Name: Mulia Widjaja 10/7/2022

Homework #3

1. a. 1011100111

Left-most bit: 1 → negative

Flip: 1011100111 → 0100011000 + 1 = 0100011001

$0 \cdot 2^9 + 1 \cdot 2^8 + 0 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0$

$= (281)_{10}$

Due to negative: $(-281)_{10}$

b. 1111111110

Left-most bit: 1 → negative

Flip: 1111111110 → 0000000001 + 1 = 0000000010

$0 \cdot 2^9 + 0 \cdot 2^8 + 0 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 0 \cdot 2^4 + 0 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0 = 2$

(cont.)

1. b. Due to negative: $(-2)_{10}$

c. 01110 11110

Left-most bit: positive → Flipping is NOT needed

$0 \cdot 2^9 + 1 \cdot 2^8 + 1 \cdot 2^7 + 1 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0$

$= (478)_{10}$

2. Left Part:

$X \oplus (Y \oplus Z) = \overline{X}(Y \oplus Z) + X\overline{(Y \oplus Z)}$

$= \overline{X}(\overline{Y}Z + Y\overline{Z}) + X\overline{(\overline{Y}Z + Y\overline{Z})}$

$= \overline{X}(\overline{Y}Z + Y\overline{Z}) + X\,\overline{\overline{Y}Z}\;\overline{Y\overline{Z}}$

$= \overline{X}(\overline{Y}Z + Y\overline{Z}) + X(\overline{\overline{Y}} + \overline{Z})\,\overline{Y \cdot \overline{Z}}$

$= \overline{X}(\overline{Y}Z + Y\overline{Z}) + X(Y + \overline{Z})(\overline{Y} + \overline{\overline{Z}})$

$= \overline{X}(\overline{Y}Z + Y\overline{Z}) + X(Y + Z)(\overline{Y} + Z)$

$= X\overline{Y}Z + XY\overline{Y} + XZ\overline{Z} + X\overline{Y}\overline{Z} + \overline{X}Y\overline{Z} + \overline{X}\,\overline{Y}Z$

$= XY\overline{Z} + X\overline{Y}\overline{Z} + \overline{X}Y\overline{Z} + \overline{X}\,\overline{Y}Z$

2. (cont.)

Right Part:

$(X \oplus Y) \oplus Z)$

$= \overline{(X \oplus Y)}\, Z + (X \oplus Y)\, \overline{Z}$

$= (\overline{X}Y + X\overline{Y})\, Z + (\overline{X}Y + X\overline{Y})\, \overline{Z}$

$= (\overline{X}Y)(\overline{X\overline{Y}})\, Z + (\overline{X}Y + X\overline{Y})\, \overline{Z}$

$= (\overline{X} + \overline{Y})(\overline{X} + \overline{\overline{Y}})\, Z + (\overline{X}Y + X\overline{Y})\, \overline{Z}$

$= (X + \overline{Y})(\overline{X} + Y)\, Z + (\overline{X}Y + X\overline{Y})\, \overline{Z}$

$= XYZ + X\overline{X}Z + X\overline{Y}Z + Y\overline{Y}Z + \overline{X}Y\overline{Z} + \overline{X}\,\overline{Y}Z$

$= XYZ + X\overline{Y}\overline{Z} + \overline{X}\,\overline{Y}Z + \overline{X}Y\overline{Z}$ // → (Proven associative)

3.

$$\begin{array}{r} 00\,1\,10\,10 \\ +\ 0\,100\,0\,1 \\ \hline 01\,111\,011 \end{array} \longrightarrow \begin{array}{r} (+54) \\ +\,(+69) \\ \hline 123 \end{array} \quad //$$

$$\begin{array}{r} 1\,1\,1\,1\,1\,1 \\ 0\,1\,1\,1\,0\,1\,0 \\ +\ 1\,1\,0\,1\,1\,1\,0 \\ \hline 1\,0\,1\,0\,1\,0\,0\,1\,1 \end{array} \longrightarrow \begin{array}{r} (+117) \\ +\,(-34) \\ \hline 83 \end{array}$$

↓ ignore

$$\begin{array}{r} 1\,1\,1\,1 \\ 1\,1\,0\,1\,1\,1\,1\,1 \\ +\ 1\,0\,1\,1\,1\,0\,0\,0 \\ \hline 1\,1\,0\,0\,1\,0\,1\,1 \end{array} \longrightarrow \begin{array}{r} (-33) \\ +\,(-72) \\ \hline -105 \end{array}$$

↓ ignore