EE2026 (Part 1)
Tutorial 1 - Solutions

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

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

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

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

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

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

$$\underline{101}\ \underline{011}\ \underline{100}.\ \underline{000}\ \underline{111}$$
$$5\quad 3\quad 4\quad\ 0\quad 7$$
$$= \left(534.07\right)_8$$

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

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

(e) By definition of positional number system:

$$6\cdot x^1 + 2\cdot x^0 - \left(2\cdot x^1 + 6\cdot x^0\right) = 3\cdot x^1 + 4\cdot x^0$$

$$\left(6-2-3\right)\cdot x + \left(2-6-4\right) = 0$$

$$\therefore\ x = 8 \quad \text{(octal)}$$

2.

```
module endian (input [31:0] X, output [31:0] Y);

   assign Y = {X[7:0], X[15:8], X[23:16], X[31:24]};

endmodule
```