Last Time

- Data Streams
Today

- Midterm Review
Logarithms and Exponents

\[ b^x = y \]
\[ x = \log_b y \]
\[ \log_b xy = \log_b x + \log_b y \]
\[ \log_b \frac{x}{y} = \log_b x - \log_b y \]
\[ \log_b x^a = a \log_b x \]
\[ \log_a x = \frac{\log_b x}{\log_b a} \]
Asymptotic Notation

Proving $f(x) = O(g(x))$
Proving $f(x) = \Omega(g(x))$
Proving $f(x) = \Theta(g(x))$

Classes of Functions – does $f(x)$ dominate $g(x)$?
Solving Recurrences.
Substitution Method.
Recurrence Tree.
Master Method.
Inductive Proofs

Structure of an Inductive Proof.

- Base Case
- Inductive Step

Loop Invariants.

- Initialization
- Maintenance
- Termination
Searching Algorithms

Binary Search
Sequential Search

- When can they be used?
- What are their runtimes.
Sorting Algorithms

Comparison Sorts

- Unbound domain
- No inspection of the values that are sorted
- Lower bound on Runtime $= O(n \log(n))$

- Insertion Sort
- Merge Sort
- Quick Sort

Non-Comparison Sorts

- Domain bounds and/or value inspection.
- Counting Sort
- Bucket Sort
- Radix Sort
Binary Search Trees

- Insertion
- Deletion
- Search
Heaps

- Max Heap Property
- Construction
- Insertion
- Deletion
- Maximum
- Representation as an Array
Balanced Search Trees

AVL Trees
- Insertion
- Deletion
- Balance Factor calculation
- Balancing operations (Rotation).

Red-Black Trees
- Properties and Definition
- Insertion
- Deletion
- Balancing operations (Rotation and Recoloring)

2-3 Trees
- Properties and Definition
- Insertion
- Deletion
Technicalities

- 75 Minutes.
- Scored out of 100 points.
- 1 8.5 x 11 sheet of paper will be allowed.
- No cell phones.
- No computers.
- Graded and returned on the following class, Tuesday 10/27.
Bye

- Next time (10/22)
  - Midterm Exam
- For Next Class
  - Study.
  - Make a crib sheet.