5.1 (Adders)
Design a 2-bit adder slice that will combine the functions of two FAs. Using the library presented in Table 2.12, compare the delay of your design with that of the design shown in Figure 5.1.
5.4 (Carry-look-ahead generators)

Using the libraries given by the tables noted below, redesign the CLA generator that was shown in Figure 5.2(c):

(a) Table 3.14,

For each of the designs, compare the delays in the generation of the following carries: \( c_4, c_8, c_{12} \) and \( c_{16} \).

(a) The CLA generator can be redesigned by replacing multiple-input gates with two-input gates by performing the following replacements:

\[
\begin{align*}
\text{The delay through each step of the 16-bit addition would be 11.2 \, ns.} \\
\text{For each step of the addition the carry delays would be:} \\
\quad c_4 &= 12.0 \, ns \\
\quad c_4 &= 24.0 \, ns \\
\quad c_4 &= 36.0 \, ns \\
\quad c_4 &= 48.0 \, ns
\end{align*}
\]
Design a logic unit that will perform the following combinations of operations:

(c) AND, OR and NOT.
5.8 (ALUs)

Design an ALU that can perform add, subtract, NAND and NOR operations.

An ALU designed to perform the add, subtract, NAND and NOR operations is similar to the ALU given in Figure 5.9 of the text, only the logic of the arithmetic and logic extenders need be changed. The schematics for the new arithmetic and logic extenders are given below:
5.10 (Decoders)
Design a 4-to-16 decoder, using:

(b) 2-to-4 decoders,
5.11 (Encoders)

Design a (c) 8-to-3 unary to binary code encoder, which is a true complement of a binary to unary code decoder.

(c) 8-to-3 Encoder
5.13 (Comparators)
Design the serial and parallel versions of a comparator that can compare the following types of number representation:
(c) floating-point.

(c) The procedure for comparing floating-point representations can be outlined as follows:

Perform comparison of exponent portion.
If ($Exp(M_1) > Exp(M_2)$) then
   output ($M_1 > M_2$)
else
   If ($Exp(M_1) < Exp(M_2)$) then
      output ($M_1 < M_2$)
   else
      Perform signed-magnitude comparison of mantissa portion.
      output result of this comparison
end
5.14 (Comparators)
Design the comparators, that would evaluate the following single relations:
(a) $X > Y$,

Assuming that $X = a_1a_0$ and $Y = b_1b_0$, the following implementations can be expanded or combined to compare values with a greater number of digits.