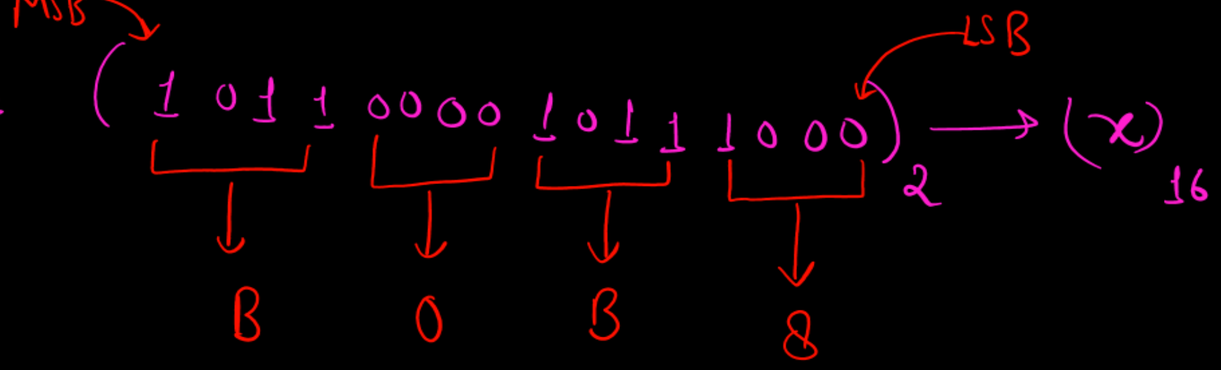
Binary → Hexadecimal

↳ to convert the Binary Number to Hex Code, we have to make pair of 4 bits from LSB. And represent each pair in Hexadecimal digit

Ex: 

⇒ (B0B8)16

Hex Code ⇒ 0xB0B8

Hex	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
→ 8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

Hexadecimal → Binary

↳ Represent each digit of Hex Code into 4 Bits Binary code.

Ex $(4\ B\ C\ D\ A\ 1\ 0\ 9\ 5)_{16} \rightarrow (x)_2$

0100 1011 1100 1101 1010 0001 0000 1001 0101

$\Rightarrow (0100\ 1011\ 1100\ 1101\ 1010\ 0001\ 0000\ 1001\ 0101)_2$

Hex	Binary
0	0
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Exercise

Q: Given $(135)_x + (144)_x = (323)_x$. find the value of Radix x.

→ Other base → decimal } using weightage sum & product Method

$$[1x^2 + 3x x^1 + 5 x x^0] + [1x^2 + 4x^1 + 4 x x^0] = [3x^2 \quad 2x^1 \quad 3x^0]$$

$$x^2 + 3x + 5 + x^2 + 4x + 4 = 3x^2 + 2x + 3$$

$$2x^2 + 7x + 9 = 3x^2 + 2x + 3$$

$$x^2 - 5x - 6 = 0 \leftarrow \text{quadratic Eq}^n$$

$$= x^2 - 6x + x - 6 = 0$$

$$\Rightarrow x(x-6) + 1(x-6) = 0 \rightarrow (x-6)(x+1)$$

$x = 6, x = -1$

Radix can not be negative.

$\boxed{x = 6}$

Q: Consider the equation $(43)_x = (y3)_8$, x & y are unknown. find the possible values of x & y.

Sol: $(43)_x = (y3)_8 \Rightarrow$ Converting to decimal

$4x^1 + 3x^0 = yx8^1 + 3 \times 8^0$

$\Rightarrow 4x+3 = 8y+3 \Rightarrow 4x+8y \Rightarrow \boxed{x=2y}$

$\Rightarrow (43)_x \longrightarrow x > [4,3]$ $\boxed{x>4}$ $\Rightarrow (y3)_8 \longrightarrow \boxed{y<8}$

Suppose

$y=7, x=14$ ✓

$y=6, x=12$ ✓

$y=5, x=10$ ✓

$y=4, x=8$ ✓

$y=3, x=6$ ✓

$y=2, x=4$ ⊗

$\Rightarrow$ 5 possible Solution

Q3 if $n^2 = (7601)_8$, where $n \in \mathbb{Z}^+$. find the value of 'n'.

