CSE222 Computer Architecture
Homework Set 02

(Review)

1. Von Neumann Architecture; Components in a computer system; Stored program; Fetch-execute cycle;
2. Number systems
   A. decimal, binary, hexadecimal;
   B. hexadecimal digits (0-9, A, B, C, D, E, F) and their binary representations
   C. conversion numbers among different number systems
3. Sign/magnitude number; two's complement number
4. Fractions: fixed-point number, floating-point number

(Exercise)

1. What is the largest and smallest **6-bit** binary number that can be represented with:
   (a) Unsigned number
   (b) Two's complemented number
   (c) Sign/magnitude number

2. You are asked to code "year-month-day" into a binary number to represent date information in format "YYYYMMDD". Indicate how many binary bits are needed in total.

3. What are the decimal numbers of the followings **8-bit** two's complement numbers? What if the following numbers are sign/magnitude numbers?
   (a) 01010011
   (b) 10110011
   (c) 10010101

4. Convert the following decimal numbers to **8-bit** two's complement numbers:
   (a) 35
   (b) -93
   (c) 120

5. Expand the following **5-bit** two's complement numbers to **8-bit** two's complement numbers, write out their decimal numbers:
   (a) 01101
   (b) 11110
   (c) 10101

6. Convert the following decimal numbers to **6-bit** two's complement binary numbers then do addition or subtraction:
   (a) 6 + 31
   (b) (-23) + 11
   (c) (-17) + (-13)
   (d) -29 - 5

7. The following are 8-bit two’s complement numbers. Apply shift operations on these numbers and convert them to decimals:
   (1) 10011011
      (a) >> 1
      (b) << 1
      (c) >>>1
   (2) 00110101
      (a) >> 2
      (b) << 2
      (c) >>>2
8. For the following decimal numbers, express them in the required formats. Write answers in hexadecimal:
   (a) -37.0625
   (b) 23.375

   (1) Express them in 16-bit fixed-point sign/magnitude format with 8 integer bits and 8 fraction bits;
   (2) Express them in 16-bit fixed-point 2’s complement format with 8 integer bits and 8 fraction bits;
   (3) Express them in single precision (32-bit) IEEE 754 floating-point format
9. Add the following IEEE 754 single-precision floating-point numbers:
   (a) 0xC0D20004 + 0x72407020
   (b) 0x5EF10324 + 0x5E039020