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computer architecture  
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hw1

1. Convert the following binary number to decimal using expanded notation.

$$\begin{aligned}10011011_2 &= 1 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 \\&= 1 + 2 + 8 + 16 + 128 \\&= 155\end{aligned}$$

2. Convert the following octal number to decimal using expanded notation.

$$5247_8 = 5 \cdot 8^3 + 2 \cdot 8^2 + 4 \cdot 8^1 + 7 \cdot 8^0 = 2560 + 128 + 32 + 7 = 2727$$

3. Convert the following decimal number: 1984

a) Convert this into binary.

$$\begin{aligned}1984 / 2 &= 992 \text{ R } 0 \\992 / 2 &= 496 \text{ R } 0 \\496 / 2 &= 248 \text{ R } 0 \\248 / 2 &= 124 \text{ R } 0 \\124 / 2 &= 62 \text{ R } 0 \\62 / 2 &= 31 \text{ R } 0 \\31 / 2 &= 15 \text{ R } 1 \\15 / 2 &= 7 \text{ R } 1 \\7 / 2 &= 3 \text{ R } 1 \\3 / 2 &= 1 \text{ R } 1 \\1 / 2 &= 0 \text{ R } 1\end{aligned}$$

Which gives  $11111000000_2$

- b) Using the answer from part a. convert that binary number into octal.

$$(11111000000)_2 = (011_2, 111_2, 000_2, 000_2)_8 = 3700_8$$

- c) Using the answer from part a, convert that binary number into hexadecimal.

$$(11111000000)_2 = (0111_2, 1100_2, 0000_2)_{16} = (7, 12, 0)_{16} = 7C0_{16}$$

4. Do Exercise 1.3 in page 55 of the textbook.

Describe the steps that transform a program written in a high-level language such as C into a representation that is directly executed by a computer processor.

It is a weird question. There are a couple answers to this:

The book, and class answer, goes into a two step process. First the highlevel code is compiled to assembly of the given machine. Then another program assembles the assembly language into machine language instructions.

Also without getting into too much detail, the new model for iso C18 has 8 steps for compilation into binary. 4 are dedicated to what the precompiler does. The next 3 are compilation steps into binary code. And the last step is linking information from the compiled files together.

5. Do Exercise 1.4 on page 55 of the textbook.

Assume a color display using 8 bits for each of the primary colors (red, green, blue) per pixel and a frame size of  $1280 \times 1024$ .

a) What is the minimum size in bytes of the frame buffer to store a frame?

$$1280 * 1024 * 8/8 = 1310720 \text{ bytes}$$

b) How long would it take, at a minimum, for the frame to be sent over a 100 Mbit/s network?

$$1280 * 1024 * 8 / (100 * 1000000) = 0.1048576 \text{ seconds}$$