Computer Science Problem of the Month
(http://narnia.homeunix.com/~robert/PoTM/)

February 2008

Background:

Computers use binary arithmetic to perform calculations that humans usually do in decimal. This sometimes means that a simple operation such as multiplication requires multiple steps on the computer.

Problem:

Show that it is possible to multiply a binary number, x, by -2 using at most two of the following operations (you may use the same operation twice or two different operations):

A. OR
B. AND
C. XOR (exclusive or)
D. bitwise-negation
E. Left shift (with 0's inserted at the right)
F. Right shift (with the rightmost bit discarded)

You may not use any other operation (+,-,*,/,% and so forth).

You should assume that x is a sign-magnitude binary integer (not two's complement) and that you have sufficient bits available so that overflow is not an issue.

Solutions:

To submit a solution to the problem of the month, e-mail your answer and a complete, rigorous justification of your answer, to *robert@narnia.homeunix.com*. I will give a cash prize of one dollar to the person who submits the first correct solution. Subsequent solvers will be recognized on the web page, but not awarded the cash prize.