

# CSC 236 Learning Outcomes

Summer 2025

1. Mathematical Tools
  - a. Mathematical Objects
    - i. Functions
    - ii. Graphs
    - iii. Prove properties of the above mathematical objects
    - iv. Model problems using the above mathematical objects
  - b. Proving  $\forall n. P(n)$ .
    - i. Apply the Principle of (Simple) Induction.
    - ii. Apply the Principle of Complete Induction (CI).
    - iii. Apply the Well Ordering Principle (WOP).
    - iv. Understand the Principle of Structural Induction (SI).
    - v. Understand the equivalence of the above 4.
2. Algorithm Analysis
  - a. Understand the correctness of an algorithm in terms of preconditions and postconditions.
  - b. Recursive correctness
  - c. Runtime
    - i. Find asymptotic runtime of iterative algorithms
    - ii. Set up and solve recurrence relations.
    - iii. Apply the substitution method and recursion tree methods.
    - iv. Apply the Master Theorem to analyze the runtime of divide and conquer algorithms.
  - d. Iterative correctness
    - i. Loop Invariants
    - ii. Partial Correctness
    - iii. Termination
3. Formal Language Theory
  - a. Understand the following terms
    - i. Alphabet
    - ii. String
    - iii. Language
  - b. Automata
    - i. Define/Analyze/Construct Deterministic Finite Automata (DFAs)
    - ii. Define/Analyze/Construct Nondeterministic Finite Automata (NFAs)
    - iii. Define/Analyze/Construct Regular Expressions
  - c. Regular languages

- i. Define Regular Languages.
- ii. Show the “equivalence” of DFAs/NFAs/Regular Expressions
- iii. Understand and apply closure properties of regular languages.
- iv. Prove languages are regular.
- v. Understand the Pumping Lemma and apply it to prove certain languages are NOT regular.