CSCI 104L Lecture 15: Midterm Review

ALGORITHMS:

- Recursion: Programming and Analysis
- Sorting Algorithms: Runtimes, Loop Invariants, Stability
- Search Algorithms: Linear, Binary, Interpolation

DATA STRUCTURES:

- Linked Lists
- Arrays and ArrayLists
- For all data structures:
  - The functions they provide.
  - How and where to use them.
  - How they are implemented.
  - How fast the operations are.
- ADTs
  - Lists
  - Queues
  - Stacks
  - Maps
  - Sets

RUNTIME ANALYSIS:

- Definition of worst-case runtime.
- How to provide upper and lower bounds
- How to perform calculations with \( O, \Omega, \Theta \).
- Setting up sums for loops.
- Setting up recurrences for recursion.
- Basic sums
  - Arithmetic
  - Geometric
  - Harmonic
- Amortized runtime (averaging runtime over multiple calls).
C++ PROGRAMMING:

- Object-oriented design
- Abstraction and Encapsulation (packing common-purpose elements into the same class).
- Structs and classes: public, protected, private.
- Constructors and destructors: shallow and deep copies.
- Pointers, passing by value and reference.
- Operator overloading and friend access.
- Inheritance and polymorphism
  - Virtual functions
  - Abstract classes
  - Scoping (BaseClass::function)
- The const keyword, how and why to use it.
- Exceptions