Worksheet: Decimal Expansion from Hexadecimal (Example 3)

Part A — Worked Example (detailed)

Problem. What is the decimal expansion of $(FACE)_{16}$?

Step 1: Recall place values in base 16. Each digit corresponds to 16^k:

$$(d_3d_2d_1d_0)_{16} = d_3 \cdot 16^3 + d_2 \cdot 16^2 + d_1 \cdot 16^1 + d_0 \cdot 16^0.$$

Step 2: Translate hex digits to decimal digits.

$$F = 15,\ A = 10,\ C = 12,\ E = 14.$$

Step 3: Substitute digits.

$$(FACE)_{16} = 15 \cdot 16^3 + 10 \cdot 16^2 + 12 \cdot 16^1 + 14 \cdot 16^0.$$

Step 4: Compute powers of 16.

$$16^3 = 4096, \quad 16^2 = 256, \quad 16^1 = 16, \quad 16^0 = 1.$$

Step 5: Multiply out.

$$15 \cdot 4096 = 61{,}440, \quad 10 \cdot 256 = 2{,}560, \quad 12 \cdot 16 = 192, \quad 14 \cdot 1 = 14.$$

Step 6: Add contributions.

$$61{,}440 + 2{,}560 + 192 + 14 = 64{,}206.$$

Answer: $\boxed{(FACE)_{16} = (64206)_{10}}$

Part B — Easier Practice

Convert $(2B)_{16}$ to decimal. Show all steps.

Part C — Easier Practice

Convert $(7F)_{16}$ to decimal. Show all steps.

Part D — Harder Practice

Convert $(BEEF)_{16}$ to decimal. Show all steps.

Reflection

How is converting from hexadecimal to decimal similar to converting from octal or binary?