**Siena College’s 33rd Annual** **High School Programming Contest**

**Sponsored by Transfinder**

**June 2, 2021**

###### **Gold Problem #6:  Easy Math but Not So Easy Algorithm- The Transfinder Problem**

###### **Background Information:**

A significant part of Transfinder’s business is assisting school districts with efficient bus routing. Having a great routing plan saves time, fuel, and depreciation costs. Finding optimal or close to optimal routing plans can be algorithmically complicated. Problem #6 is the Transfinder Problem for this year because the problem requires looking at every possibility.

There is a well-known math puzzle, where you are asked to take the digits 1, 2, 3, 4, 5, 6, 7, 8, and 9, in that precise order and add the + and – operators in between digits to get an expression value of 100.  In the puzzle, you are allowed to combine consecutive digits together, such as 7 and 8 to get the number 78.  One solution to this is 123 + 4 – 5 + 67 – 89 = 100.

A solution to the general problem is an expression using only + or – operations (no parentheses) which adds to a given value.

Your problem is to find all solutions to the sequence of digits 1, 2, 3, 4, 5, 6, 7, 8, AND 9 which add to an input value of N.  If no solutions exist, you would print NO SOLUTIONS FOUND.  If multiple solutions exist, print them in preference order using

* Small numbers before larger numbers from left to right as the primary factor
* Plus operator before minus operator from left to right as the secondary factor

Programming Problem:

Input:  A target integer N, where -23,456,788 ≤ N ≤ 123,456,789

Output: All solutions printed in the specified order, or NO SOLUTIONS FOUND, if no legal solutions exist. If there are multiple solutions, they must be printed on their own line.

Example 1: Input:

100

 Output:

1+2+3-4+5+6+78+9

1+2+34-5+67-8+9

1+23-4+5+6+78-9

1+23-4+56+7+8+9

12+3+4+5-6-7+89

12-3-4+5-6+7+89

12+3-4+5+67+8+9

123-4-5-6-7+8-9

123+4-5+67-89

123+45-67+8-9

123-45-67+89

Example 2: Input:

998

Output:

 NO SOLUTIONS FOUND