Please print out this form (two-sided, if you can) and write your answers legibly in the spaces provided. If you can’t write legibly, type.

1. Consider an 8 bit barrel shifter, using the design that uses $n \log_2 n$ multiplexors. If $dln(7 \text{ downto } 0) = 10110101$ and the shift input is 101, what are the bits at the output of the first row of multiplexors? What are the bits at the output of the second row of multiplexors? The third row?

2. Estimate the number of LUTs used by the following code fragment. Assume that all signals are 16 bits wide and that the architecture has no other signal assignments to $x$. Justify your answer.

   if rising_edge(clk) then
      ...
      if a = b then x <= c;
      elsif a > c then x <= c + d;
      else x <= x + 1;
      end if;
3. Suppose we have a state machine with 23 states. How many flip flops are needed to represent the state if we use a one-hot encoding? How many are needed with a binary encoding? How many LUT4s would be needed to implement the condition in the if-statement below if binary encoding is used?

   if state = stateOfMind then ...

   How many LUTs would be needed if one-hot encoding was used?