

### P3 :: Table This!

You are to write a program that prints the truth table for a Boolean expression. Your program must compute the following Boolean operators over Boolean arguments **p**, **q**, and **r**. In the truth table below, seven Boolean operators are shown.

<b>p</b>	<b>q</b>	<b>p AND q</b>	<b>p IMPL q</b>	<b>p NAND q</b>	<b>p NOR q</b>	<b>p OR q</b>	<b>p XNOR q</b>	<b>p XOR q</b>
0	0	0	1	1	1	0	1	0
0	1	0	1	1	0	1	0	1
1	0	0	0	1	0	1	0	1
1	1	1	1	0	0	1	1	0

Thus, “1 NOR 0” evaluates to the binary digit 0, while “0 NOR 0” evaluates to 1. The Boolean expression “1 NOR 0 XOR 1 AND 1” evaluated from left to right is 1.

$$\begin{aligned}
 &(((1 \text{ NOR } 0) \text{ XOR } 1) \text{ AND } 1) \\
 &\quad ((0 \text{ XOR } 1) \text{ AND } 1) \\
 &\quad\quad (1 \text{ AND } 1) \\
 &\quad\quad\quad 1
 \end{aligned}$$

A Boolean expression (over variables **p**, **q**, and **r**) is computed from left to right. Thus the truth table with these three variables contains eight entries. For example, the truth table for “**p AND q**” over these three variables is:

<b>p</b>	<b>q</b>	<b>r</b>	<b>p AND q</b>
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

#### **Input Format**

Your program will read from standard input. You will receive only one line of input which will contain a Boolean expression **E** over the variables **p**, **q**, and **r** using the Boolean operators (**AND**, **IMPL**, **NAND**, **NOR**, **OR**, **XNOR**, **XOR**). The variables and operators are separated by a single space. Note that the operators are always represented in CAPITAL LETTERS and the variables are in lower case.

#### **Output Format**

Your program will write to standard output. Your program should produce (in total) nine lines of output. The first line of output is the table header “**p q r E**” (note the capitalization). The next eight lines of output contain the truth table where the first three columns contain all eight potential values of **p**, **q**, and **r** (from “0 0 0” to “1 1 1”) and the final column contains the computed values of expression **E** for these values of **p**, **q**, and **r**.

**Sample Input and Corresponding Sample Output**

Sample Input	Sample Output
p AND q	p q r E 0 0 0 0 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 0 1 1 0 1 1 1 1 1
p XOR q XOR p	p q r E 0 0 0 0 0 0 1 0 0 1 0 1 0 1 1 1 1 0 0 0 1 0 1 0 1 1 0 1 1 1 1 1
q NOR r IMPL p	p q r E 0 0 0 0 0 0 1 1 0 1 0 1 0 1 1 1 1 0 0 1 1 0 1 1 1 1 0 1 1 1 1 1