COMP-2650 Computer Architecture I: Digital Design Winter 2026

Lab 2 – Simplification of Boolean Expressions

Due: Friday, January 23, 2026

Question 1. [10 marks]

a. Determine by means of a truth table the validity of DeMorgan's theorem for three variables: (ABC)' = A' + B' + C'.

b. List the truth table of a three-variable eXclusive-OR (sometimes called 'odd') function: D = A x B x C, where x denotes the XOR operator.

Question 2. [10 marks]

Simplify the following expressions using Boolean algebra. In each case, state the Axiom (ie. Postulate) or Theorem being applied at each step.

a. A + AB
b. AB + AB'
c. (BC' + A'D)(AB' + CD')

Question 3. [10 marks]

Simplify the following expressions using Boolean algebra. In each case, state the Axiom (ie. Postulate) or Theorem being applied at each step.

a. A'BC + AC
b. A'B + ABC' + ABC
c. AB + A(CD + CD')

Question 4. [10 marks]

Using DeMorgan's theorem(s), show that:

a. (A + B)'(A' + B')' = 0
b. A + A'B + A'B' = 1

Question 5. [10 marks]

Given the Boolean expression: F = X'Y + XYZ'

a. Derive an algebraic expression for the complement F'.
b. Show that FF' = 0. (Use algebra, not truth tables)
c. Show that F + F' = 1. (Use algebra, not truth tables)

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.