

Worksheet: Decimal Expansions from Binary Numbers

Part A: Worked Example

Example: Find the decimal expansion of the binary integer $(0101011111)_2$.

Step 1: Write digits with place values.

$$(0101011111)_2 = 0 \cdot 2^9 + 1 \cdot 2^8 + 0 \cdot 2^7 + 1 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0$$

Step 2: Simplify.

$$= 0 + 256 + 0 + 64 + 0 + 16 + 8 + 4 + 2 + 1$$

Step 3: Add.

$$= 351$$

So, $(0101011111)_2 = (351)_{10}$.

Part B: Easier Practice

Convert the binary number $(1011)_2$ into decimal. Show all steps.

Answer: $(1011)_2 = (11)_{10}$.

Part C: Harder Practice

Convert the binary number $(11011010101)_2$ into decimal. Show all steps.

Part D: Reflection

Why do we write binary expansions as sums of powers of 2? How does this compare to base 10?