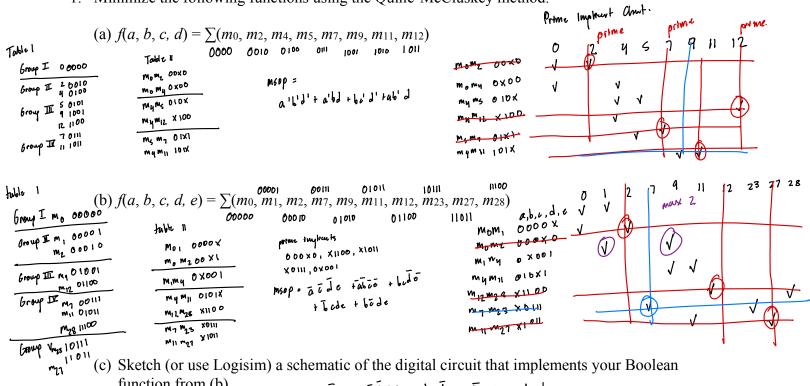# ECE 255 – Introduction to Digital Logic Design
Homework Assignment 4
Due October 13

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1. Minimize the following functions using the Quine-McCluskey method.

(a) $f(a, b, c, d) = \sum(m_0, m_2, m_4, m_5, m_7, m_9, m_{11}, m_{12})$

$0000 \quad 0010 \quad 0100 \quad 0111 \quad 1001 \quad 1010 \quad 1011$

Table I

Group I   0 0000

Group II   2 0010
           4 0100

Group III   5 0101
            9 1001
           12 1100

Group IV   7 0111
           11 1011

Table II

$m_0 m_2$ 00X0
$m_0 m_4$ 0X00
$m_4 m_5$ 010X
$m_4 m_{12}$ X100
$m_5 m_7$ 01X1
$m_9 m_{11}$ 10X

$msop = a'b'd' + a'bd + bc'd' + ab'd$

Prime Implicant Chart.

$m_0 m_2$ 00X0
$m_0 m_4$ 0X00
$m_4 m_5$ 010X
$m_4 m_{12}$ X100
$m_5 m_7$ 01X1
$m_9 m_{11}$ 101X

(b) $f(a, b, c, d, e) = \sum(m_0, m_1, m_2, m_7, m_9, m_{11}, m_{12}, m_{23}, m_{27}, m_{28})$

$00001 \quad 00111 \quad 01011 \quad 10111 \quad 11100$
$00000 \quad 00010 \quad 01010 \quad 01100 \quad 11011$

Table I

Group I m_0 00000

Group II m_1 00001
           m_2 00010

Group III m_9 01001
           m_{12} 01100

Group IV m_7 00111
          m_{11} 01011
          m_{28} 11100

Group V m_{23} 10111
          m_{27} 11011

Table II

$m_0 m_1$ 0000X
$m_0 m_2$ 00 X1
$m_1 m_9$ 0X001
$m_9 m_{11}$ 0101X
$m_{12} m_{28}$ X1100
$m_7 m_{23}$ X0111
$m_{11} m_{27}$ X1011

prime implicants
000X0, X1100, X1011
X0111, 0X001

$msop = \bar{a}\bar{c}\bar{d}e + \bar{a}b\bar{c}\bar{e} + bc\bar{d}\bar{e}$
$+ \bar{b}cde + b\bar{c}de$

Prime Implicant Chart

a, b, c, d, e
$m_0 m_1$ 0000X
$m_0 m_2$ 000X0
$m_1 m_9$ 0X001
$m_9 m_{11}$ 010X1
$m_{12} m_{28}$ X1100
$m_7 m_{23}$ X0111
$m_{11} m_{27}$ X1011

(c) Sketch (or use Logisim) a schematic of the digital circuit that implements your Boolean function from (b).

$msop = \bar{a}\bar{c}\bar{d}e + \bar{a}b\bar{c}\bar{e} + bc\bar{d}\bar{e} + \bar{b}cde + b\bar{c}de$