ENGN2219/COMP6719
Computer Systems & Organization
Problem Set 1

Note: This problem set is optional for your practice only and not part of the assessment scheme.

Question 1:

Briefly explain how software programmers can write programs in their favorite programming language (e.g., Python) without fully comprehending the physics behind transistors (the fundamental building block of a modern computer). How is the microarchitecture abstraction different from the architecture (or ISA) abstraction? Why do we need a transformation hierarchy in computer systems?

Question 2:

What is the smallest (most negative) 32-bit binary number that can be represented with

(a) unsigned numbers?
(b) two's complement numbers?
(c) sign/magnitude numbers?

Question 3:

Convert the following decimal numbers to 8-bit two's complement numbers or indicate that the decimal number would overflow the range.

(a) 124
(b) −63
(c) 42
(d) −128
(e) 133

Question 4:

Convert the following decimal numbers to 6-bit two's complement binary numbers and add them. Indicate whether the sum overflows a 6-bit result.

(a) 16 + 9
(b) −4 + 19
(c) 3 + −32
(d) −16 + −9
(e) −27 + −31

Convert the following decimal numbers to 5-bit two's complement binary numbers and subtract them. Indicate whether the difference overflows a 5-bit result.

(a) $9 - 7$
(b) $12 - 15$
(c) $-6 - 11$
(d) $4 - -8$

Convert the following hexadecimal numbers to decimal:

(a) AB3E
(b) 776F