COMP-2650 Computer Architecture I: Digital Design Winter 2026

Lab Exercise 1 – Basic Numeracy

Due: Friday, Jan 16, 2026

- Review Chapter 1 of the textbook.
- Show your step-by-step work for the complete attempt, otherwise it will be considered incomplete.

Question 1. [10 marks]

Express each value below as a binary string of 0's and 1's.

1) 88_{10}
2) 444.1875_{10}
3) 56_{8}
4) $2E4B_{16}$
5) $(1000\ 0101)_{BCD}$
6) 'Z' (printable character Z - ASCII)
7) 'z' (printable character z - ASCII)
8) ACK (signal - ASCII)

Question 2. [10 marks]

1) Convert $(101011001001)_2$
   a. in base-8 and base-16 representations (by grouping)
   b. in base-10 and then to base-8 and base-16.

   Hint: Representations of base-8 and base-16 in a. and b. should match.
2) Represent $(AB)_{16}$ in base-2, base-8, and base-10.

Question 3. [10 marks]

1) Express the number $\mathbf{-1_{10}}$ in
   a) Signed binary, assuming the representation consists of 4 bits
   b) 1's-complement form, assuming the representation consists of 8 bits.
   c) 2's-complement form, assuming the representation consists of 16 bits.

2) Express the number $\mathbf{5678_{10}}$ in both 9's-complement and 10's-complement integer form.

Question 4. [10 marks]

1. Convert the number $\mathbf{4CG4_{19}}$ (base-19) to its equivalent value in base-10, and also in base-13. The digits in base-19 extend from 0 to 9, then use A, B, C, D, E, F, G, H and I.
2. Express the minimum (most negative) and maximum (most positive) values of a 8 bit 2's-complement integer representation. Provide both the binary strings and their signed decimal (base-10, with sign +/-) equivalent values.

Question 5. [10 marks]

1) Express the number $(1)_{10}$ to $(15)_{10}$ in BCD.

2) Perform BCD addition and verify using decimal integer (Base-10) addition:
   a) 1001 0100 + 0110 0111
   b) 1001 1000 + 0001 0010

FINAL NOTES:

Assigned Reading: Read Chapter 1 of the textbook, reviewing Gray codes, and excess-N representations of decimal (BCD) numbers. You may be tested on this material, but responsibility for the assigned reading and learning lies with each individual student.

Submission:

A. Submit the lab work on Brightspace before the deadline.
B. Students are responsible for uploading the work in high resolution when submitted as images.
C. No extensions will be granted. Students are provided five days to complete the assignment, and it is student's responsibility to manage the time and complete the assignment before the submission deadline.

Evaluation:

A. Students are evaluated on all stated requirements.
B. It is mandatory that students complete their work and must be able to justify their answers when asked to do so by instructors and teaching staff.
C. If the work is not clearly written or presented, or submission is in unsupported file type, it will be graded as zero.