1. Given the following three functions:
   
a. A 2-bit-wide shifter takes two input signals, \( i_0 \) and \( i_1 \), and shifts them to two outputs, \( o_0 \) and \( o_1 \), under the control of a shift signal. If this signal SHIFT is false, then the inputs are connected straight through to the outputs. If SHIFT is true, then \( i_0 \) is routed to \( o_1 \) and \( o_0 \) should be set to a 0.

b. A 1-bit demultiplexer takes an input signal IN and shifts it to one of two outputs, \( o_0 \) and \( o_1 \), under the control of a single SELECT signal. If SELECT is 0, then IN is connected through to \( o_0 \) and \( o_1 \) is connected to a 0. If SELECT is 1, then IN is connected through to \( o_1 \) and \( o_0 \) is connected to a 0.

c. A 2-bit multiplexer takes two input signals, \( i_0 \) and \( i_1 \), and shifts one of them to the single output OUT under the control of a 1-bit select signal. If the SELECT signal is false, then \( i_0 \) is passed to OUT. If SELECT is true, then \( i_1 \) is passed to OUT.

Complete the following five items:

a. Construct their truth tables.

b. What are the functions in sum of products forms.

c. Draw logic schematics using AND, OR, and INVERT gates.

2. Consider a Boolean function that takes two input signals, A and B, and shifts one of them to the single output OUT under the control of a 1-bit SELECT signal. If the SELECT signal is true, then A is passed to OUT. If SELECT is false, then B is inverted and passed to OUT.

a. Write the truth table for this Boolean function.

b. Write the function in sum of products form.

c. Draw the logic schematic by using AND, OR, and INVERT gates.