Complements Example

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Diminished Radix Complement (DRC)

- Given a number *N* in base *r* having *n* digits, the (r-1)'s complement of N is defined as:

  $(r^n - 1) - N$

- Decimal numbers are in base-10.

  (r-1) = (10-1) = 9.

- The 9's complement would be defined as:

  $(10^n - 1) - N$

- So, to determine the 9's complement of 52:

  $(10^2 - 1) - 52 = 47$

- Another example is to determine the 9's complement of 3124:

  $(10^4 - 1) - 3124 = 6875$

Radix Complement

- The r's complement of an n-digit number N in base-r is defined as:

  $r^n - N$ - for $N \neq 0$

  0 - for $N = 0$

- We may obtain r's complement by adding 1 to (r-1)'s complement. Since $r^n - N = [(r^n - 1) - N]+1$
- 10's complement of 3229 is:

  $10^4 - 3229 = 6771$

- 2's complement of 101101 is:

  $2^6 - 101101 = 010011$

- Note: to determine 2's complement, leave the least significant 0's and the first 1 unchanged and then switch the remaining 1's to 0' and 0's to 1's.

Find R = M – N using different Radices and Complements

$M = (55)_{10} = (00110111)_2 = (67)_8 = (37)_{16}$, $N = (37)_{10} = (00100101)_2 = (45)_8 = (25)_{16}$

Diminished Radix Complement (-N) $N' = (62)_{10} = (11011010)_2 = (32)_8 = (DA)_{16,}$

Radix Complement (- N): $N'' = (63)_{10} = (11011011)_2 = (33)_8 = (DB)_{16}$

$R = M + N' = (55)_{10} + (62)_{10} = (117)_{10}$, Add carry $R = (17 + 1)_{10} = (18)_{10}$

$R = M + N' = (00110111)_2 + (11011010)_2 = (100010001)_2$,

Add carry $R = (00010001 + 1)_2 = (00010010)_2 = (18)_{10}$

$R = M + N' = (67)_8 + (32)_8 = (121)_8$, Add carry $R = (21 + 1)_8 = (22)_8 = (18)_{10}$

$R = M + N' = (37)_{16} + (DA)_{16} = (111)_{16,}$ Add carry $R = (11 + 1)_{16} = (12)_{16} = (18)_{10}$

$R = M + N'' = (55)_{10} + (63)_{10} = (118)_{10}$, Discard carry $R = (18)_{10}$

$R = M + N'' = (00110111)_2 + (11011011)_2 = (100010010)_2$, Discard carry $(00010010)_2 = (18)_{10}$

$R = M + N'' = (67)_8 + (33)_8 = (122)_8$, Discard carry $R = (22)_8 = (18)_{10}$

$R = M + N'' = (37)_{16} + (DB)_{16} = (112)_{16}$, Discard carry $R = (12)_{16} = (18)_{10}$