r's Complement Subtraction

A= Minuend
B=Subtrahend

1. Add minuend (A) to the r's complement of subtrahend (B)
2. (a) If end around carry occurs discard it   A>B
   (b) If end around carry does not occurs then answer is in r's complement form.   A<B

(i)	To get answer in true form ,perform r's complement of

result (step (b))and place negative sign in front of it

① r = 10 (Decimal)

10's complement Subtraction

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

$B = (27)_{10}$ = Subtrahend

Direct method

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

1. Add minuend (A) to the r's (10's) complement of subtrahend (B)

A − B

$(53)_{10} - (27)_{10}$

A = 53

10's complement of 27 = 9's Complement + 1

= 72 + 1

= $(73)_{10}$

A = 53

10's Complement (27) = 73

A > B   53 − 27

Result = $(26)_{10}$

10's Complement of B (27) = 13.

$\overline{1\,26}$ → Result $= (26)_{10}$

end carry → neglect

If end around carry occurs discard it

Result = 26 ✓

A B → A<B = −ve result

② $(27)_{10}$ ✓ − $(53)_{10}$ → 10's Complement subtraction

Minuend Subtrahend

A = 27

Direct method

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

10's Complement of 53

9's Complement 53 = 46
+1   1

$\underline{\underline{47}}$

A = 27

B = 47 No end carry

0

10's Complement $\underline{74}$ ✓ ✓ 74 is in 10's Complement

True form

10's Complement of 74 = 9's Complement of 74 +1 ⇒ 25 = +1

$\underline{\underline{26}}$

$\boxed{-26}$ True form

③

(r = 8) 8's Complement Subtraction Direct method

(r = 8) 8's Complement Subtraction
(octal) $(53)_8 - (27)_8 =$

A $\quad$ B $\rightarrow$ A > B

$A = (53)_8$

8's complement of $(27)_8 = (51)_8$

7's complement $(27) = 50$
$+1 \qquad = \;\; 1$

51 ✓

Direct method

borrow → 8 $\quad 8+3 = (11)$

$$\begin{array}{r} 53 \\ -27 \\ \hline (24)_8 \end{array} \qquad \begin{array}{r} = 11 \\ -7 \\ \hline 4 \end{array}$$

$A = (53)_8$

8's Complement of B $= (51)_8$

$$\begin{array}{r} 53 \\ 51 \\ \hline 104 \end{array}$$

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

carry $\quad$ Sum

end carry → $\cancel{1}24$ neglect

A > B

$(24)_8$

Minuend

4. $(27)_8 - (53)_8$ using 8's Complement Subtraction

8's Complement of $(53)_8 \Rightarrow (25)_8$

7's Complement $= 24$
$+1$
$\overline{25}$ 8's Complement of B

Carry → 1

$A = 27$

$B = +25$

8's

$7+5 = (12)_{10} = (14)_8$

$a \mid 12$

Sum

$1+5$ $=$ 10 8

8's B $= \begin{array}{r} 25 \\ + \\ \hline 54 \end{array}$ Result

8's Complement

$$\begin{array}{r|l} 8 & 12 \\ 8 & 1 - 4 \\ & 0 - 1 \end{array}$$

carry sum

True form

$7's\ (54) = 23$

$+ \quad 1$

-24 True form

8's

(a) $(73)_{10} - (64)_{10}$

(b) $(64)_{10} - (73)_{10}$

(c) $(73)_8 - (64)_8$

(d) $(64)_8 - (73)_8$

5 Hexadecimal Subtraction

$(A7)_{16} - (63)_{16} =$

Direct method

$$\begin{array}{r} A7 \\ -\ 63 \\ \hline 44 \end{array}$$

16's Complement Subtraction

16's Complement of (63) =

15's Complement of 63 $=$

$$\begin{array}{cc} 15 & 15 \\ 6 & 3 \\ \hline 9 & C \\ & +\ 1 \\ \hline \end{array}$$

