

- P1. (10 points) Problem 2.53 in the textbook. You cannot use more than 10 gates.
- P2. (10 points) Problem 2.51 in the textbook. Please make your circuit as simple as possible.
- P3. (10 points) Problem 2.52 in the textbook. Please make your circuit as simple as possible.
- P4. (25 points) Use a K-map to simplify the following functions in SOP forms **as much as possible**:
- (a) $f(a) = \sum m(0,1)$
 - (b) $f(a,b,c) = \sum m(0,3,5,6)$
 - (c) $f(a,b,c) = a'bc' + a'b'c + a'bc + ab'c + abc$
 - (d) $f(a,b,c,d) = \sum m(0,2,5,8,9,10,12,13,14,15)$
 - (e) $f(a,b,c,d) = \sum m(1,7,9,10,11,12,13,15)$
- P5. (15 points) Use a K-map to simplify the following functions in POS forms **as much as possible**:
- (b) $f(a,b,c) = \prod M(0,3,5,6)$
 - (c) $f(a,b,c) = a'bc' + a'b'c + a'bc + ab'c + abc$
 - (d) $f(a,b,c,d) = \sum m(0,2,5,8,9,10,12,13,14,15)$
- P6. (10 points) Problem 2.35 in the textbook. For part (b), please do it with the help of a K-map.
- P7. (20 points) A four-variable function that is equal to 1 if any three or all four of its variables are equal to 1 is called a *majority* function.
- (a) Write the truth table for the majority function.
 - (b) Use a K-map to derive the simplest SOP expression for this majority function.
 - (c) Use a K-map to derive the simplest POS expression for this majority function.
 - (d) Compare the costs of the circuits implementing the expressions in part (b) and part (c) in terms of the total number of gates plus the total number of inputs.