EE2020 (Part 1)
Tutorial 1 - Solutions

1. (a) Iteratively divide by two (remainder's division progressively gives digits)

$$\begin{array}{rrrrrrrrrrrrrrr} & \overline{83} & & \overline{41} & & \overline{20} & & \overline{10} & & \overline{5} & & \overline{2} & & \overline{1} & \overline{0} \\ 2\overline{)166} & \leftarrow & 2\overline{)\ 83} & \leftarrow & 2\overline{)41} & \leftarrow & 2\overline{)20} & \leftarrow & 2\overline{)10} & \leftarrow & 2\overline{)5} & \leftarrow & 2\overline{)2} & \leftarrow & 2\overline{)1} \\ \underline{166} & & \underline{\ 82} & & \underline{40} & & \underline{20} & & \underline{10} & & \underline{4} & & \underline{2} & & \underline{0} \\ 0 & & 1 & & 1 & & 0 & & 0 & & 1 & & 0 & & 1 \end{array}$$

$$.34\times 2 = \mathbf{0}.68 \rightarrow .68\times 2 = \mathbf{1}.36 \rightarrow .36\times 2 = \mathbf{0}.72 \rightarrow .72\times 2 = \mathbf{1}.44.....$$
$$= (10100110.0101\ldots)_2$$

(b)
$$\begin{array}{rrrrrrr} & \overline{87} & & \overline{\ 5} & & \overline{0} \\ 16\overline{)1400} & \leftarrow & 16\overline{)\ 87} & \leftarrow & 16\overline{)5} \\ \underline{1392} & & \underline{\ 80} & & \underline{0} \\ 8 & & 7 & & 5 \end{array}$$

$$.16\times 16 = \mathbf{2}.56 \rightarrow .56\times 16 = \mathbf{8}.96 \rightarrow .96\times 16 = \mathbf{F}.36 \rightarrow .36\times 16 = \mathbf{5}.76.....$$
$$= (578.28F5....)_{16}$$

(c) Group digits in 3-digit sets and convert digit by digit

$$\underbrace{10}_{5}\underbrace{101}_{3}\underbrace{100}_{4}.\underbrace{000}_{0}\underbrace{111}_{7}$$
$$= (534.07)_8$$

(d) Group digits in 4-digit sets and convert digit by digit

$$A59.FCE = \underbrace{1010}\ \ \underbrace{0101}\ \ \underbrace{1001}\ \bullet\ \underbrace{1111}\ \ \underbrace{1100}\ \ \underbrace{1110}$$

$$= 4623$$

(e)

$$\begin{array}{l} 6\mathbf{2}- \\ \underline{2\mathbf{6}} \\ 3\mathbf{4} \end{array}$$

x + 2 - 6 = 4.

$\therefore$ x = 8. The number system is octal.

2. First look at the sign from the MSB, then convert the remaining bits (magnitude) as usually done in conversion from decimal to binary (iterative divisions)

Decimal	Sign Mag.
127	01111111
-0	10000000
-55	10110111

3. Look at the sign, just convert from decimal to binary if positive , or revers all bits of magnitude if negative

Decimal	1's Comp.
43	0000101011
-1	1111111110
-128	1101111111

4. Look at the MSB to know about the sign. Regarding the magnitude, just convert from decimal to binary if positive (MSB=0), or evaluate 2's complement if negative (MSB=1), and then convert to decimal

(a) $10000(\textbf{2's}) \xrightarrow{-1} 01111(\textbf{1's}) \xrightarrow{\textbf{complement}} 10000(\textbf{magnitude}) \rightarrow -16$

(b) $10000001(\textbf{2's}) \xrightarrow{-1} 10000000(\textbf{1's}) \xrightarrow{\textbf{complement}} 01111111(\textbf{mag.}) \rightarrow -127$