Find out the base or radix

a) Determine the possible unknown base of a Relation

Ex:- $\sqrt{22} = 6$

Maximum value of digit = 6

$$\boxed{\text{base} \geq 7}$$

$( )_7 \rightarrow (0,1,2,3,4,5,6)_7$

Process

i) Convert both sides to decimal

$$(\sqrt{22})_b = 6_b$$

$(10)_2 \xrightarrow{\text{decimal}} 1\times 2^1 + 1\times 2^0 = 2+1 = 3$

(binary to decimal)

$$\left(\sqrt{\underset{1}{2}\underset{0}{2}}\right)_b = \underset{0}{6}b$$

Σ digit x b (Place Value)

$$\sqrt{2\times b^0 + 2\times b^1} = 6\times b^0$$

$$\sqrt{2+2b} = 6$$

Squaring both sides

$$2+2b = 36$$

$$2b = 34$$

$$b = \frac{34}{2} = 17$$

base is 17

Base Conversion

From any base to any base

* Why Conversion

If any system works on binary (Computer) but the I/P is not in binary, then the I/P needs to converted to binary.

* From any base to any base

Convert from $(\quad)_x \rightarrow (\quad)_y$

Steps needed

i) $(\quad)_x \rightarrow (\quad)_{10}$ Convert $(\quad)_x$ to $(\quad)_{10}$

2) $(\quad)_{10} \rightarrow (\quad)_y$ Convert $(\quad)_{10}$ to $(\quad)_y$

Decimal is intermediate plat form.

Step 1:- Convert $(\quad)_x$ to $(\quad)_{10}$

$(A)_r = (a_{n-1}, a_{n-2}, \ldots\ldots a_1 a_0 a_{-1} \ldots a_{-m})_r$

Has many digits.

(n digits before 0 & m digits after 0) (decimal)

$(A)_{10} = (a_{n-1} \times r^{n-1} + a_{n-2} r^{n-2} + \ldots\ldots + a_1 r^1 + a_0 r^0 + a_{-1} r^{-1} + \ldots + a_{-m} \times r^{-m})$

$= \sum_{-m}^{n-1} a_i r^i \rightarrow \sum_{-m}^{n-1} a_i r^i$

i) $(1011)_2 = (\quad 11 \quad)_{10}$

$1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$8 + 0 + 2 + 1 = 11$

2) $(11001.11)_2 = (\quad)$

$1\times2^4 + 1\times2^3 + 0 + 0 + 1\times2^0 + 1\times2^{-1} + 1\times2^{-2}$

$16 + 8 + 0 + 0 \quad 1 + \frac{1}{2} + \frac{1}{4}$

$16 + 8 + 0 + 0 + 1 + .5 + .25$

$(24.75)_{10}$

3) $(101.1)_8 = (65.125)_{10}$

$1\times8^2 + 0\times8^1 + 1\times8^0 + 1\times8^{-1}$

$64 + 0 + 1 + \frac{1}{8}$

$65 + 0.125$

$= 65.125$

Questions

i) $(10A)_{16} = (\quad)_{10}$

2) $(42123)_5 = (\quad)_{10}$

3) $(7124)_7 = (\quad)_{10}$

4) $(6124)_7 = (\quad)_{10}$