Computer Number Systems Worksheet
Created by Sam Craig and the West Lafayette ACSL Club of 2014–2015

A subscript after a number designates what base it is in. For example, 20_{10} is 20 in base ten, but usually base ten is assumed and left out. 10_{16} is 10 in base 16, or 16 in base ten. A **bit** is a **bi**nary digi**t**.

Questions

1. Convert $15F_{16}$ to octal.
2. Convert 101000100011_2 to hexadecimal.
3. Evaluate $21A7_{16} - 110_{16}$ in hexadecimal.
4. Evaluate $10531_8 + 12414_8$ in octal.
5. Evaluate $1101111_2 - 111011_2$ in binary.
6. Evaluate $3C0_{16} + 340_8$ in hexadecimal.
7. In the Technology Department's new computer, each "word" of memory contains 16 bits representing 4 pieces of information. The first 5 bits represent Field A; the next 3 bits, Field B; the next 3 bits, Field C; and the last 5 bits, Field D. For example, the 16 bits comprising the "word" 9699_{16} has fields with values of 19_{16}, 4_{16}, 6_{16}, and A_{16}. What is Field C in $6FAC_{16}$? (Express your answer as a base 16 number.)

Answers

1.

$$\begin{aligned} 15\mathrm{F}_{16} &= 0001\ 0101\ 1111_2 \\ &= 101\ 011\ 111_2 \\ &= 537_8 \end{aligned}$$

2.

$$\begin{aligned} 101000100011_2 &= 1010\ 0010\ 0011_2 \\ &= \mathrm{A23}_{16} \end{aligned}$$

3.

$$\begin{array}{r} 21\mathrm{A}7 \\ -\ 11\ 0 \\ \hline 209\ 7 \end{array}$$

4.

$$\begin{array}{r} \overset{1}{} \\ 10531 \\ +12414 \\ \hline 23145 \end{array}$$

5.

$$\begin{array}{r} \overset{1}{\not 1}\overset{0}{\not 1}\overset{1}{1}01111 \\ -\ 1\,1\,1011 \\ \hline 1\,1\,0100 \end{array}$$

6.

$$3\mathrm{C}0_{16} = 0011\ 1100\ 0000_2$$

$$340_8 = 011\ 100\ 000_2$$

$$\begin{array}{r} {\scriptstyle 1\ 11\ 1} \\ 1111000000 \\ +\ \ 11100000 \\ \hline 10010100000 \end{array}$$

7.

$$\begin{aligned} 6\text{FAC}_{16} &= 0110\ 1111\ 1010\ 1100_2 \\ &= 01101\ 111\ 101\ 01100 \end{aligned}$$

so

$$\begin{aligned} \text{Field A} &= \text{D}_{16} \\ \textbf{Field B} &= 7_{16} \\ \text{Field C} &= 5_{16} \\ \text{Field D} &= \text{C}_{16} \end{aligned}$$