CS286 Computer Architecture & Organization
Summer 2021
Exercise Questions for June 2, 2021 (SOLUTIONS)

QUESTION #1

Transform 389\(_{10}\) to the binary format (in binary number) and the hex-decimal format. Show all intermediate work.

**Note:** \(X_{10}\) means ‘X’ is in the decimal, \(X_{16}\) means ‘X’ is in the hexa-decimal, and \(X_{2}\) means ‘X’ is in the binary.

**Binary:**

\[
389_{10} = 256_{10} + 128_{10} + 4_{10} + 1_{10} = 2^8 + 2^7 + 2^2 + 2^0 = 110000101_{2}
\]

**Hexa-Decimal:**

\[
389_{10} = 256_{10} + 128_{10} + 5_{10} = (256 \times 1) + (16 \times 8) + (1 \times 5) = (16^2 \times 1_{16}) + (16^1 \times 8_{16}) + (16^0 \times 5_{16}) = 185_{16}
\]

QUESTION #2

Transform A2D\(_{16}\) to the decimal format (in decimal number) and the binary format (binary number). Show all intermediate work.

**Decimal:**

\[
A2D_{16} = (16^2_{10} \times A_{16}) + (16^1_{10} \times 2_{16}) + (16^0_{10} \times D_{16}) = (256_{10} \times 10_{10}) + (16_{10} \times 2_{10}) + (1_{10} \times 13_{10}) = 2560_{10} + 32_{10} + 13_{10} = 2605_{10}
\]

**Binary:**

\[
2605_{10} = 2048_{10} + 512_{10} + 32_{10} + 8_{10} + 4_{10} + 1_{10}
\]
QUESTION #3

Transform $10110101001_2$ to the decimal format (in decimal number) and the hex-decimal format. Show all intermediate work.

Decimal:

$10110101001_2 = 2^{11} + 2^9 + 2^8 + 2^7 + 2^5 + 2^4 + 2^0$

$= 1024 + 512 + 256 + 128 + 32 + 8 + 1$

$= 1024_10 + 512_10 + 256_10 + 128_10 + 32_10 + 8_10 + 1_10$

$= 1449_{10}$

Hexa-Decimal:

$1449_{10} = (256 \times 5) + (16 \times 10) + (1 \times 9)$

$= (16^2 \times 5_{16}) + (16^1 \times A_{16}) + (16^0 \times 9_{16})$

$= 5A9_{16}$

QUESTION #4

How many digits are needed for $1024_{10}$ in binary and hex-decimal numbers? Show all intermediate work.

Binary: $1024_{10} = 10000000000_2$

(11 digits)

Hexa-Decimal: $1024_{10} = (256 \times 4) + (16 \times 0) + (1 \times 0)$

$= 400_{16}$

(3 digits)