integer → decimal

↳ that means 'n' is a decimal number

$n^2 = (7601)_8$

$\Rightarrow n^2 = 7 \times 8^3 + 6 \times 8^2 + 0 \times 8 + 1 \times 8^0$

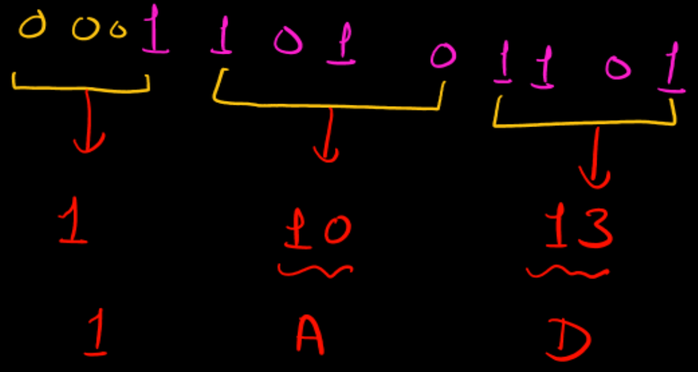
$n^2 = 7 \times 512 + 6 \times 64 + 1$

$n^2 = 3584 + 384 + 1$

$n^2 = 3969 \Rightarrow n = \sqrt{3969} = 63$

Q4 The hexadecimal equivalent of binary number 110101101 is?

Bin → Hex



$\Rightarrow (1AD)_{16}$ or **0x1AD**

Q. The number 1102 with radix 3 is equivalent to 123 in which Base System?

$\Rightarrow (1102)_3 = (123)_x$

Converting LHS & RHS to decimal

$1\times3^3 + 1\times3^2 + 0\times3^1 + 2\times3^0 = 1x^2 + 2x^1 + 3x^0$

$= 27 + 9 + 2 = x^2 + 2x + 3$

$\Rightarrow x^2 + 2x - 35 = 0$

$\Rightarrow x^2 - 7x + 5x - 35 = 0$

$\Rightarrow x(x-7) + 5(x-7) = 0$

$\Rightarrow (x-7)(x+5) = 0$

$\boxed{x = 7}$ $x = -5$ ← Not Possible

Q6 Given $\sqrt{(224)_r} = (13)_r$. find the value of radix r.

Converting Both Sides into decimal.

$$\sqrt{2r^2 + 2r^1 + 4r^0} = 1r^1 + 3r^0$$

$$= \sqrt{2r^2 + 2r + 4} = r + 3$$

$$= 2r^2 + 2r + 4 = (r+3)^2$$

$$= 2r^2 + 2r + 4 = r^2 + 6r + 9$$

$$= r^2 - 4r - 5 = 0$$

$$= r^2 - 5r + r - 5 = 0$$

$$\Rightarrow r(r-5) + 1(r-5) = 0$$

$$(r-5)(r+1) = 0$$

$\boxed{r = 5}$ or $r = -1$ ↳ Not Possible as radix > 0

Ans

Q7. $(1217)_8 \rightarrow (x)_{16}$ - find x

trick → Octal ↔ Bin ↔ Hex

Octal → Hex

(1 2 1 7) ← octal

8

001 010 001 111 → Binary

0010 1000 1111

2 8 15 → F

$\Rightarrow (28F)_{16}$

Q8 if $(12A7C)_{16} = (x)_8$. find x.

trick : Hex → Bin → Octal

4 Bit representation

3 bit Pairs

1 2 A 7 C

0001 0010 1010 0111 1100

0 0001 001010 100111 100

0 1 2 2 5 1 7 4

$= (22517 4)_8$

Binary & Decimal Relation

Pattern

2 bits = 4 numbers $\Rightarrow 2^2$ numbers

3 bits = 8 numbers $\Rightarrow 2^3$ numbers

4 bits = 16 numbers $\Rightarrow 2^4$ numbers

n bits = 2^n numbers represent कर सकते हैं।

$\log_a(b) = n \iff a^n = b$

$\log_2(n) = 10 \Rightarrow n = 2^{10} = 1024$

2 bits = 4 numbers

3 bits = 8 numbers

4 bits = 16 numbers

Dec	Binary
0	0 → 00
1	1 → 01
2	10 → 10
3	11 → 11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

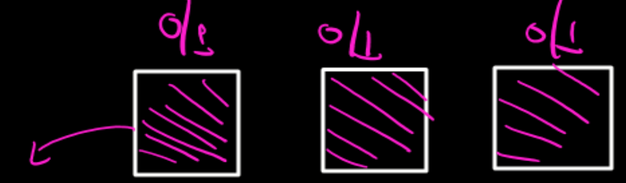
Q: How many bits are required to encode decimal numbers from 0 to 9999 in straight binary code.

Sol: We have 0 to 9999 decimal numbers. that means we need 2^n number of Combinations that are greater than or equals to 10,000.

$$2^n \geq 10{,}000 \qquad n \in Z^+$$

$$\Downarrow$$

$$\lceil \log_2 (10000) \rceil \leftarrow \text{Ceil}$$



2 ways $2 \times 2 \times 2 = 2^3 = 8$ Comb

$\Rightarrow$ $2^{10} = 1024$

$2^{11} = 2048$

$2^{12} = 4096$

$2^{13} = 8192$

$2^{14} = 16384$ → in 14 bits we can represent 16384 numbers.

Next → decimal points