1. Complete 4-1 and 4-19

4-1 Design a combinational circuit with three inputs and one output. The output is equal to logic-1 when the binary value of the input is less than 3. The output is logic-0 otherwise.

4-19 Draw the NAND logic diagram for each of the following expressions using multiple-level NAND gate circuits:
(a) $(AB' + CD')E + BC(A + B)$
(b) $w(x + y + z) + xyz$

2. Using AND and OR gates find the circuit that minimizes the number of gate inputs for the function:

$$f(u,w,x,y,z) = uy + uw' + xyz + x'yz' + w'x'z'$$

3. A function $F(a,b,c,d)$ is 1 if more that one of its inputs is 1.

   (a) Write the maxterm expression for $F(a,b,c,d)$

   (b) Find the minimum gate three level (AND-OR-AND) circuit.

4. Realize the following functions using only 2-input NAND gates. Repeat for 2-input NOR gates.

   (a) $f(w,x,y,z) = w'y' + wyz + x'y'z' + xz$

   (b) $f(w,x,y,z) = w'x'z + w'xyz' + wxy' + y'z$