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Mathematics

Converting Base 2 to Base 10

Step 1: List the digits in order, as they appear in the number they've given.

Step 2: Then, in another row, count these digits from off the **RIGHT**, starting with <u>zero.</u>

*Reminder: The first row above (labelled "digits") contains the digits from the binary number; the second row (labelled "numbering") contains the power of 8 (the base) corresponding to each digit.

$2^1 = 2$ Rule: Two to the power of 1 is 2 $2^0 = 1$ Rule: Any number to the power of 0 is one.

Example 1: 110001_2 to base $_{10}$

Step 1:

Digits	1	1	0	0	0	1
numbering	5	4	3	2	1	0

Step 2: $1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

Step 3: $1 \times 32 + 1 \times 16 + 0 \times 8 + 0 \times 4 + 0 \times 2 + 1 \times 1$

Step 4: $32 + 16 + 0 + 0 + 0 + 0 + 1$

Step 5: 49

Ans= $110001_2 = \underline{49}_{10}$

Example 2: 10011100_2 to base $_{10}$

Step 1:

Digits	1	0	0	1	1	1	0	0
numbering	7	6	5	4	3	2	1	0

Step 2: $1 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$

Step 3: $1 \times 128 + 0 \times 64 + 0 \times 32 + 1 \times 16 + 1 \times 8 + 1 \times 4 + 0 \times 2 + 0 \times 1$

Step 4: $128 + 0 + 0 + 16 + 8 + 4 + 0 + 0$

Step 5: 156

Ans= $10011100_2 = \underline{156}_{10}$

Activity 3

Convert these numbers from Base $_2$ to Base $_{10}$. Show **ALL** working.

1) $1010_2 = $ _____ $_{10}$

2) $11000_2 = $ _____ $_{10}$

3) $101011_2 = $ _____ $_{10}$

4) $1001010_2 = $ _____ $_{10}$

5) $10111001_2 = $ _____ $_{10}$