UNIVERSITY OF
WATERLOO

University of Waterloo
Faculty of Mathematics

Centre for Education in
Mathematics and Computing

Grade 6 Math Circles
# Fall 2012
Logic Problems

Logic problems are problems that can be solved using reasoning and deduction.

Some tips for solving logic problems:

- Read the question a few times thoroughly and sift out irrelevant information.

- Try to use common sense.

- Use a chart or a diagram, if appropriate, to list out all of the possibilities.

- Begin eliminating options, by using the clues.

- Tackle the information slowly, by using one clue at a time.

- Be persistent. Sometimes it takes multiple read-throughs before you are able to solve the puzzle.
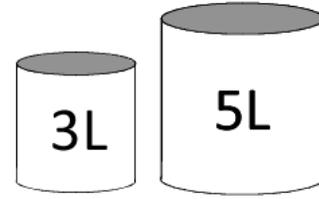
Example 1
You have three boxes of toys. One contains just Lego, one contains just action figures and one contains a mixture of both. Each box is labeled: one says "Lego", one says "Action Figures" and one says "Lego and Action Figures". However, we know that none of the boxes are labeled correctly. How can you label the boxes correctly if you are only allowed to take and look at one item from just one of the boxes?

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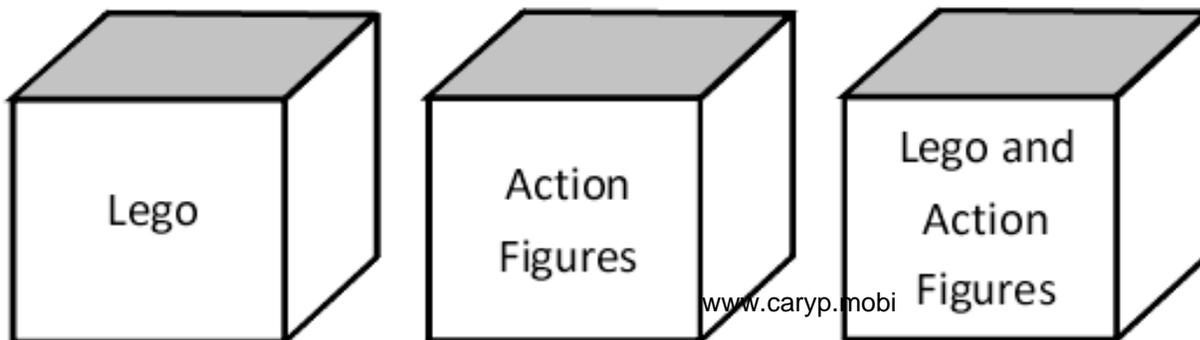
Example 2

Jacob has two cups with no measuring markings on them. He wants to measure out 4L of water, but one cup holds 3L and the other holds 5L. He can fill each of the cups to the top, empty them out, or pour from one cup into the other. Can you help him out?

Example 3

Mary's mother has 4 children.
Her oldest child's name is April.
The next oldest child is named May.
The second youngest' name is June.
What is the youngest child's name?

Example 4

Five witches have been busily preparing for Halloween. Each of the witches has spent many hours touching up their broomsticks with new paint and grooming their cats. Which witch owns which cat and owns which colour broomstick?

(**Broomstick colours**: Blue and green stripes, black and yellow, green and orange, orange and red, bright yellow.

1. Glinda owns a cat, whose named Cat-acomb, but green doesn't go well with her eyes.

2. Wanda detests red and black.

3. Elphaba likes her broomstick to contain green, but she doesn't own a cat called Cat-astrophe.

4. Lucinda's broomstick does not contain orange and does not own Cat-erpillar, but Cat-erpillar rides on a broomstick containing yellow.

5. Cat-niss is always purring as she is flown across the sky on an orange and red broomstick.

6. Griselda does not own Cat-alyst.

		Cat					Broomstick Colour				
		Cat-acomb	Cat-niss	Cat-astrophe	Cat-erpillar	Cat-alyst	Black/Yellow	Blue/Green Stripes	Bright Yellow	Green/Orange	Orange/Red
Witch	Elphaba										
	Glinda										
	Griselda										
	Lucinda										
	Wanda										
Broomstick Colour	Black/Yellow										
	Blue/Green Stripes										
	Bright Yellow										
	Green/Orange										
	Orange/Red										

Witch	Cat	Broomstick Colour

Sudoku

Rules: The objective of Sudoku is to fill the empty cells with numbers between 1 to 9 (with one number in each cell) according to the following guidelines,

1. each number can only appear once in each row,

2. each number can only appear once in each column, and

3. each number can only appear once in each 3×3 region.

A few tips:

- Cross reference between columns, rows and smaller squares

- Use process of elimination for squares

- Look ahead a few steps

		1		3	6	5	4	7
	6		9					8
				8		6		
3	9	6			7		2	
	1						6	
	2		3			1	8	9
		9		4				
1					3		5	
4	5	8	1	7		9		

Strimko

Rules: The objective of Strimko is to fill the empty circles with the missing numbers following three rules. You may use numbers 1 to n for any $n \times n$ grid.

