

Homework 1

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Justin VanWinkle
ju497607

1) a) $757.17_{10} \rightarrow \text{Base } 16$
 $\hookrightarrow 2F5.2B851E..._{16}$

$16 \overline{) 757} = 47 \text{ R } 5$
 $16 \overline{) 47} = 2 \text{ R } 15 = F$
 $16 \overline{) 2} = 0 \text{ R } 2$

$.17 \times 16 = \textcircled{2}.72 \times 16 = \textcircled{11}.52 \times 16 =$
 $\textcircled{8}.32 \times 16 = \textcircled{5}.12 \times 16 = \textcircled{1}.92 \times 16 =$
 $\textcircled{14}.72$
 $\hookrightarrow \text{Repeat}$

$2F5.2B851E..._{16} \rightarrow \text{Base } 2$

$200_{16} = 0010\ 0000\ 0000_2$
 $F0_{16} = \text{---} 1111\ 0000_2$
 $5_{16} = \text{---} \text{---} 0101_2$

$\hookrightarrow 0010\ 1111\ 0101.0010\ 1011\ 1000\ 0101\ 0001\ 1110_2$

b) $356.25_{10} \rightarrow \text{Base } 16$
 $\hookrightarrow 164.4_{16}$

$16 \overline{) 356} = 22 \text{ R } 4$
 $16 \overline{) 22} = 1 \text{ R } 6$
 $16 \overline{) 1} = 0 \text{ R } 1$

$.25 \times 16 = \textcircled{4}.0$

$164.4_{16} \rightarrow \text{Base } 2$
 $\hookrightarrow 0001\ 0110\ 0100.0100$

3) $3B2.45_{14} \rightarrow \text{Base } 6$

$2 \times 1 = 2$
 $B \times 14 = 154$
 $3 \times 196 = 588$
 $4 \times \frac{1}{14} = \frac{4}{14}$
 $+ 5 \times \frac{1}{196} = \frac{5}{196}$
 $\approx 744.311_{10}$

$6 \overline{) 744} = 124 \text{ R } 0$
 $6 \overline{) 124} = 20 \text{ R } 4$
 $6 \overline{) 20} = 3 \text{ R } 2$
 $6 \overline{) 3} = 0 \text{ R } 3$

$.311 \times 6 = \textcircled{1}.866 \times 6 = \textcircled{5}.196 \times 6 = \textcircled{1}.176 \times 6 =$
 $\textcircled{1}.056 \times 6 = \textcircled{2}.336 \times 6 = \textcircled{2}.016 \times 6 = \textcircled{0}.096 \times 6 =$
 $\textcircled{0}.576 \times 6 = \textcircled{3}.456 \times 6 = \textcircled{2}.736 \times 6 = \textcircled{4}.416 \times 6 =$
 $\textcircled{2}.496 \times 6 = \textcircled{2}.976 \times 6 = \textcircled{5}.856 \times 6 = \textcircled{5}.136 \times 6 =$
 $\textcircled{0}.816 \times 6 = \textcircled{4}.896 \times 6 = \textcircled{5}.376 \times 6 = \textcircled{2}.256 \times 6 =$
 $\textcircled{1}.536 \times 6 = \textcircled{3}.216 \times 6 = \textcircled{1}.296 \times 6 = \textcircled{1}.776 \times 6 =$
 $\textcircled{4}.656 \times 6 = \textcircled{3}.936 \times 6 = \textcircled{5}.616 \times 6 = \textcircled{3}.696 \times 6 =$
 $\textcircled{4}.176 \times 6$
 $\hookrightarrow \text{Repeat}$

$3B2.45_{14} \approx 3240.1511020032422550452131143534..._6$

3) a)

