

WEEK 1 TASK 2

- Calculate $10-19$, $20+30$, $36-12$ in signed, 1s and 2s complement.

- Using 1s complement

- $10 - 19$

$$(10)_{10} = (01010)_2 = 0\ 01010_2$$

$$(-19)_{10} = -(10011)_2 = 1\ 01100_2$$

$$\begin{array}{r} 0\ 01010 \\ +1\ 01100 \\ \hline \end{array}$$

$$1\ 10110$$

no carry, take 1s complement of the result

$1\ 01001 \leftarrow$ result

- $20 + 30$

$$(20)_{10} = (10100)_2 = 0\ 10100_2$$

$$(30)_{10} = (11110)_2 = 0\ 11110_2$$

$$\begin{array}{r} 0\ 10100 \\ +0\ 11110 \\ \hline \end{array}$$

$$0\ 1\ 10010$$

$0\ 110010 \leftarrow$ result

- $36 - 12$

$$(36)_{10} = (100100)_2 = 0\ 100100_2$$

$$(-12)_{10} = -(001100)_2 = 1\ 110011_2$$

$$\begin{array}{r} 0\ 100100 \\ +1\ 110011 \\ \hline \end{array}$$

$$1\ 0\ 010111$$

add carry to lower bit

$0\ 011000 \leftarrow$ result

- Using 2s complement

- $10 - 19$

$$(10)_{10} = (01010)_2 = 0\ 01010_2$$

$$(-19)_{10} = -(10011)_2 = 1\ 01101_2$$

$$\begin{array}{r} 0\ 01010 \\ +1\ 01101 \\ \hline \end{array}$$

$$1\ 10111$$

no carry, take 2s complement of the result

$1\ 01001 \leftarrow$ result

- $20 + 30$

$$(20)_{10} = (10100)_2 = 0\ 10100_2$$

$$(30)_{10} = (11110)_2 = 0\ 11110_2$$

$$\begin{array}{r} 0\ 10100 \\ +0\ 11110 \\ \hline \end{array}$$

$$0\ 1\ 10010$$

$0\ 110010 \leftarrow$ result

- 36 - 12

$$\begin{array}{r} (36)_{10} = (100100)_2 = 0\ 100100_2 \\ (-12)_{10} = -(001100)_2 = 1\ 110100_2 \\ \phantom{(-12)_{10} = -(001100)_2 = 1\ 110100_2} 0\ 100100 \\ \phantom{(-12)_{10} = -(001100)_2 = 1\ 110100_2} \underline{+1\ 110100} \\ 1\ 0\ 011000 \quad \text{discard carry} \\ 0\ 011000 \leftarrow \text{result} \end{array}$$

- Using signed

- 10 - 19

$$\begin{array}{r} (10)_{10} = (01010)_2 = 0\ 01010_2 \\ (-19)_{10} = -(10011)_2 = 1\ 10011_2 \\ \phantom{(-19)_{10} = -(10011)_2 = 1\ 10011_2} 0\ 01010 \\ \phantom{(-19)_{10} = -(10011)_2 = 1\ 10011_2} \underline{+1\ 10011} \\ 1\ 11101 \end{array}$$
- 20 + 30

$$\begin{array}{r} (20)_{10} = (10100)_2 = 0\ 10100_2 \\ (30)_{10} = (11110)_2 = 0\ 11110_2 \\ \phantom{(30)_{10} = (11110)_2 = 0\ 11110_2} 0\ 10100 \\ \phantom{(30)_{10} = (11110)_2 = 0\ 11110_2} \underline{+0\ 11110} \\ 0\ 1\ 10010 \end{array}$$
- 36 - 12

$$\begin{array}{r} (36)_{10} = (100100)_2 = 0\ 100100_2 \\ (-12)_{10} = -(001100)_2 = 1\ 001100_2 \\ \phantom{(-12)_{10} = -(001100)_2 = 1\ 001100_2} 0\ 100100 \\ \phantom{(-12)_{10} = -(001100)_2 = 1\ 001100_2} \underline{+1\ 001100} \\ 1\ 110000 \end{array}$$