1. each row must contain different numbers,

2. each column must contain different numbers, and

3. each stream must contain different numbers.
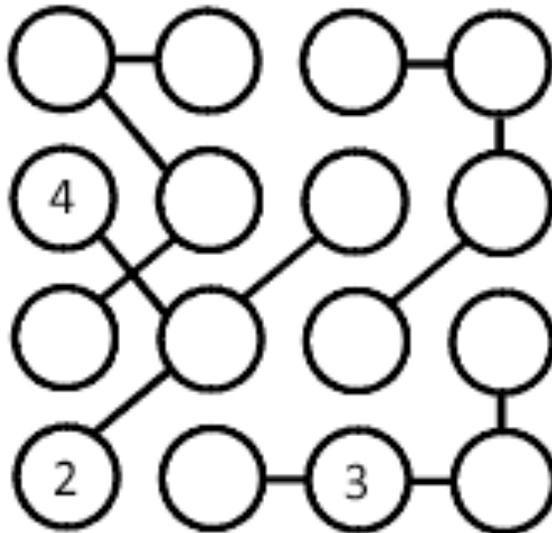
Calcudoku

Rules: The objective of Calcudoku is to fill all the empty squares so that the numbers 1 to n (where n is the number of rows or columns in the grid) appear exactly once in each row and column and the numbers in each block produce the result of the math operation shown in the top left corner of the block. A number may be used more than once in the same block.

A few tips:

- Start with the small blocks and then move to the larger ones.

- Make small pencilmarks noting which numbers are allowed in the empty squares. This will help narrow down possibilities later on.

- Always double check before placing a number.

- Never guess! Only make moves based on logical deductions.

5+	1	5+	
	4	2	4+
5+	2	4	
	4+		4

Problem Set

1. Two fathers and two sons go to the St. Jacob's Market. Each of them get an apple fritter to eat when they get home. However, when they get home, there are only 3 apple fritters. They didn't eat or lose any of them. How could this be?

2. Mrs Pink, Mr Blue and Miss Yellow are all meeting to go bowling. One person is wearing a blue shirt, one is wearing a yellow shirt and one is wearing a pink shirt. Miss Yellow is very observant and says "Look at that! We are all wearing different coloured shirts from our names!" The person wearing the pink shirt says "Wow Miss Yellow, you're right!" Can you determine who is wearing what coloured shirt?

3. Bella says to Jacob and Edward "I have more than 999 pens." Jacob then tries to correct her by saying, "No Bella, you have fewer than 1000 pens." Edward then says, "Bella has at least one pen." If only one of the previous statements is true, how many pens does Bella own?

4. It is noon and John wants to go get lunch at Subway. But, there is a terrible snowstorm outside and it is impossible for him to drive there. However, the forecast says that the snow will turn into hail and it will hail the rest of the day. How can you determine whether the sun will be shining 36 hours from now?

5. During the summer, Paula had a 5 scoop ice cream cone while at Wonderland. The 5 flavours were strawberry, chocolate, vanilla, cookie dough and bubble gum. Using the following clues, determine the order of the ice cream flavours:

   - The bottom flavour is 10 letters.
   - The vanilla scoops touches both the chocolate and cookie dough scoop.
   - Vanilla is below the chocolate scoop but above the bubblegum scoop.

6. You are on a hike to the top of a mountain. You come to a fork in the road. You could go two ways, but only one of them leads to the top. Fortunately, there are two men standing there, one next to each path. However, one always lies and the other one always speaks the truth, but you do not know which one is which. The men do not like to answer questions, so you are only allowed to ask one question, to only one man. What question should you ask?

7. A football coach wants to name a captain, but can't decide between 3 of his best players. He blindfolds them and puts a helmet on each of their heads. Afterwards, the coach takes off their blindfolds. He tells them that their helmet is either blue or white. He tells them that whoever can figure out the color of their helmet will be the captain. Also he tells them that at least one of the players will be wearing a blue helmet. The players can all see each other's helmets except of course, their own. Player A sees that the other 2 are wearing blue helmets. For hours no one spoke, then Player A stands up and tells the coach the colour of his helmet. What color is it and how does he know?

8. Your friend Jordan, got in trouble at school. His teacher decided to play a little game to determine what his punishment should be. The teacher told him that he is allowed to say one sentence before accepting his punishment. If Jordan lies, he will have to write 1000 lines. However, if he tells the truth, Jordan will have to serve detention for a month. Jordan says his one sentence and to your surprise, Jordan isn't punished at all because his teacher can't determine what it should be. What did Jordan say?

9. You must cut a birthday cake into exactly eight pieces, but you are only allowed to make three straight cuts, and you cannot move pieces of the cake as you cut. How can you do it?

10. * Henry's school principal is a little strange. On the first day, he has all of his students perform an unusual task. There are 1000 lockers and 1000 students in this school. His principal asks the first student to go to every locker and open it. Then he has the second student go to every second locker and close it. The third goes to every third locker and, if it is closed, he opens it, and if it is open, he closes it. The fourth student does this to every fourth locker, and so on. After the process is completed with the thousandth student, how many lockers are open?

