# ITI 1100B

## MIDTERM SOLUTIONS

Q1) $(63)_{10} = (00111111)_2$

$(-63)_{10} = (11000001)_2$

$(115)_{10} = (01110011)_2$

$(-115)_{10} = (10001101)_2$

$\Rightarrow (-115)_{10} - (-63)_{10} = (-115)_{10} + (63)_{10}$

$= (10001101)_2 + (00111111)_2$

$= \boxed{(11001100)_2}$

Q2) Decimal to Binary.

a.) $(60.125)_{10} \rightarrow$ Binary.

| Division by 2 | Quotient | Remainder. |
|---|---|---|
| 60/2 | 30 | $a_0 = 0$ |
| 30/2 | 15 | $a_1 = 0$ |
| 15/2 | 7 | $a_2 = 1$ |
| 7/2 | 3 | $a_3 = 1$ |
| 3/2 | 1 | $a_4 = 1$ |
| 1/2 | 0 | $a_5 = 1$ |

Q2) Cont: Therefore, Integer part is: 

$$(60)_{10} = (111100)_2$$

Fraction Part:

| Multiplication by 2 | Integer | Fraction |
|---|---|---|
| $0.125 \times 2$ | $a_{-1}=0$ | 0.25 |
| $0.25 \times 2$ | $a_{-2}=0$ | 0.5 |
| $0.5 \times 2$ | $a_{-3}=1$ | 0 |

$$(0.125)_{10} = (0.001)_2$$

Combining Integer and fraction part, we get:

$$(60.125)_{10} = (111100)_2 + (0.001)_2$$

$$= \boxed{(111100.001)_2}$$

Q2) b.) Decimal to Octal:

* For Integer part divide by 8.
* For Fraction part multiply by 8.

OR.

Convert the result in Q2) a.) directly to Octal as follows:

$$\underbrace{111}_{7}\ \underbrace{100}_{4}.\ \underbrace{001}_{1}$$

$$\boxed{(60.125)_{10} = (74.1)_8}$$

Q3) $ab + a'c + bc + a'b'c$

$= \underbrace{abc} + \underbrace{abc'} + \underbrace{a'bc} + \underbrace{a'b'c} + \underbrace{abc} + \underbrace{a'bc} + \underbrace{a'b'c}$

$abc$, $a'bc$, $a'b'c$

$= \underbrace{abc} + \underbrace{a'bc} + \underbrace{a'b'c} + \underbrace{abc'}$

$= ab, \; a'c$

$= \boxed{ab + a'c} \Rightarrow$ Answer is (d)

Q4) Given:

$f(x,y,z) = (x+y')(x'+z)(y'+z)(x'+y+z)$

Recall:

$(x+y') = (x+y'+zz') = (x+y'+z)(x+y'+z')$

$(x'+z) = (x'+yy'+z) = (x'+y+z)(x'+y'+z)$

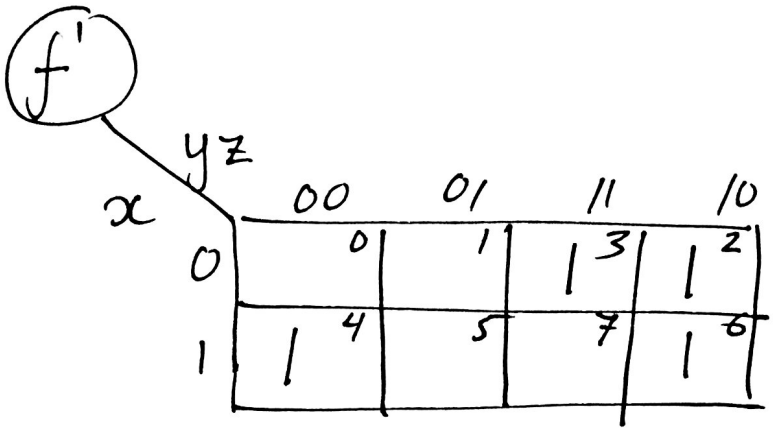
$(y'+z) = (xx'+y'+z) = (x+y'+z)(x'+y'+z)$

$\Rightarrow f(x,y,z) = \underbrace{(x+y'+z)}\underbrace{(x+y'+z')}\underbrace{(x'+y+z)}\underbrace{(x'+y'+z)}\underbrace{(x+y'+z)}\underbrace{(x'+y'+z)}\underbrace{(x'+y+z)}$

