# ICS 2021 Problem Sheet #7

Problem 7.1

a)

$f(x_5, x_4, x_3, x_2, x_1, x_0) = m\_0 + m\_1 + m\_2 + m\_3 + m\_5 + m\_8 + m\_13 + m\_21 + m\_34 + m\_55$

cost (m_0 + m_1 + m_2 + m_3 + m_5 + m_8 + m_13 + m_21 + m_34 + m_55) = (5 * 10) + 9 = 59

b)

| | | |
|---|---|---|
| 000000 m_0 # | m0,1<br>m0,2<br>m0,8 # | M0,8 |
| 000001 m_1 #<br>000010 m_2 #<br>001000 m_8 # | m1,3<br>m1,5 #<br>m2,3<br>m2,34 # | M1,5<br>M2,34 |
| 000011 m_3 #<br>000101 m_5 #<br>100010 m_34 # | m5,13 #<br>m5,21 # | M5,13<br>M5,21 |
| 001101 m_13 #<br>010101 m_21 # | | |
| 110111 m_55 | | |

Prime Implicants = m0,8, m1,5, m2,34, m5,13, m5,21, m55, m0,1,2,3

c)

| | | 0 | 1 | 2 | 3 | 5 | 8 | 13 | 21 | 34 | 55 | Essential Prime Implicants |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| m0,1,2,3 | 0000__ | x | x | x | X | | | | | | | $\bar{X}_5\bar{X}_4\bar{X}_3\bar{X}_2$ |
| m0,8 | 00_000 | x | | | | | X | | | | | $\bar{X}_5\bar{X}_4\bar{X}_2\bar{X}_1\bar{X}_0$ |
| m1,5 | 000_01 | | x | | | x | | | | | | $\bar{X}_5\bar{X}_4\bar{X}_3\bar{X}_1X_0$ |
| m2,34 | _00010 | | | x | | | | | | X | | $\bar{X}_4\bar{X}_3\bar{X}_2X_1\bar{X}_0$ |
| m5,13 | 00_101 | | | | | x | | X | | | | $\bar{X}_5\bar{X}_4X_2\bar{X}_1X_0$ |
| m5,21 | 0_0101 | | | | | x | | | X | | | $\bar{X}_5\bar{X}_3X_2\bar{X}_1X_0$ |
| m55 | 110111 | | | | | | | | | | X | $X_5X_4\bar{X}_3X_2X_1X_0$ |

Essential prime implicants = m0,1,2,3, m0,8, m2,34, m5,13, m5,21, m55

d)

Minimal Boolean expression:

$$y = (\bar{x}_5\bar{x}_4\bar{x}_3\bar{x}_2) + (\bar{x}_5\bar{x}_4\bar{x}_2\bar{x}_1\bar{x}_0) + (\bar{x}_5\bar{x}_4x_2\bar{x}_1x_0) + (\bar{x}_5\bar{x}_3x_2\bar{x}_1x_0) + (\bar{x}_4\bar{x}_3\bar{x}_2x_1\bar{x}_0) + (x_5x_4\bar{x}_3x_2x_1x_0)$$