CS171 Final Review

The exam will be accumulative and may cover materials from the textbook (readings are posted on the class schedule page), lecture notes, quizzes, and assignments. It will focus slightly more on the materials after midterm. Below is a review of the key topics.

Java Basics and OO
- Object type variables vs. primitive type variables
- Method calls, call stack
- Local variables vs. Parameter variables vs. Instance variables
- Inheritance

Arrays
- Typical array processing and traversal
- Binary search for ordered arrays – algorithm, implementations (loop-based version and recursive version), and cost analysis

Algorithm analysis
- Common functions - constant, logarithm, linear, quadratic, polynomial, exponential, factorial in increasing order of growth
- Cost analysis using direct methods and recursive relations

Linked lists
- Linked lists vs. array
- Insert, search, delete – implementations and cost
- Variations - double-ended list, doubly-linked list, circular list, sorted linked list

Stacks and queues
- Basic operations: push and pop for stacks; enqueue and dequeue for queues
- Implementations using resizing arrays and linked list
- Generics and iterators
- Deques

Sorting
- Bubble sort, selection sort, and insertion sort – algorithms, implementations, and cost analysis
- Mergesort and quicksort – algorithms, implementations, and cost analysis

Recursion
- Recursive method, base case
- Tracing recursive method calls and evaluating the output
- Solving recurrence relations
- Divide and conquer
- Dynamic programming, memoization
Binary search trees
- Definitions and terminologies
- Insert, search, finding minimum/maximum – algorithm, implementation, and cost
- Pre-order, in-order, post-order traversal – algorithm, implementation, cost
- Delete – understand algorithm and be able to predict the result after delete, no implementation is required

Priority queue and heaps
- Tree vs. array implementation
- Insert, removeMin/removeMax: algorithm, predict result, cost.

Hash table
- Definitions
- Common hashing functions (modulo)
- Collision resolution: separate chaining, linear probing

Graphs
- Definitions and terminologies
- Adjacency matrix and adjacency list representations
- BFS and DFS traversal algorithms – algorithm, implementation
- Shortest path for unweighted graphs (BFS)
- Connected components
- Shortest path for weighted graphs (Dijkstra, A*) – algorithm, implementation, predict results