$\therefore f(x,y,z) = (x+y'+z)(x+y'+z')(x'+y+z)(x'+y'+z)$

$\Rightarrow f' = x'yz' + x'yz + xy'z' + xyz'.$

Q4) Cont:



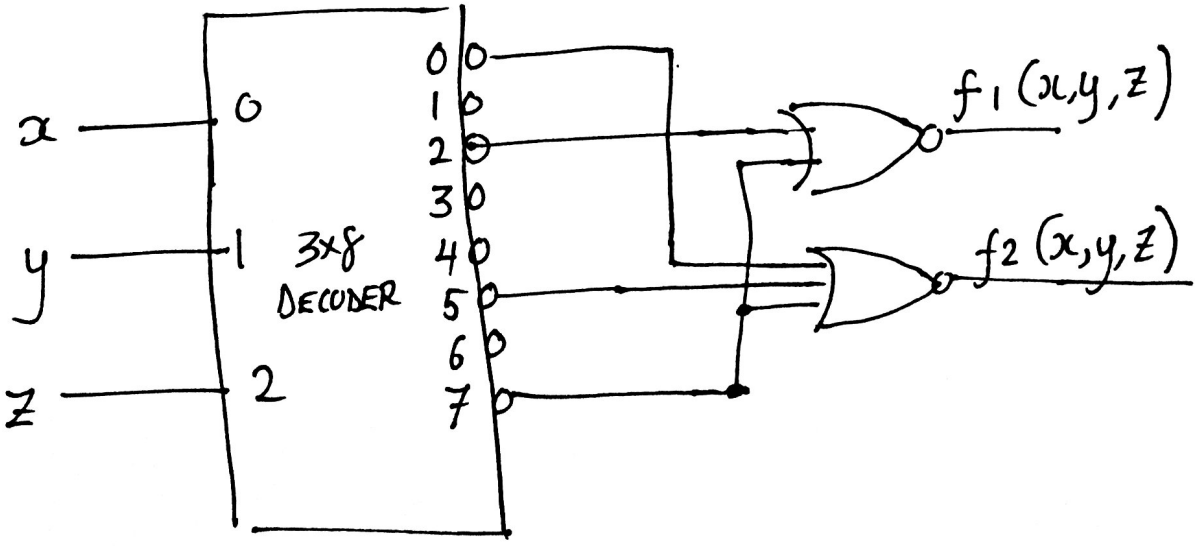

$$\Rightarrow f' = \Sigma m\,(2,3,4,6)$$

$$f = \Sigma m\,(0,1,5,7)$$

Q5) Given: $f_1(x,y,z) = \Sigma m\,(0,1,3,4,5,6)$

$f_2(x,y,z) = \Pi M\,(0,5,7)$

$f_1(x,y,z) = \Sigma m(0,1,3,4,5,6) = \Pi M(2,7)$



Q6) $F(A,B,C,D) = \Sigma m(1,4,6,7,9,10,11,12)$ ⑤

| * m | A | * C | D | * B | F | |
|---|---|---|---|---|---|---|
| $m_0$ | 0 | 0 | 0 | 0 | 0 | B |
| $m_4$ | 0 | 0 | 0 | 1 | 1 | |
| $m_1$ | 0 | 0 | 1 | 0 | 1 | B' |
| $m_5$ | 0 | 0 | 1 | 1 | 0 | |
| $m_2$ | 0 | 1 | 0 | 0 | 0 | B |
| $m_6$ | 0 | 1 | 0 | 1 | 1 | |
| $m_3$ | 0 | 1 | 1 | 0 | 0 | B |
| $m_7$ | 0 | 1 | 1 | 1 | 1 | |
| $m_8$ | 1 | 0 | 0 | 0 | 0 | B |
| $m_{12}$ | 1 | 0 | 0 | 1 | 1 | |
| $m_9$ | 1 | 0 | 1 | 0 | 1 | B' |
| $m_{13}$ | 1 | 0 | 1 | 1 | 0 | |
| $m_{10}$ | 1 | 1 | 0 | 0 | 1 | B' |
| $m_{14}$ | 1 | 1 | 0 | 1 | 0 | |
| $m_{11}$ | 1 | 1 | 1 | 0 | 1 | B' |
| $m_{15}$ | 1 | 1 | 1 | 1 | 0 | |

NOTE: * B is at the right-most column before F
* The sequence of minterms reflects the location of B in table.

