COMP-2650 Computer Architecture I: Digital Design Winter 2026

Lab Exercise 5 – Combinational Logic Design

Due : Friday, 13 February, 2026

- *Draw the input and output lines neatly and carefully as indicated during the lectures. Unclear answers*
- *Refer textbook and lecture slides for more details on the parts below. Ask questions if you experience any difficulties.*

Question 1. Adders [10 marks]

a) How is half adder different from full adder? Indicate the difference using truth table and the block diagram.
b) Why is Multi-bit adder called Ripple Adder? Show it using a block diagram of two inputs of 4 bits.

Question 2. Subtractor [10 marks]

a) Draw an implementation diagram of the full subtractor.
b) Using logic diagram, full subtractor using two half subtractors

Hint: Implementation and logic diagram refer to Gate Implementation

Question 3. Multiplexers [10 marks]

a) For given number of select lines, derive the truth table for multiplexer:
   i. For 1 Select line
   ii. For 3 Select lines

Hint: Determine the number of inputs

b) Implement the 1:4 DEMUX with Enable (where E=1, E'=0). Mention how the circuit works when Enable is inverted.

Question 4. Comparator [10 marks]

a) Derive the truth table for a function G which is true when A is greater than B, where A and B are two-bit binary numbers.
b) Obtain Boolean Function for G(A1A0B1B0) using the suitable simplification method.
c) Implement G(A1A0B1B0)

Question 5. Overflow [10 marks]

Perform the Signed Binary Addition using 2's Compliment.

a) +66 +(+13)

b) +66 +(-13)

c) -66
+(+13)

d) -66
+ (-13)

Additional Assigned Reading and Self-study Exercises:

Review and attempt problems at the end of Chapter 3 in the textbook; you may omit the questions that deal with HDL unless you are specifically interested. It is not required that students submit their work, nor will it be evaluated. However, examination questions may be based on these problems, so it is worthwhile to complete this work.

FINAL NOTES:

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.