$\begin{array}{r} 0111 \\ + 1110 \\ \hline 10101 \end{array}$	$\begin{array}{r} 0111 \\ - 0111 \\ \hline 0111 \end{array}$	$\begin{array}{r} 0111 \\ \times 1110 \\ \hline 0000 \\ + 01110 \\ \hline 01110 \end{array}$
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$$\begin{array}{r}
 + 011100 \\
 \hline
 101010 \\
 + 011100 \\
 \hline
 1100010
 \end{array}$$

$$\begin{array}{r}
 b) \quad \begin{array}{r} 111001 \\ + 11001 \\ \hline 1010010 \end{array} \quad \begin{array}{r} 111001 \\ - 11001 \\ \hline 100000 \end{array} \quad \begin{array}{r} 111001 \\ \times 11001 \\ \hline 111001 \\ + 111001000 \\ \hline 1000000001 \\ + 1110010000 \\ \hline 10110010001 \end{array}
 \end{array}$$

$$\begin{array}{r}
 c) \quad \begin{array}{r} 111001 \\ + 10110 \\ \hline 1001111 \end{array} \quad \begin{array}{r} 111001 \\ - 10110 \\ \hline 100011 \end{array} \quad \begin{array}{r} 111001 \\ \times 10110 \\ \hline 1110010 \\ + 11100100 \\ \hline 101010110 \\ + 111001000 \\ \hline 10011100110 \end{array}
 \end{array}$$

4) a) $111110011001.101_2 \rightarrow \text{Base } 8$
 $\hookrightarrow 7631.5_8$

$111110011001.1010 \rightarrow \text{Base } 16$
 $\hookrightarrow F99.A_{16}$

$7631.5_8 \rightarrow \text{Base } 10$
 $\hookrightarrow 3993.625_{10}$

$$\begin{array}{r}
 1 \times 1 = 1 \\
 3 \times 8 = 24 \\
 6 \times 64 = 384 \\
 7 \times 512 = 3584 \\
 + 5 \times \frac{1}{8} = \frac{5}{8} \\
 \hline
 3993.625
 \end{array}$$

$F99.A \rightarrow \text{Base } 10$
 $\hookrightarrow 3993.625_{10}$

$$\begin{array}{r}
 A \times \frac{1}{16} = \frac{A}{16} \\
 9 \times 1 = 9 \\
 9 \times 16 = 144 \\
 + F \times 256 = 3840 \\
 \hline
 3993.625
 \end{array}$$

b) $111100011001.010 \rightarrow \text{Base } 8$
 $\hookrightarrow 7431.2_8$

$111100011001.0100 \rightarrow \text{Base } 16$
 $\hookrightarrow F19.4_{16}$

$7431.2_8 \rightarrow \text{Base } 10$
 $\hookrightarrow 3865.25_{10}$

$$\begin{array}{r}
 2 \times \frac{1}{8} = \frac{1}{4} \\
 1 \times 1 = 1 \\
 3 \times 8 = 24 \\
 4 \times 64 = 256 \\
 + 7 \times 512 = 3584 \\
 \hline
 3865.25_{10}
 \end{array}$$

$F19.4_{16} \rightarrow \text{Base } 10$
 $\hookrightarrow 3865.25_{10}$

$$\begin{array}{r}
 4 \times \frac{1}{16} = \frac{1}{4} \\
 9 \times 1 = 9
 \end{array}$$

$$F17.7_{16} \rightarrow \text{Base } 10$$

$$\hookrightarrow 3865.25_{10}$$

$$4 \times 16 = 64$$

$$9 \times 1 = 9$$

$$1 \times 16 = 16$$

$$+ F \times 256 = 3840$$

$$3865.25_{10}$$

5) $01\ 10\ 02\ 12\ 20\ 20\ 10_3 \rightarrow \text{Base } 9$

$$1\ 3\ 2\ 5\ 6\ 6\ 3_9$$

$$\hookrightarrow 1325.663_9$$

6) a)

$$\begin{array}{r} 1111 \\ + 1001 \\ \hline 11000 \end{array} \quad \begin{array}{r} 1111 \\ - 1001 \\ \hline 0110 \end{array} \quad \begin{array}{r} 1111 \\ \times 1001 \\ \hline 1111 \\ + 1111000 \\ \hline 10000111 \end{array}$$

b)

$$\begin{array}{r} 1111001 \\ + 110110 \\ \hline 10101111 \end{array} \quad \begin{array}{r} 111\overset{0}{\cancel{1}}\overset{1}{\cancel{0}}\overset{1}{\cancel{0}}1 \\ - 110110 \\ \hline 1000011 \end{array} \quad \begin{array}{r} 1111001 \\ \times 110110 \\ \hline 11110010 \\ + 111000100 \\ \hline 1011010110 \\ + 11110010000 \\ \hline 101001100110 \\ + 111100100000 \\ \hline 1100110000110 \end{array}$$

c)

$$\begin{array}{r} 110110 \\ + 11001 \\ \hline 1001111 \end{array} \quad \begin{array}{r} 110\overset{0}{\cancel{1}}\overset{1}{\cancel{0}}\overset{1}{\cancel{0}} \\ - 11001 \\ \hline 11101 \end{array} \quad \begin{array}{r} 110110 \\ \times 11001 \\ \hline 110110 \\ + 110110000 \\ \hline 111100110 \\ + 1101100000 \\ \hline 10101000110 \end{array}$$

