University of California, Berkeley *Spring 2012*
EE 42/100 *Prof. A. Niknejad*

Problem Set 8 (rev B)
Due Friday (5pm), April 20, 2012

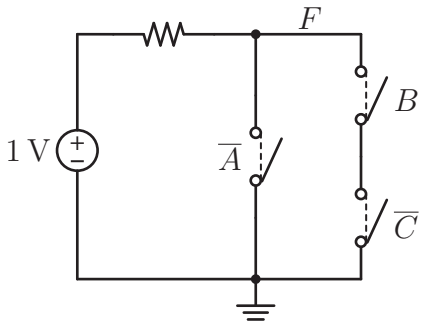
1. (a) Convert $B52_{16}$ into binary and decimal form. How many bits are required? (b) Convert 1010110 into decimal and hexadecimal form. (c) Find the binary representation of -57 and 34 using two's complement. Add the numbers directly in binary form and check that it matches the sum in decimal.

2. Consider the following logic statement: "If at least two of A, B, and C are true, then F is true. Otherwise, F is false." (a) Write out the truth table corresponding to this statement. (b) What is a Boolean expression that matches it? (c) Now implement this statement using logic gates (the inputs A, B, and C are given).

3. Use a truth table to prove the identity $ABC + AB\overline{C} + A\overline{B}\,\overline{C} + A\overline{B}C = A$. Now do it again, but using Boolean algebra.

4. Consider the logic function $F = AB\overline{C}\,\overline{D} + ABCD + ABC\overline{D} + \overline{A}BCD$. (a) Find the minimum SOP expression and realize it using AND, OR, and NOT gates. (b) Then find the minimum POS expression.

5. Consider the following circuit, where the inputs are the switch positions. If an input A is high, then any switches labeled A are closed and any labeled $\overline{A}$ are open. Conversely, if A is low, we have the opposite effect. The output F is high if the voltage is 1 V and low otherwise. Write a Boolean expression for the output in terms of the inputs. Construct the corresponding logic circuit.



6. (a) In binary, what is an easy way of multiplying and dividing numbers by powers of 2? *Hint: Consider how to multiply by powers of 10 in decimal.* (b) What is a general formula for the number of all possible **input and output** combinations for a circuit with n input variables?