

3) (5 pts) ALG (Bitwise Operators)

Determine the value of each of these arithmetic expressions in C. Please use the space below for your scratch work.

$$(i) 56 | 17 \quad \underline{57}$$

$$(ii) 47 \& 83 \quad \underline{3}$$

$$(iii) 79 \wedge 36 \quad \underline{107}$$

$$(iv) 13 \ll 3 \quad \underline{104}$$

$$(v) 187 \gg 4 \quad \underline{11}$$

Here is the work for each part:

$$\begin{array}{rcl}
 56 & = & 111000_2 \\
 |17 & = & 010001_2 \\
 \hline
 & & 111001_2 = 57_{10}
 \end{array}
 \qquad
 \begin{array}{rcl}
 47 & = & 101111_2 \\
 \&83 & = & 1010011_2 \\
 \hline
 & & 0000011_2 = 3_{10}
 \end{array}
 \qquad
 \begin{array}{rcl}
 79 & = & 1001111_2 \\
 \wedge 36 & = & 100100_2 \\
 \hline
 & & 1101011 = 107_{10}
 \end{array}$$

$$13 \ll 3 = 13 * 2^3 = 13 * 8 = 104$$

$$187 \gg 4 = 187 / 2^4 = 11$$

Note: Here are the last two parts using binary representation:

$$13 = 1101_2, 1101_2 \ll 3 = 1101000_2 = 104$$

$$187 = 10111011_2, 10111011_2 \gg 4 = 1011_2 = 11$$

Grading: 1 pt per part, no work necessary, only answers graded.