Answer: (C) B, B', B, B, B, B', B', B'

Q7).

Given:

$$F(A,B,C,D) = (A' \oplus B' \oplus C' \oplus D')'$$

$$\Rightarrow F'(A,B,C,D) = A' \oplus B' \oplus C' \oplus D'$$

$$= (A'B + AB') \oplus (C'D + CD')$$

$$= (A'B+AB')(C'D+CD')' + (A'B+AB')'(C'D+CD')$$

$$= (A'B+AB')\big((C+D')(C'+D)\big) + \big((A+B')(A'+B)\big)(C'D+CD')$$

$$= (A'B+AB')(CD+C'D') + (AB+A'B')(C'D+CD')$$

$$= \underbrace{A'BCD}_{m_7} + \underbrace{A'BC'D'}_{m_4} + \underbrace{AB'CD}_{m_{11}} + \underbrace{AB'C'D'}_{m_8} + \underbrace{ABC'D}_{m_{13}} + \underbrace{ABCD'}_{m_{14}} + \underbrace{A'B'C'D}_{m_1} + \underbrace{A'B'CD'}_{m_2}$$

$$F'_{(A,B,C,D)} = \sum m(1,2,4,7,8,11,13,14)$$

$$\Rightarrow F(A,B,C,D) = \sum_m(0,3,5,6,9,10,12,15)$$

$$\therefore F(A,B,C,D) = \prod_M(1,2,4,7,8,11,13,14)$$

Q8) Given: (7)

$$F(A,B,C,D) = \pi_M(1,3,5,7,13,15),\ \pi_D(9,11)$$

(F)

| AB \ CD | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 1 (0) | 0 (1) | 0 (3) | 1 (2) |
| 01 | 1 (4) | 0 (5) | 0 (7) | 1 (6) |
| 11 | 1 (12) | 0 (13) | 0 (15) | 1 (14) |
| 10 | 1 (8) | X (9) | X (11) | 1 (10) |

D

$$\Rightarrow F'(A,B,C,D) = D$$

$$F = D'$$

Q9) Given: (8)

$F(A,B,C,D) = AC' + B'D + A'CD + ABCD$

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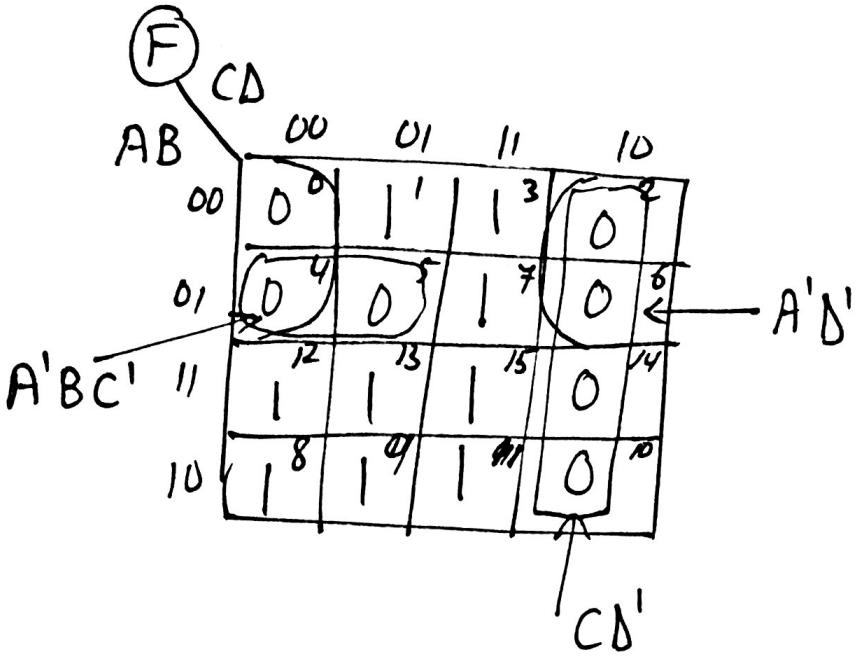


$\Rightarrow F'(A,B,C,D) = A'D' + CD' + A'BC'$

$F = (A+D)(C'+D)(A+B'+C)$