$12 \rightarrow C$

16's Complement = $\overline{\underline{9\ D}}$

$$\begin{array}{r} {}^{1} \\ A7 \\ 9D \\ \hline 1)44 \\ \hline \end{array}$$

16's Complement of (63)

end carry → neglect

$$\begin{array}{r} 7 \\ +D \\ \hline (14)_{16} \end{array}$$

Carry Sum

D = 13

$$\begin{array}{r} 7 \\ \hline 20 \\ \hline \end{array}$$

$(20)_{10}$

16 | 20

1 − 4

$$\boxed{\overset{11}{\overset{9}{20}}}_{10} = (14)_{16}$$

Result = (44)

⑦ $(63)_{16} - (A7)_{16}$

16's Complement Subtraction

Direct method

$$\begin{array}{r} 63 \\ -A7 \\ \hline -44 \\ \hline \end{array}$$

16's complement of (A7) =

15's Complement of A7 =

$$\begin{array}{cc} 15 & 15 \\ A & 7 \\ \hline 5 & 8 \\ & +1 \\ \hline 5 & 9 \\ \hline \end{array}$$

16's Complement of (A7) → 59

$$\begin{array}{r} 63 \\ +59 \end{array}$$

9+3 = 12

6+5 = 11

A = 10

B = 11 ✓

$$\begin{array}{r} 5\;9 \\ + \\ \hline B\;C \\ \hline \end{array}$$

16's Complement

$6+5=11$

$A = 10$
$B = 11$
$C = 12$

True form

16's complement of $(BC)_{16}$

15's Complement of $(BC)_{16}$ =

$$\begin{array}{rr} 15 & 15 \\ B & C=12 \\ {\scriptstyle 11} & \\ \hline 4 & 3 \\ + & 1 \\ \hline 4 & 4 \\ \hline \end{array}$$

16's Complement $\rightarrow$ 44

True form = -44

8) Binary ($r = 2$)

2's Complement Subtraction

$(53)_{10} - (27)_{10} \Rightarrow (26)_{10}$

$$\begin{array}{l|ll} 2 & 53 & \\ \hline 2 & 26 & -1 \quad \text{LSB} \\ \hline 2 & 13 & -0 \\ \hline 2 & 6 & -1 \\ \hline 2 & 3 & -0 \\ \hline 2 & 1 & -1 \\ \hline & 0 & -1 \quad \text{MSB} \end{array}$$

$(53)_{10} = (110101)_2$

$(27)_{10} = (11011)_2$

$(110101) - (011011)$

$(110101)_2 - (011011)_2$ 0 — 1 MSB

Minuend = 110101

2's complement of $(011011)_2$

1's complement of $(011011)_2$ = 100100
$+1$

2's complement = 100101

A>B

Carry→ 1 1

Minuend = 110101 = 6 bits

2's complement of Subtrahend = 100101 = 6 bits

1)011010 = 7 bits

end around carry → neglect

$1+1 = (2)_{10}$

Binary = $(10)_2$

Carry Sum

$1+1+1 = (3)_{10}$

$= (11)_2$

Carry Sum

$2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0$

Result = 011010

$2^4 \times 1 + 2^3 \times 1 + 2^1 \times 1$

$16 + 8 + 2 = (26)_{10}$

⑨ perform 2's complement subtraction

5 bits 6 bit

$(011011)_2 - (110101)_2$

Minuend Subtrahend

Minuend   Subtrahend

2's complement of $(110101)_2$

1's complement of 110101 ⇒ 001010
$+1$
001011

carry   1 1   1 1
Minuend = 011011
001011
100110   No carry

Result in 2's complement

True form

1's complement of 100110 = 011001
$+1$
011010

2's complement

True form = − 011010

$(1010)_2 - (111)_2$ Perform using 2's complement

$(10)_{10} - (7)_{10} \Rightarrow (3)_{10}$

2's complement of $(0111)_2$ = 1000   1's comp
$+1$
1001

A = 1010
2's B = 1001

A = 10

2's B = 1001

neglect $\rightarrow$ 1) 0011 ✓ Result = 0011 = $(3)_{10}$

$$\begin{array}{r} 1010 \\ -\ 111 \\ \hline 0011 \end{array}$$

Binary rules

	Difference	Borrow
0 − 0	= 0	0
0 − 1	= 1	1
1 − 0	= 1	0
1 − 1	= 0	0