6.4 For this function, find a minimum sum-of-products solution, using the Quine-McCluskey method.

$f(a, b, c, d) = \Sigma\, m(1, 3, 4, 5, 6, 7, 10, 12, 13) + \Sigma\, d(2, 9, 15)$

6.5 Find all prime implicants of the following function and then find all minimum solutions using Petrick's method:

$F(A, B, C, D) = \Sigma\, m(9, 12, 13, 15) + \Sigma\, d(1, 4, 5, 7, 8, 11,14)$

6.6 Using the method of map-entered variables, use four-variable maps to find a minimum sum-of-products expression for

(a) $F(A, B, C, D, E) = \Sigma\, m(0, 4, 5, 7, 9) + \Sigma\, d(6, 11) + \mathrm{E}(m_1 + m_{15})$, where the m's represent minterms of the variables A, B, C, and D.

(b) $Z(A, B, C, D, E, F, G) = \Sigma\, m(0, 3, 13, 15) + \Sigma\, d(1, 2, 7, 9, 14) + E(m_6 + m_8) + Fm_{12} + Gm_5$

6.9 For each function, find a minimum sum-of-products solution using the Quine-McCluskey method.

(a) $f(a, b, c, d) = \Sigma\, m(2, 3, 4, 7, 9, 11, 12, 13, 14) + \Sigma\, d(1, 10, 15)$

(b) $f(a, b, c, d) = \Sigma\, m(0, 1, 5, 6, 8, 9, 11, 13) + \Sigma\, d(7, 10, 12)$

(c) $f(a, b, c, d) = \Sigma\, m(3, 4, 6, 7, 8, 9, 11, 13, 14) + \Sigma\, d(2, 5, 15)$

6.10 Work Problem 5.24(a) using the Quine-McCluskey method.

6.11 $F(A, B, C, D, E) = \Sigma\, m(0, 2, 6, 7, 8, 10, 11, 12, 13, 14, 16, 18, 19, 29, 30) + \Sigma\, d(4, 9, 21)$

Find the minimum sum-of-products expression for F, using the Quine-McCluskey method. Underline the essential prime implicants in this expression.

6.12 Using the Quine-McCluskey method, find all minimum sum-of-products expressions for

(a) $f(A, B, C, D, E) = \Sigma\, m(0, 1, 2, 3, 4, 8, 9, 10, 11, 19, 21, 22, 23, 27, 28, 29, 30)$

(b) $f(A, B, C, D, E) = \Sigma\, m(0, 1, 2, 4, 8, 11, 13, 14, 15, 17, 18, 20, 21, 26, 27, 30, 31)$

6.13 Using the Quine-McCluskey method, find all minimum product-of-sums expressions for the functions of Problem 6.12.

6.14 (a) Using the Quine-McCluskey, method find all prime implicants of $f(A, B, C, D) = \Sigma\, m(1, 3, 5, 6, 8, 9, 12, 14, 15) + \Sigma\, d(4, 10, 13)$. Identify all essential prime implicants and find all minimum sum-of-products expressions.

(b) Repeat Part (a) for f'.

6.16 $G(A, B, C, D, E, F) = \Sigma\, m(1, 2, 3, 16, 17, 18, 19, 26, 32, 39, 48, 63) + \Sigma\, d(15, 28, 29, 30)$

(a) Find all minimum sum-of-products expressions for G.
(b) Circle the *essential* prime implicants in your answer.
(c) If there were no don't-care terms present in the original function, how would your answer to part (a) change? (Do this by inspection of the prime implicant chart; do *not* rework the problem.)

6.17 (a) Use the Quine-McCluskey procedure to find *all* prime implicants of the function $G(A, B, C, D, E, F) = \Sigma\, m(1, 7, 11, 12, 15, 33, 35, 43, 47, 59, 60) + \Sigma\, d(30, 50, 54, 58)$. Identify all essential prime implicants and find all minimum sum-of-products expressions.
(b) Repeat Part (a) for G'.

6.18 The following prime implicant table (chart) is for a four-variable function $f(A, B, C, D)$.
(a) Give the decimal representation for each of the prime implicants.
(b) List the maxterms of f.
(c) List the don't-cares of f, if any.
(d) Give the algebraic expression for each of the essential prime implicants.

	2	3	7	9	11	13
−0–1		×		×	×	
−01–	×	×			×	
--11		×	×		×	
1--1				×	×	×

6.23 (a) Rework Problem 6.6(a), using a five-variable map.
(b) Rework Problem 6.6(a), using the Quine-McCluskey method. Note that you must express F in terms of minterms of all five variables; the original four-variable minterms cannot be used.

6.24 Using map-entered variables, find the minimum sum-of-products expressions for the following function:

$G = C'E'F + DEF + AD'E'F' + BDE'F + AD'EF'$