

# Cryptarithms and Some Logic\*

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**Cryptarithms** are mathematical puzzles in which the digits are replaced by letters of the alphabet. Remember that there are 10 digits: 0 – 9. Moreover, each letter represents the same digit throughout the problem.

To solve a cryptarithm means to find which digits correspond to which letters so that you get a valid mathematical equality.

Solve the following cryptarithms. (Note that sometimes several solutions are possible).

$$1. \begin{array}{r} E \ G \ G \\ + \ E \ G \ G \\ \hline P \ A \ G \ E \end{array}$$

$$E = \quad G = \quad A =$$

$$2. \begin{array}{r} S \ H \ E \\ + \ E \ E \ L \\ \hline E \ L \ S \ E \end{array}$$

$$S = \quad H = \quad E = \quad L =$$

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\*The problems in this handout are taken from the book "Sideways Arithmetic from Westside School" by Louis Sachar.

$$3. \begin{array}{r} M \ O \ M \\ + \ M \ O \ P \\ \hline Y \ O \ Y \ O \end{array}$$

$$M = \quad O = \quad Y =$$

$$4. \begin{array}{r} S \ T \ A \ Y \ S \\ + \quad \quad S \ A \ Y \\ \hline T \ R \ U \ S \ T \end{array}$$

$$S = \quad T = \quad A = \quad R = \quad Y = \quad U =$$

$$5. \begin{array}{r} F O U R \\ + S E V E N \\ \hline E L E V E N \end{array}$$

$$\begin{array}{l} O = \quad U = \quad F = \quad R = \quad S = \quad E = \quad V = \quad N = \\ L = \end{array}$$

$$6. \begin{array}{r} Y O Y O \\ - P O P \\ \hline P O P \end{array}$$

$$P = \quad Y = \quad O =$$

***Will Logic Prevail?***

By now you should understand the difference between the concepts of true and false. Most likely, at your school you have been asked to decide if a given statement is true or false. This time you will be given a group of statements and must find a way to logically decide if each of the statements is true or false in such a way that the answers are consistent with each other.

Here is an example:

1. The answer to this statement is the same as the answer to statement 2.

$T$      $F$

2. The answer to this statement is different from the answer to statement 1.

$T$      $F$

In order for the answers to be consistent with each other, statement 1 would have to be false and statement 2 would need to be true. (If the answers were reversed, there would be a contradiction. If both are true or both are false, there is a contradiction as well). For the following statements, decide whether they are true or false in a such way that the answers are consistent with each other.

Problem 1:

1. Statement number 3 is false.

*T*    *F*

2. Statement number 1 is true.

*T*    *F*

3. The answers to statements 1  
and 2 are the same.

*T*    *F*

Problem 2:

1. Statement number 4 is false.

*T*    *F*

2. Statement number 5 is false.

*T*    *F*

3. Statement number 1 is false.

*T*    *F*

4. Statement number 2 is false.

*T*    *F*

5. The answer to this statement  
is the same as at least two of  
the above answers.

*T*    *F*

## Problem 3:

1. Statement number 5 is false.  
 $T \quad F$
2. Statement number 1 is false.  
 $T \quad F$
3. Statement number 4 is true.  
 $T \quad F$
4. There is only one false statement  
in this problem.  
 $T \quad F$
5. The answers to statements 2  
and 3 are the same.  
 $T \quad F$

## Problem 4:

1. The answer to this statement is  
different from the answer to  
statement number 5.  
 $T \quad F$
2. The answer to this statement is  
different from the answer to  
statement number 3.  
 $T \quad F$
3. The answer to this statement is  
the same as the answer to  
statement number 4.  
 $T \quad F$
4. The answer to this statement is  
different from the answer to  
statement number 2.  
 $T \quad F$
5. The answer to this statement is  
the same as the answer to  
statement number 1.  
 $T \quad F$