

**6. Combinational Circuits (8 points)**

The well-known Fibonacci numbers are 1, 1, 2, 3, 5, 8, 13, ... Let the Boolean variables  $a$ ,  $b$ , and  $c$  together represent a 3-bit non-negative binary number (that is, not in 2's-complement representation). Let  $c$  be the least significant bit (that is, write the number as  $abc$ ). Let  $F$  be a Boolean variable that indicates whether the number represented by  $a$ ,  $b$ , and  $c$  is a Fibonacci number. ( $F = 1$  if it is, and 0 otherwise.)

(a) Write out the truth table for the function  $F$ .

(b) Write out the sum-of-products formula for  $F$  (with no simplifications).

- (c) Draw a circuit using AND, OR, and NOT gates that takes inputs  $a$ ,  $b$ , and  $c$  and generates output  $F$  (with no simplifications). You may use AND and OR gates with more than 2 inputs if you need to.

- (d) For a tiny amount of extra credit, simplify the formula and the circuit.