7) a) $222.2_{10} \rightarrow \text{Base } 16$

$$\hookrightarrow \text{DE}.3\ldots_{16}$$

$$16 \overline{)222} = 13 \quad R\ 14$$

$$16 \overline{)13} = 0 \quad R\ 13$$

$$.2 \times 16 = \textcircled{3}.2$$

$$\hookrightarrow \text{Repeat}$$

$$\text{DE}.3_{16} \rightarrow \text{ASCII}$$

$$\hookrightarrow 1000100\ 1000101\ 0101110\ 0110011$$

b) $181.18_{10} \rightarrow \text{Base } 16$

$$\hookrightarrow \text{B5}.2\text{E}147\text{A}_{16}$$

$$16 \overline{)181} = 11 \quad R\ 5$$

$$16 \overline{)11} = 0 \quad R\ 11$$

$$.18 \times 16 = \textcircled{2}.88 \times 16 = \textcircled{14}.08 \times 16 =$$

$$\textcircled{0}.28 \times 16 = \textcircled{4}.48 \times 16 = \textcircled{7}.68 \times 16 =$$

$$\textcircled{10}.88$$

$$\hookrightarrow \text{Repeat}$$

$$\text{B5}.2\text{E}147\text{A} \rightarrow \text{ASCII}$$

$$\hookrightarrow 1000010\ 0110101\ 0101110\ 0110010\ 1000101$$

$$0110001\ 0110100\ 0110111\ 1000001$$

8) 1's Complement:

$$\begin{array}{r} 11010 \rightarrow 11010 \\ -10100 \\ \hline 01010 \end{array} \quad \begin{array}{r} +01011 \\ \hline 100101 \\ + \text{Carry} \rightarrow 1 \\ \hline 100110 \end{array}$$

$$\begin{array}{r} 01011 \rightarrow 01011 \\ -11000 \\ \hline 10010 \end{array} \quad \begin{array}{r} +00111 \\ \hline 10010 \end{array}$$

$$\begin{array}{r} 10001 \rightarrow 10001 \\ -01010 \\ \hline 100110 \\ + \text{Carry} \rightarrow 1 \\ \hline 100111 \end{array}$$

$$\begin{array}{r} 10101 \rightarrow 10101 \\ -11010 \\ \hline 11010 \end{array} \quad \begin{array}{r} +00101 \\ \hline 11010 \end{array}$$

2's Complement:

$$\begin{array}{r} 11010 \rightarrow 11010 \\ -10100 \\ \hline 100110 \\ \hookrightarrow 00110 \end{array} \quad \begin{array}{r} +01100 \\ \hline 100110 \\ \hookrightarrow 00110 \end{array}$$

$$\begin{array}{r} 01011 \rightarrow 01011 \\ -11000 \\ \hline 10011 \end{array} \quad \begin{array}{r} +01000 \\ \hline 10011 \end{array}$$

$$\begin{array}{r} 10001 \rightarrow 10001 \\ -01010 \\ \hline 100111 \\ \hookrightarrow 00111 \end{array} \quad \begin{array}{r} +10110 \\ \hline 100111 \\ \hookrightarrow 00111 \end{array}$$

$$\begin{array}{r} 10101 \rightarrow 10101 \\ -11010 \\ \hline 11011 \end{array} \quad \begin{array}{r} +00110 \\ \hline 11011 \end{array}$$

9)

	4	3	2	1
8	1	1	0	1
1	0	0	0	1
4	1	0	0	0
7	1	1	0	0

8147 = 1101 0001 1000 1100

- OR -

	4	3	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	1	0	0
4	1	0	0	0
5	1	0	0	1
6	1	0	1	0
7	1	1	0	0
8	1	1	0	1
9	1	1	1	0