Homework 1

CPTS 466
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1.
   - Microcomputer: a small computer with a microprocessor and other I/O within it, what you'd typically think of when you say "computer."
   - Microprocessor: a chip that executes instructions.
   - Microcontroller: a chip that contains a microprocessor, memory, I/O ports.

2. An embedded system is a computer with a specific purpose, usually for real-time computing. Typically, the parts are minimized for a specific purpose and extraneous hardware is stripped out.

3. Digital watches, traffic lights, automotive, avionics, industrial (PLCs, etc).

4. Switches, USB, keyboard, touchscreen.

5. Displays, USB, audio output.

6. Flash ROM has a higher density, since RAM requires refresh lines and ROM does not.

7.
   1. C
   2. D
   3. A
   4. B
   5. E

8.
   - Bit: 1
   - Nibble: 4
   - Byte: 8
   - Hword: 16
   - Word: 32

9. Unsigned numbers use all the bits for the magnitude of a number. A signed number has a specific bit to represent the sign of the number. In two's complement, for a negative number, the magnitude is inverted and 1 is added to the number to represent the signed number.

10. `0100 1110 0001b`

    `2341h`

    `0x4E1`

    For a 32-bit sign-extended binary, `0000 ... 0100 1110 0001b`

11. Inverting 1249, we get `1111 ...1011 0001 1110b`. Then adding one, `1111 ...1011 0001 1111b`.

12. In sign-magnitude, `1000 ... 0100 1110 0001b`.

13.

- $-10 + 12$:

$$\begin{aligned} -10 &= (\neg \texttt{10b} + 1) = \neg 1111010_2 + 1 \\ &= 11110110_2 \\ 12 &= 00001100_2 \\ -10 + 12 &= 00000010 = 2? \end{aligned}$$

I think this overflowed because it has an extra carry bit.

- $-20 + 19$:

$$\begin{aligned} -20 &= \neg 00010100_2 + 1 = 11101011_2 + 1 \\ &= 11101100_2 \\ 19 &= 00010011_2 \\ -20 + 19 &= 11111111_2 \\ &= -(00000000_2 + 1_{10}) = -1 \end{aligned}$$

- $10000000_h + 10000000_h$:

$$\begin{aligned} 0001 \ldots 0000 + 0001 \ldots 0000 &= 0010 \ldots 0000 \\ &= 20000000_h \end{aligned}$$