Cryptarithms and Some Logic

10/20/13

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. \[
\begin{array}{ccc}
E & G & G \\
+ & E & G & G \\
P & A & G & E
\end{array}
\]

\[
E = \quad G = \quad A =
\]

2. \[
\begin{array}{ccc}
S & H & E \\
+ & E & E & L \\
E & L & S & E
\end{array}
\]

\[
S = \quad H = \quad E = \quad L =
\]

*The problems in this handout are taken from the book “Sideways Arithmetic from Westside School” by Louis Sachar.
\[
\begin{array}{c}
3. \quad \frac{M\ O\ M}{Y\ O\ Y\ O} \\
\end{array}
\]

\[
M = \quad O = \quad Y = 
\]

\[
\begin{array}{c}
4. \quad \frac{S\ T\ A\ Y\ S}{T\ R\ U\ S\ T} \\
\end{array}
\]

\[
S = \quad T = \quad A = \quad R = \quad Y = \quad U = 
\]
5. \[ \begin{array}{c}
F & O & U & R \\
+ & S & E & V & E & N \\
\hline
E & L & E & V & E & N \\
\end{array} \]

6. \[ \begin{array}{c}
Y & O & Y & O \\
- & P & O & P \\
\hline
P & O & P \\
\end{array} \]
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.
   \( T F \)
2. Statement number 1 is false.
   \( T F \)
3. Statement number 4 is true.
   \( T F \)
4. There is only one false statement in this problem.
   \( T F \)
5. The answers to statements 2 and 3 are the same.
   \( T F \)

Problem 4:
1. The answer to this statement is different from the answer to statement number 5.
   \( T F \)
2. The answer to this statement is different from the answer to statement number 3.
   \( T F \)
3. The answer to this statement is the same as the answer to statement number 4.
   \( T F \)
4. The answer to this statement is different from the answer to statement number 2.
   \( T F \)
5. The answer to this statement is the same as the answer to statement number 1.
   \( T F \)