HW2.5. Memory Endianness

Recall that the endianness of a system decides how multibyte blocks are stored in memory. In a little-endian system, memory is stored with the most significant byte at the highest address, while a big-endian system stores the most significant byte at the lowest address. Under normal circumstances, the endianness of a system is irrelevant, since we write and read to a variable in a consistent manner; if we write `int x = 5;`, we don't really care how the 5 is stored, as long as we get back `5` whenever we read that int.

There are two major cases when endianness matters:

- When sending data over a network. In particular, most network protocols use big-endian due to various physical effects, while most CPUs run in little-endian.
- When interpreting blocks of one size as another size (for example, interpreting an int as a char array). In this case, the order of the bytes will affect how our data gets interpreted in the new size. A later exercise will provide an example of when this might happen.

Suppose that we have the following bytes stored in memory:

```
0x00001000: 0x00
0x00001001: 0x01
0x00001002: 0xFF
0x00001003: 0xFF
```

We then run the line `printf("%d\n", *(int*)(0x1000));`. Assume that `int`s are 32 bits long (i.e. 4-bytes). Remember that `%d` will print out an integer not hex.

Q1.1: What gets printed out on a big-endian system?

integer

Q1.2: What gets printed out on a little-endian system? Hint: C uses 2's complement for signed integers, as with most signed number systems.

integer

For this part, assume that we have a little endian system. We run the following code:

```
uint32_t *x = malloc(sizeof(uint32_t)*4); //Assume that x == 0x20000000
x[0] = 0xDEADBEEF;
x[1] = 0xC561C156;
x[2] = 0x00DC1A55;
x[3] = 0xABADCAFE;
uint64_t y = *((uint64_t*)x);
```

Q2.1: What byte is stored at memory address `0x2000000E`? Answer in hexadecimal, with no prefix.

0x

Q2.2: What would `strlen((char*)x)` return?

integer

Q2.3: What is the value of y? Answer in hexadecimal, with no prefix.

0x

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Homework 2

Assessment overview

Total points: 20/100

Score: 20%

Question

Value: 15

History:

Awarded points: 0/15

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