Lecture 4

Tricks for Conversion

① $(\text{base})^{x}$ = 1 followed by x 0's in that base

$(2)^4 \rightarrow (10000)_2$

$(3)^3 \rightarrow (1000)_3$

$(12)^2 \rightarrow (100)_{12}$

$(5)^6 \quad (1000000)_5$

$(\ )_{10} \longrightarrow (\ )_x$

- $(64)_{10} \longrightarrow (\ )_2$
  $\downarrow$
  $(2)^6 \text{ — } (1000000)_2$

- $(32)_{10} \longrightarrow (\ )_2$
  $\downarrow$
  $(2)^5 \longrightarrow (100000)_2$

- $(343)_{10} \text{ — } (\ )_7$
  $\downarrow$
  $(7)^3 \text{ — } (1000)_7$

- $(\cancel{12})^2$

- $(512)_{10} \text{ — } (\ )_2$
  $\downarrow$
  $2^\wedge 9 \text{ — } (1000000000)_2$

$2^0 — 1$
$2^1 — 2$
$2^2 — 4$
$2^3 — 8$
$2^4 — 16$
$2^5 — 32$
$2^6 — 64$
$2^7 — 128$
$2^8 — 256$
$2^9 — 512$
$2^{10} \longrightarrow 1024$

$(512)_{10} — ( )_8$
$\downarrow$
$(8)^3$ $\quad (1000)_8$

$(256)_{10} — ( )_{16}$
$\downarrow$
$(16)^2 — (100)_{16}$

② Contineous 1's in any base

$(11111)_2 — (2)^5 - 1 — (31)_{10}$

$(1111)_2 — 2^4 - 1 \rightarrow (15)_{10}$

$(11111111)_2 — 2^8 - 1 \rightarrow (255)_{10}$

$(11111)_y — ( )_{10}$

$y^4 \; y^3 \; y^2 \; y^1 \; y^0$

$y^0 + y^1 + y^2 + y^3 + y^4$

geometric progression formula sum of gp

$$\left[a \times \left(\frac{r^n - 1}{r - 1} \right) \right] \longrightarrow 1 * \left[\frac{y^5 - 1}{y - 1} \right]$$

$$\frac{2^5 - 1}{2 - 1} = 2^5 - 1 = 31 \text{ Ans}$$

Date:
Page No.:

$(11111111)_y$ — $\frac{y^{8}-1}{y-1}$

$2^{8-1} = 127$ Ans

- $(63)_{10}$ — $\cancel{2^{6-1}}$ $2^{6}-1 = (111111)_2$

$(31)_{10} - 2^{5-1} = (11111)_2$

$(127) - 2^{7-1} = (1111111)_2$

$(255)_{10} - 2^{8-1} = (11111111)_2$

(3) $(33)_{10}$ — $8\ (\ )_2$

↓

$(32)_{10}$ — $(100000)_2$

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

$(100001)_2 = (33)_{10}$

$(67)_{10} \rightarrow (1000000)_2 = 64+3$

↓

$(1000011)_2$

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Date:
Page No.:

$(132)_{10} \rightarrow 128 + 4 = 10000000$

$+100$

$(132)_{10} \leftarrow (10000100)_2$

$(135)_{10} \rightarrow 128 + 7 = 10000000$

$+111$

$(135)_{10} = (10000111)_2$

$(517)_{10} \rightarrow (512 + 5) = 1000000000$

$+ 101$

$(517)_{10} = (1000000101)_2$

$(419)_{10} \longrightarrow (\ )_2$

$2^8 = 256 = 419 - 100000000$

-256

163

$2^7 = 128 + 10000000$

35

$2^5 = 32 + 0100000$

3

$(416)_{10} = (110100000)_2$

$+11$

$(419)_{10} = (110100011)_2$

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Date:
Page No.

- $(96)_{10}$ — $(1100000)_2$
  $64+32$

- $(192)_{10}$ — $(128+64)$
  $(11000000)_2$

- $(224)_{10}$ — $(11100000)_2$

- $(240)_{10}$ — $(11110000)_2$

- $(66)_{10}$ — $(1000010)_2$

(3) If number is slightly greater than power two then make some 0s as 1s

- $(120)_{10}$ — $(\ )_2$
  $2^{7}-1 = (1111111)_2 = 127$
  $-\ 111$
  $(1111000)_2 = 120$

• $(125)_{10} = (1111111)_2 = 127$

-2

$(1111101)_2$

③ If number is slighty smaller than power 2 then make some 1s as 0s

• $(240)_{10}$ — $(255-15)$

↓

$2^{8}-1$

$(11111111)_2$

-15

$(11110000)_2 = (240)_{10}$

• $(250)_{10}$ — $(11111111)_2 = 255$

11111111

-101

$\to (11111010)$

$(500)_{10}$ — $(111111111)_2 = 511$

100

$(111110100)_2$

↓

$(500)_{10}$

(5) base $\rightarrow x$

~~any 0~~ any num 0 $\Rightarrow * x$

" " 1 $\Rightarrow * x+1$

" " 2 $\Rightarrow * x+2$

so on...

$12 \rightarrow 123$ —

$\downarrow$

$12 \times 10 + 3$

$(23)_8$ — $(234)_8$

$23 * 8 + 4$

$(23)_9$ — $(230)_9$

$23 * 9 + 0$

~~84~~21

$\underbrace{110}_{12}\underbrace{0\,0}$ = $(24)_{10}$

$x = 2$

any num 0 = $* x$

$12 \times 2 = (24)_{10}$

- $\underbrace{1011}\,0\,1$

  $11 \times 2 \times 2 + 1 = (45)_{10}$

- $\underbrace{1011}\,1\,1$

  $11 \times 2 + 1 \times 2 + 1 = (47)_{10}$

- $\underbrace{1100}\,100$

  $12 \times 2 + 1 \times 2 \times 2 = (100)_{10}$

- $(1100001)_2 = (97)_{10}$
- $(101101101)_2 = (365)_{10}$

$$\begin{array}{r} 176 \\ 176 \\ \hline 352 \\ +3 \\ \hline \end{array}$$

final Conclusion

Binary ⟶ Decimal

$(100000)_2 = (32)_{10}$

$(100001)_2 = (33)_{10}$

$(1000000000) = (516)_{10}$

$(11111)_2 - (31)_{10}$

$(111110)_2 - (126)_{10}$

many 0's — $(bas)^n$ — Trick 1

many 1's — Continous 1's — Trick 2

Mix 1, 0s => 0 = *2

1 => *2*1

* Decial to binay

Power 2 → $(base)^n$

$(32)_{10}$ — $(100000)_2$

2^5

$(64)_{10}$ — $(1000000)_2$

$(128)_{10}$ — $(10000000)_2$

$(63)_{10}$ → $(111111)_2$

2^{6-1}

$(65)_{10}$ → $(1000001)_2$

$(129)_{10}$ → $(10000001)_2$

Power of 2

Slightly more than power of 2

power 2 −1

Slightly lesser than power of 2

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Date:
Page No:

$(100)_{10} = (\ )_2$

↓

even

mean * 0

Master Trick

0

even ← 50

odd 25 0 0

12 100

↓

$(1100100)_2$

- $(200)_{10} = (11001000)_2$

~~11010100~~

- $(150)_{10} = (10010110)_2$

- $(300)_{10} = (100101100)_2$

$11000 = (24)_{10}$

$3 \times 8 = 24$

0 — $\times 2$

00 — $\times \times 4$

000 — * 8

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