CSE140 Exercises, Spring 2000, CK Cheng

(I) Karnaugh Map: Express the following function in a minimal sum of products form.
\[ f(a, b, c, d) = \sum m(1, 2, 4, 5, 8, 14) + \sum d(6, 10, 13). \]

(II) Karnaugh Map: Express the following function in a minimal product of sums form.
\[ f(a, b, c, d) = \sum m(1, 2, 4, 5, 8, 14) + \sum d(6, 10, 13). \]

(III) Karnaugh Map: Implement the following function with a minimal two level NOR network.
\[ f(a, b, c, d) = \sum m(0, 4, 5, 9, 11, 14, 15) + \sum d(2, 8). \]

(IV) Quine-McCluskey Method: Find the minimum sum of products expression of the following function using the Quine-McCluskey method. Show your process of deriving the prime implicants and include the implication chart.
\[ f(a, b, c, d, e) = \sum m(0, 1, 2, 9, 15, 19, 23, 25, 30) + \sum d(4, 5, 28, 31). \]

(V) Quine-McCluskey Method: Find the minimum sum of products form of the following function using the Quine-McCluskey method. Show your process of deriving the prime implicants and include the implication chart.
\[ f(a, b, c, d) = \sum m(0, 1, 4, 5, 6, 7, 9, 11, 15) + \sum d(10, 14). \]

(VI) Given a four input Boolean function
\[ f(a, b, c, d) = \sum m(0, 1, 2, 9, 13, 15) + \sum d(4, 5, 11). \] Implement the function using a minimal network of AND, OR, NOT gates.

(VII) Write the characteristic equations and excitation tables of four types of flip-flops.

(VIII) XOR, AND gates: Express \( f(a, b, c) = a + ab' + (a + b) + (a' + b' + c) \) in a minimal sum-of-products form.