11. * Fred weighs half as much as Frank, and Finnigan weighs three times as much as Fred. Together, they weigh 720 pounds. How much does each man weigh?

12. Five children who all live on the same street in Waterloo are going trick-o-treating for Halloween. Which child wore which costume and how many treats did they each collect?

   a) Boris collected more treats than Selina and also collected more treats than the wizard, which was not Selina's choice of costume.

   b) Glen dressed up as a ghost or a werewolf and did not collect an even number of sweets.

   c) The witch collected fewer treats than Jessie but more than Selina.

   d) Trish wore the pumpkin costume or witch costume and collected 6 fewer candies than the child who wore the ghost costume.

   e) The child wearing the pumpkin costume collected fewer treats than the child wearing the werewolf outfit.

		Costume					Treats				
		Ghost	Pumpkin	Werewolf	Witch	Wizard	25	31	37	42	48
Name	Boris										
	Glen										
	Jessie										
	Selina										
	Trish										
Treats	25										
	31										
	37										
	42										
	48										

Name	Costume	Treats

13. *** Einstein's Riddle**

There are 5 houses in a row on a street, and each one is painted a different colour. Living in the houses are 5 people with all different nationalities. The 5 owners drink a certain type of beverage, wear a certain brand of clothing and keep a certain pet. No owners have the same pet, wear the same brand or drink the same beverage. The question is, who owns the fish?

Clues:

- The British man lives in the red house.
- The Swedish man has a pet dog.
- The Danish man drinks tea.
- The green house is on the left and next to the white house.
- The green homeowner drinks coffee.
- The person who wears Adidas has a pet bird.
- The owner of the yellow house wears Lacoste.
- The man living in the center house drinks milk.
- The Norwegian lives in the first house.
- The man who wears Nike lives next to the one who has a cat.
- The man who keeps the horse lives next to the man who wears Lacoste.
- The owner who wears Calvin Klein drinks juice.
- The German man wears Quiksilver.
- The Norwegian man lives next to the blue house.
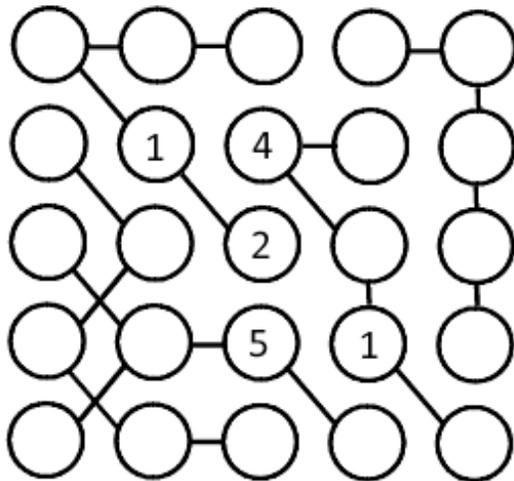- The man who wears Nike has a neighbour who drinks water.

NATION	NATION	NATION	NATION	NATION
DRINK	DRINK	DRINK	DRINK	DRINK
CLOTHING	CLOTHING	CLOTHING	CLOTHING	CLOTHING
PET	PET	PET	PET	PET

14. Solve the following Sudoku puzzle:

1		5						2
7				6				
2			3	4		5		9
			4	1				
	3		9		8		2	
			3	7				
5		9	7	3				1
			9					5
6						8		3

15. Solve the following Strimko puzzles:

(a) Medium level

(b) Hard level
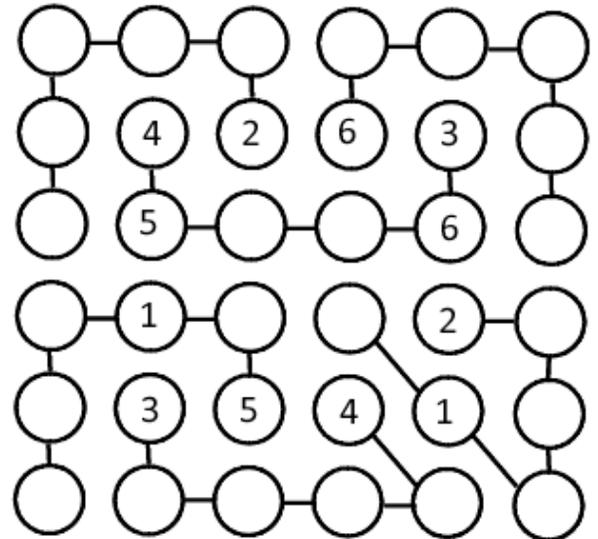
16. Solve the following Calcudoku puzzles:

(a) Easy level

10+		5+		7+	6
10+		11+	3		
	9+		4+		5+
9+		5+	11+		
			6+		4
4+		6+		11+	

(b) Hard level

2-	1080×		14+		6
		19+			
			60×		1
3				23+	
7+					7+
5					