p

* Finding 1's and 2's compliment

$(101011.11)_2$

Base 2 $\longrightarrow$ 2's

$\searrow$ 1's

1's compliment

$2^6 - (101011.11)_2$

$$\begin{array}{r} 111111.11 \\ -101011.11 \\ \hline 010100.00 \end{array}$$

2's compliment $\longrightarrow$

$$\begin{array}{r} 1000000.00 \\ .101011.11 \\ \hline 010100.01 \end{array}$$

L-8

* <u>Subtraction using "r" and "(b-1)"'s compliment</u>

o why compliments? we want to do subtraction using adder circuit.

<u>Base 10</u>

Subtraction using r's compliment

$136 \longrightarrow$ menu end

$-53 \longrightarrow$ subtrahand

$136$

$-053$

10's compliment $\begin{array}{r} 1000 \\ -053 \\ \hline 947 \end{array}$ $\Longrightarrow$

$$\begin{array}{r} 136 \\ +947 \\ \hline 1083 \\ -1000 \\ \hline 83 \end{array}$$

<u>Ignore</u>

Carry

Take 10's compliment of Subtrahand and add it to menuend

**Case 1)** If final carry generated then ans. is positive & is given by after ignoring the carry

**Case 2)** if final carry is not generated then the ans is negative and is in 10's compliment form.

**Case 1 ex**

o

```
   46          46           46
 - 25    =>   +100        + 75
             - 25         /21
                           ⌐⌐  => ans
                           ↳ Ignore
                             this
```

**Case 2 ex**

o

```
   25          25             25
 - 46    =>   100       =>   + 54    =>  -(100 - 79)
             - 46            79
                                        = - 21 Ans
```

o **Base 2**

```
  101101         101101
- 001011   =>  + 110101  ─────→ 2's compliment
               1 100010        of subtrahard
               ↓     ↓
             Ignore  Ans
             this!
```

# Rule of 2's Compliment Subtraction

Take 2's compliment of subtrahand and add it to menuend [match dijits]

→ If final carry is generated then ans is positive & is given by after ignoring the carry

→ But if carry is not generated than ans is negative & is 2's Compliment form.

* Subtraction using $(2-1)'s$ Compliment

Base 10

$$13^6$$
$$- 43$$
$$93$$

$$13^6$$
$$- 043$$

$$136$$
$$999$$
$$- 043$$

$$136$$
$$= + 956$$
$$1092$$

add carry in the last

$$092$$
$$+1$$
$$93 \quad Ans$$

end around carry

Subtration using 9's compliment

$\rightarrow (r-1)'s$

- Take 9's compliment of the subtrhand and add it to menuend
  if final carry is generated [end around carry]
  ans is positive and is given by this
  end around carray at the "last place"

$$\begin{array}{r} +43 \\ -136 \end{array} \Rightarrow \quad 1\,\cancel{136} \quad \begin{array}{r} 43 \\ 999 \\ -136 \end{array} \Rightarrow \begin{array}{r} 43 \\ +863 \\ \hline 906 \end{array}$$

$$(906 - 999) \quad \Rightarrow \quad -(999-906) = -93$$

- If carry is not generated then ans is -ve
  then and is in 9's compliment form.
  $(r-1)'s$

* Base 2
$$\begin{array}{r} 1011011 \\ -0011111 \end{array} \Rightarrow \begin{array}{r} 1011011 \\ 1110000 \\ \hline 11001011 \end{array}$$
add here

$$\begin{array}{r} \cancel{1}10100 \\ 1001011 \\ +1 \\ \hline 1001100 \end{array} \text{ Ans}$$

$$\begin{array}{r} 0001111 \\ -1011011 \end{array}$$

$$\begin{array}{r} 0001111 \\ 0100100 \\ \hline 0110011 \end{array} \Rightarrow \begin{array}{r} 1111111 \\ -0110011 \\ \hline 1001100 \end{array}$$