

A6

Q1)

$$\begin{array}{rcl} 1. \quad 51 & = & 00110011 \\ + 77 & = & 01001101 \\ \hline & & 10000000 \end{array}$$

↓
1st bit being sign bit

we have a negative number as the sum of 2 positive numbers. hence an overflow

+128 is not in the range $[-128, 127]$
(actual result after adding in decimal representation)

$$\begin{array}{rcl} 2. \quad 53 & = & 00110101 \\ 112 & = & 01110000 \\ -112 & = & 10001111 \\ & + & 1 \\ \hline & & 10010000 \quad (\text{2's complement}) \end{array}$$

$$\begin{array}{rcl} 53 + (-112) & = & 00110101 \\ & & 10010000 \\ \hline & & 11000101 \end{array}$$

↓
No carry here, 1st bit sign bit.

hence 2's complement representation will be.

$$\begin{array}{rcl} 00111010 & & \\ + 1 & & \\ \hline 00111011 & & \end{array}$$

$$\begin{aligned} &= -(2^0 + 2^1 + 2^3 + 2^4 + 2^5) \\ &= -(1 + 2 + 8 + 16 + 32) \\ &= -(11 + 48) = -(59) \end{aligned}$$

$$3. \quad 35 = 00100011$$

$$23 = 00010111$$

$$-23 = 11101000 + 1$$

$$\underline{11101001} \quad (2's \text{ complement})$$

$$35 + (-23) = 00100011$$

$$11101001$$

$$\underline{\cancel{0}0001100}$$

$$\cancel{\#} = 2^2 + 2^3 = 12$$

$$4. \quad 87 = 01010111$$

$$+ \quad 12 = 00001100$$

$$+ \quad \underline{01100011}$$

$$= 99$$

$$5. \quad 75 = 01001011$$

$$-75 = 10110100$$

$$+ 1$$

$$\underline{10110101}$$

$$54 = 00110110$$

$$-54 = 11001001$$

$$+ 1$$

$$\underline{11001010}$$

$$(-75) + (-54) = 10110101$$

$$11001010$$

$$\underline{\cancel{0}1111111}$$

$$= 2^0 + 2^1 + 2^2 + 2^3 + \dots + 2^6 = 2^7 - 1 = 127$$

Underflow

\therefore addition of 2 negative nos cannot be positive

Again

~~1st~~ is