

(r-1)'s complement subtraction

Sunday, August 23, 2020 7:23 PM

A = Minuend

B = Subtrahend

1. Add minuend (A) to the (r-1)'s complement of subtrahend (B)
2. (a) If end around carry occurs then add that carry to the LSB of the result obtained from step 1 $A > B$
(b) If end around carry does not occur then answer is in (r-1)'s complement form. $A < B$
- 3 To get answer in true form, perform (r-1)'s complement of result (step 2b) and place negative sign in front of it

$$\textcircled{1} \text{ 9's Complement of } \overset{A}{(53)_{10}} - \overset{B}{(27)_{10}} \Rightarrow A > B$$

$r = 10$; $(r-1)'s \Rightarrow (10-1)'s = 9's$

$$A = (53)_{10} \text{ Minuend}$$

$$9's \text{ Complement of } (27)_{10} \Rightarrow (72)_{10}$$

$$A = 53 \rightarrow 2 \text{ digits}$$

$$9's \text{ Complement } B = \underline{72} \rightarrow 2 \text{ digits}$$

9's Complement B = 72 \rightarrow 2 digits
of

end carry \rightarrow

$$\begin{array}{r} 125 \\ - 1 \\ \hline 124 \end{array}$$

Result 26 ✓

Direct method

$$\begin{array}{r} 53 \\ - 27 \\ \hline 26 \end{array}$$

② $\overset{A}{(27)}_{10} - \overset{B}{(53)}_{10}$ using 9's Complement
Subtraction ($A < B$)

Direct method

$$\begin{array}{r} 27 \\ - 53 \\ \hline -26 \end{array}$$

9's Complement of $(53)_{10} = (46)_{10}$

A = Minuend = 27

9's Complement of (B) = Subtrahend = 46

9's Complement \rightarrow 73 Result

9's Complement $\overline{73}$ Result
 ↓
 No carry

True form

9's Complement of (73) = 26

True result = -26 ✓

③ $\overset{A}{(53)} - \overset{B}{(27)}$ using 8's complement
_{8 8}
 Subtraction

Direct method
 $\begin{array}{r} \overset{\rightarrow 8}{53} \\ - 27 \\ \hline 24 \end{array}$ $8+3=11$

8's complement of (27) =

7's complement of (27) $\left\{ \begin{array}{r} 77 \\ 27 \\ \hline 50 \end{array} \right\}$ ✓

8's complement = 7's + 1 = 51

$$8's \text{ Complement} = 7's \text{ Complement} + 1 \Rightarrow 51$$

$$A = 53$$

$$8's \text{ Comp } B = 51$$

$$\begin{array}{r} 10 \ 4 \\ \hline 1 \ 2 \ 4 \\ \hline \end{array}$$

end carry
neglect

$$(10)_{10} = (12)_8$$

$$\begin{array}{r} 8 \overline{) 10} \\ 8 \overline{) 1} \rightarrow 2 \uparrow \\ 0 - 1 \end{array}$$

carry sum

$$7's \text{ Complement } A = 53$$

$$(B) = 50$$

$$\begin{array}{r} 10 \overline{) 3} \\ 1 \ 2 \ 3 \\ \hline 1 \\ \hline 24 \end{array}$$

end carry

$$\underline{A > B}$$

④ $(27)_8 - (53)_8$ using 7's Complement
 subtraction

$A < B \checkmark$

$$\begin{array}{r} \text{Direct} \\ 27 \\ - 53 \\ \hline -24 \end{array}$$

7's Complement of $(53)_{10} = (24)_8$

$A = 27$

$(11)_{10} = (13)_8$

7's Complement of $B = 24$

No carry $\rightarrow \boxed{53} \rightarrow$ 7's Complement

$$\begin{array}{r} 8 \overline{) 11} \\ 1 - 3 \end{array}$$

True form

$(53)_8$ i. must be in 7's Complement = 24

True form = -24 \checkmark

④ $\overset{A}{(B6)}_{16} - \overset{B}{(72)}_{16}$ subtract using 15's complement $A > B$

15's Complement of $(72)_{16} \Rightarrow \overset{15}{-7} \overset{15}{-2}$
 $\underline{\hspace{1cm}} \quad \underline{\hspace{1cm}}$
 $\underline{8 \quad D}$

$B = 11$

Direct
$\underline{B6}$
$- 72$
$\underline{\hspace{1cm}}$
44

$D = 13$

15's Comp $(72) = 8D$

carry \rightarrow

$\overset{1}{B6}$
$\underline{\hspace{1cm}}$
143
$\underline{\hspace{1cm}}$
1
$\underline{\hspace{1cm}}$
44

$(20)_{10} = (14)_{16}$ $\overset{13}{\underset{6}{(19)}}_{10} = (\quad)_{16}$

$16 \overline{) 19}$
 $\underline{1-3}$

8's \rightarrow end carry \rightarrow discarded

$(8-1)$'s \rightarrow end carry \rightarrow Add that to the
 $A > B$ LSB of the result

7's

9's

15's

1's

$$= (19)_{10}$$

$$\begin{array}{r} 16^1 16^0 \\ (13)_{16} = (19)_{10} \end{array}$$

$$= (13)_{16}$$

↑↑ 16
Carry Sum

$$\begin{array}{r} 16 \overline{) 19} \\ 16 \overline{) 1} - 3 \uparrow \text{LSB} \\ 0 - 1 \downarrow \text{MSB} \end{array}$$

$$16^1 \times 1 + 16^0 \times 3$$

$$16 + 3 = 19$$

$$\begin{array}{r} 16^0 \\ (B)_{16} = (19)_{10} \end{array}$$

$$16^0 \times B = \underline{\underline{(B)_{16}}}$$

$$\textcircled{5} \quad (72)_{16} - (B6)_{16}$$

$$15\text{'s Complement of } (B6) = \begin{array}{r} 15 \quad 15 \\ B \quad 6 \\ \hline 4 \quad 9 \\ \hline \end{array}$$

$$\begin{array}{r} 72 \\ 49 \\ \hline B \quad B \\ \hline \end{array}$$

$$9+2=11=B$$

15's
Complement

True form

$$15\text{'s Complement of } BB =$$

$$\begin{array}{r} 15 \quad 15 \\ B \quad B \\ \hline 4 \quad 4 \\ \hline \end{array}$$

$$\therefore \text{ True } = -44$$

⑦ $(101)_2 - (011)_2$ using 1's Complement

$$(5)_{10} - (3)_{10} = (2)_{10}$$

1's Complement of $(011)_2 = 100$

$$A = 101 \rightarrow 3 \text{ bits}$$

$$(011)_2 \text{ 1's Comp } B = 100 \rightarrow 3 \text{ bits}$$

$$\begin{array}{r} \text{end} \\ \text{Carry} \end{array} \rightarrow \begin{array}{r} 1001 \\ \hline \end{array} \rightarrow 4 \text{ bits}$$

$$(2)_{10} = \underline{010} \text{ Result}$$

⑦ $(011)_2 - (101)_2$ using 1's Complement subtraction
 $A \quad B \Rightarrow A < B$

1's Complement of $(101)_2 = (010)_2$
 $A = \overset{1}{0}11$

$(101)_2$ 1's Comp $B = \underline{010}$
 1's Complement $\rightarrow \overset{1}{0}1$ No carry
 result

True form

1's Complement of $(101)_2 = (010)_2$

True form = $-(\underline{010})_2$

⑧ $(11011.10)_2 - (101.01)_2$
 using 1's Complement subtraction