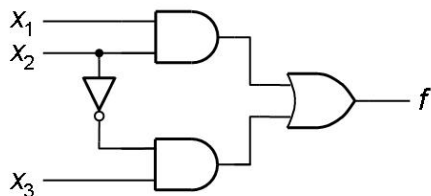


- P1. (10 points) Problem 2.11 in the textbook.
- P2. (10 points) Problem 2.21 in the textbook. Show all steps.
- P3. (10 points) Draw a circuit diagram for the function in P2 using NAND gates only.
- P4. (10 points) A full adder is a circuit which adds three bits X, Y, Z together and returns two bits C and S to represent the total as a 2-bit binary number CS . C is the MSB and S is the LSB. For example, if $X=1, Y=1, Z=0$, the total should be 2, or 10_2 in binary. Hence $C=1$ and $S=0$. Write the truth tables for the functions C and S .
- P5. (10 points). Write the functions C and S from P4 in short hand notation using (a) min terms and (b) max terms. Also write functions C and S in canonical sum-of-products (SOP) and canonical product-of-sums (POS) forms.
- P6. (10 points) Obtain the simplest SOP expressions for the functions C and S in problem P5 and draw their respective circuit diagrams.
- P7. (10 points) Let $L(A,B,C,D)$ be a four-way light control with four switches $A, B, C,$ and D .
(a) Write the truth table for the function L .
(b) Write the canonical sum-of-products expression for the function L .
(c) Write the canonical product-of-sums expression for the function L .
- P8. (10 points) Show how to implement a NOT function using: (a) 2-input NAND, (b) 2-input NOR, and (c) a 2-1 multiplexer. For part (a) and part (b), you should use a different way from what has been shown in class (connecting both terminals to the input signal). Note that you are allowed to connect constant voltages (i.e., logic values 0 or 1) to the gates.
- P9. (10 points) By applying DeMorgan's Theorem directly to the following circuit, convert it into one that uses only:
(a) NAND gates and NOT gates.
(b) NOR gates and NOT gates.



P10. (10 points) Please write down the number of transistors required to implement the following circuits in CMOS technology.

- (a) The function C in P6. (Assuming functions C and S are implemented independently.)
- (b) The function S in P6. (Assuming functions C and S are implemented independently.)
- (c) The original circuit in P9.
- (d) The circuit in P9(a).
- (e) The circuit in P9(b).