

Homework 2

- All homework must be turned in on PDF format. This can be scanned or typed in any paper size, but the format must be PDF and the file must be readable. This document can be modified for your homework submission. An additional homework template is available on Canvas to assist you in creating your answers, and content from lecture notes can be used.
- All final answers must be circled or in green.
- All homework must have a name on the top of every page.
- Submission errors (not in PDF, illegible, etc.) will not be re-graded.

Problem 1

Convert the following decimal (base-10) numbers into **binary** (base-2). Results should be accurate to within 0.01_{10} .

1. Convert -121.625_{10} into hexadecimal.
2. Convert -121_7 into hexadecimal (hint: go through base 10). Problem 2

(1) -121.625_{10}

$$\begin{array}{r}
 121 \\
 64 \\
 \hline
 57 \\
 32 \\
 \hline
 25 \\
 16 \\
 \hline
 9 \\
 8 \\
 \hline
 1 \\
 \hline
 0.
 \end{array}
 \quad
 \begin{array}{r}
 0.625 \\
 0.5 \\
 \hline
 0.125 \\
 0.125 \\
 \hline
 0
 \end{array}
 \quad
 \begin{array}{r}
 1 \\
 2 \\
 \hline
 1 \\
 2^3
 \end{array}$$

Haegang Yang

$$\Rightarrow -121.625_{10} = -1111001.101_2$$

$$\Rightarrow -1111001.101_2$$

$$\Rightarrow \boxed{-1111001.101_2}$$

$$(2) -121_7 \Rightarrow -(1x7^0 + 2x7^1 + 1x7^2) = -(1 + 14 + 49)_{10} = -64_{10}$$

$$-64_{10} \Rightarrow -1001000_2 \Rightarrow \boxed{-40_{16}}$$

Haegang Yang

1. $143_7 + 153_7$ (perform the operation and express your answer in base-7).
2. $1AE_{16} - 2F3_{16}$ (perform the operation and express your answer in base-16).
3. $10110111_2 \times 10010001_2$ (perform the operation and express your answer in base-2).

$$\textcircled{1} \quad 143_7 + 153_7$$

$$\begin{array}{r} 1 \\ 143 \\ + 153 \\ \hline 326 \end{array} \Rightarrow 326_7$$

Haegang Yang

$$\textcircled{2} \quad 1AE_{16} - 2F3_{16}$$

$$\begin{array}{r} 1 \\ 2F3 \\ - 1AE \\ \hline 145 \end{array} \Rightarrow -145_{16}$$

Haegang Yang

$$\textcircled{3} \quad 10110111_2 \times 10010001_2$$

$$\begin{array}{r} 10110111 \\ \times 10010001 \\ \hline 101101110000000 \\ 101101110000000 \\ \hline 11001110100111 \end{array} \Rightarrow 11001110100111_2$$

Haegang Yang

Problem 3

Give the **base-2, 8-bit signed magnitude**, and **8-bit 2's complement** representation of the following numbers. Note any irregularities in your answer and work.

1. 0_{10}
2. 128_{10}
3. -128_{10}
4. 127_{10}
5. -127_{10}
6. -52_{10}

① $0_{10} \rightarrow 0_2$

00000000_2

$2's \text{ comp.}$

$1111111_2 + 00000001_2$

$\Rightarrow 00000000_2$

overflow

② $128_{10} \rightarrow 1_2 = 10000000_2$

10000000_2

$2's \text{ comp.}$

$0111111_2 + 00000001_2$

$\Rightarrow 10000000_2$ **overflow**

③ $-128_{10} = -2^7 = -10000000_2$

10000000_2

$2's \text{ comp.}$

$0111111_2 + 00000001_2$

$= 10000000_2$

④ $127_{10} \rightarrow 111111_2$

127
 64
 32
 16
 15
 8
 4
 2
 1
 $0.$

0111111_2

$2's \text{ comp.}$

0111111_2

Haegang by

(5) -12_{10}

$$\begin{array}{r} 127 \\ 64 \\ 63 \\ 32 \\ 31 \\ 16 \\ 15 \\ 8 \\ 7 \\ 4 \\ 3 \\ 2 \\ 1 \\ 0 \end{array}$$

-111111_2

$\Rightarrow 011111_2$

2's comp

$$1000000_2 + 00000001_2$$
 $\Rightarrow 10000001_2$

(6) -52

$$\begin{array}{r} 52 \\ 32 \\ 20 \\ 16 \\ 4 \\ 0 \end{array}$$

-110100_2

$\Rightarrow 00110100_2$

2's comp.

$$11001011_2 + 00000000_2$$

Invert

 $\Rightarrow 11001100_2$