Problem A and Solution

A Ball of a Birthday Party

Problem

Jaylen, Shelby, Kara and Logan went to a birthday party for their friend Zabrina. Each of them brought a gift. The gifts were a skipping rope, marbles, a book, and a soccer ball. After the party each child went home with a different colour balloon: red, blue, green, or orange. Using the clues, figure out which child brought what gift, and what colour balloon they took home.

- Jaylen did not bring the marbles as a gift, but he did go home with a blue balloon.
- Shelby brought the soccer ball as a gift, but did not go home with a red or green balloon.
- The friend who brought the skipping rope as a gift went home with a red balloon.
- Kara brought the marbles as a gift.

The table below may be helpful to keep track of information.

	Skipping Rope	Marbles	Book	Soccer Ball	Red Balloon	Blue Balloon	Green Balloon	Orange Balloon
Jaylen								
Shelby								
Kara								
Logan								





Solution

One way to determine the connections between the people attending the party, the presents, and the balloons is as follows:

We start by examining the clues. We can check the boxes that we **know** are connected, and fill in the boxes that we know are **not** connected. For example, based on the first clue, we can check the box that connects Jaylen with a blue balloon, and fill in the box that connects Jaylen with marbles. The result after evaluating all the clues is this:

	Skipping Rope	Marbles	Book	Soccer Ball	Red Balloon	Blue Balloon	Green Balloon	Orange Balloon
Jaylen						✓		
Shelby				✓				
Kara		✓						
Logan								

Next, wherever there is a ✓, we can eliminate all of the other choices in the same category. For example, since we know that Kara brought the marbles, then we know that none of the other guests brought the marbles, and we know that Kara did not bring any of the other gifts. Updating the table with this information results in the following table:

	Skipping Rope	Marbles	Book	Soccer Ball	Red Balloon	Blue Balloon	Green Balloon	Orange Balloon
Jaylen						✓		
Shelby				✓				
Kara		✓						
Logan								



Now we can make some logical deductions. At this point we know that Shelby did not take home the red, blue, or green balloon, so she must have received the orange balloon. Since Shelby received the orange balloon, neither Kara nor Logan received it. Since we know that Jaylen did not take home the red balloon, based on the third clue he did not bring the skipping rope. The updated table is now:

	Skipping Rope	Marbles	Book	Soccer Ball	Red Balloon	Blue Balloon	Green Balloon	Orange Balloon
Jaylen						✓		
Shelby				✓				✓
Kara		✓						
Logan								

Again, we can make some logical deductions. The only choice left for the gift Jaylen brought is the book. This means that Logan did not bring the book, so he must have brought the skipping rope. From the third clue, this also means that Logan took home the red balloon. This leaves only the green balloon unassigned, so Kara must have received that balloon. In summary:

	Skipping Rope	Marbles	Book	Soccer Ball	Red Balloon	Blue Balloon	Green Balloon	Orange Balloon
Jaylen			✓			✓		
Shelby				✓				✓
Kara		✓					✓	
Logan	✓				✓			

- Jaylen brought the book and took home the blue balloon.
- Shelby brought the soccer ball and took home the orange balloon.
- Kara brought the marbles and took home the green balloon.
- Logan brought the skipping rope and took home the red balloon.





Teacher's Notes

Logic is an essential part of Mathematics and Computer Science. Many post-secondary institutions offer entire courses dedicated to understanding and using logic.

Formal logic allows people to make convincing arguments and come to logical conclusions based on known facts. People make logical arguments all the time, but they normally use natural language to make the case. Spoken or written natural language can be imprecise and ambiguous.

Mathematicians and computer scientists use tools such as *propositional logic*, to make clearly structured arguments. These arguments start with statements that are known to be either true or false (known as *propositions*), and then use standard rules to prove some other conclusions. The propositions and arguments are written using mathematical notation, which in turn can be translated to statements that a computer can interpret. Formal logic methods are used for everything from the design of computer hardware, to proving that systems designed by software engineers are reliable, to the creation of expert systems by people studying artificial intelligence.

