CSCI 104
Course Review
Andrew Goodney
Final Exam Details

- Wednesday May 1\textsuperscript{st} at 8am!
- Room assignments on Website
- Gradescope + attendance sheet (bring laptop/tablet)
- Focus on material after midterm
  - Counting, probability, number theory, hash functions, tries, skip lists, merge trees, amortized analysis
- Some questions on previous material
Topic Areas/Example Questions

• Vectors/Deques
  Both a std::vector and a std::deque use a dynamically allocated array as the backing store.

• Linked Lists
  A linked list can grow/shrink without periodic resizing (i.e. without periodically copying all current items).

• Counting
  You have six white eggs and six brown eggs. How many ways can the eggs be arranged in an 12 compartment egg crate?
Topic Areas/Example Questions

• Number Theory

Calculate the following:
\[ 5^{11} \mod 9 \]

• Probability

A store accepts either cash or debit card (but not credit cards, Apple Pay, checks, etc). Out of the customers who walk in the door: 23% carry only cash, 65% carry only a debit card, and 9% carry both cash and a debit card.

What is the probability a customer carries a payment method the shop accepts?
Topic Areas/Example Questions

• Binary Search Trees

  Which traversal method is best when deleting all nodes of a binary search tree?

• AVL Trees

  – Given a tree, calculate the balance of the nodes
  – Given a tree, insert a node. Identify rotations to fix balance
Topic Areas/Example Questions

• **Heaps**
  
  A heap is using a vector called `data` starting with index 1. A node is at `data[i]` if the right child of this node exists, where is it?

• **ADTs**
  
  If you have a data structure implementing a map, you could use the same data structure to implement a list.

• **Runtime**
  
  Big-$O$ for the worst-case means REGARDLESS of possible inputs the runtime is upper-bounded by $O(f(n))$. 
Topic Areas/Example Questions

• Hashtables

  The main disadvantage to using closed addressing methods (e.g. chaining, buckets) is the ____ as compared to open addressing (probing):

• Recursion on Linked Lists
  – Given a code snippet, trace the code with a given input
  – Given a code snippet with a missing line, choose the correct line
Topic Areas/Example Questions

• Graphs (Algorithms/Traversals)

You are writing a program that reads a graph from a file and then queries the graph. Once the graph is read from the file it will not change. The queries are based on testing if an edge exists between two vertexes. Which data structure should you use to store the graph:

• Skip Lists

Skip lists would make a good implementation for which of the ADT(s):
Topic Areas/Example Questions

• Object Oriented Design

Is the following true or false: encapsulation is when we define new object types from those already defined in order to specify hierarchical relationships and extend functionality.

• Hash functions/Bloom Filters

Instead of storing passwords (p) in a database we store h(p). What one property must the hash function h() have in order for this to even be a good idea (i.e if we don't have this property, then others don't matter)?
Topic Areas/Example Questions

• Prefix Trees
  – Given a prefix tree, answer questions about the keys

• Recursion with backtracking
  
  Backtracking recursion can solve problems that have exponential runtimes by:

• STL/Iterators
  
  The C++ STL provides _____ classes that implement various _____.

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Topic Areas/Example Questions

• Splay Trees
  – Given a splay tree and an insertion/removal, identify rotations

• Log Structured Merge Trees
  – Given a LSMT and an operation, identify before/after, #merges, etc

• Amortized Runtime
  – General Questions