

Computer Organization and Structure

Homework #1
Due: 2007/10/16

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.