Midterm Review Checklist

Here are a list of algorithms, paradigms, math, and definitions that you should know from lecture, discussion, and homework. This is not meant to be comprehensive. It is merely a reminder of what we have covered thus far.

Algorithms

1. Divide and Conquer
   (a) Cake-cutting protocol
   (b) Mergesort $\Theta(\qquad)$
   (c) Multiplying 2 n-bit numbers $\Theta(\qquad)$
   (d) Searching for A[i] $= i$ in an array A $\Theta(\qquad)$
   (e) Maximum and minimum finding $\Theta(\qquad)$
   (f) Finding bad chips $\Theta(\qquad)$
   (g) Closest Pair of Points $\Theta(\qquad)$
   (h) Quicksort $\Theta(\qquad)$
   (i) Randomized-Quicksort Expected running time $= \Theta(\qquad)$
   (j) Probabilistic Selection Expected running time $= \Theta(\qquad)$
   (k) Deterministic Selection $\Theta(\qquad)$
   (l) Finding the median of two sorted lists $\Theta(\qquad)$
   (m) Nuts & bolts sorting $\Theta(\qquad)$
   (n) Majority problem / 10% problem $\Theta(\qquad)$
   (o) Coin Minimization $\Theta(\qquad)$
   (p) Strassen's algorithm for square matrix multiplication $\Theta(\qquad)$
2. Parallel algorithms
   (a) sorting $\Theta(\qquad)$
   (b) median finding $\Theta(\qquad)$
3. Dynamic Programming
   (a) Even-Split $\Theta(\qquad)$
   (b) Shuffle $\Theta(\qquad)$
   (c) Subset-Sum $\Theta(\qquad)$
   (d) Longest Common Subsequence $\Theta(\qquad)$
   (e) Thief's Problem (0–1 Knapsack) $\Theta(\qquad)$
   (f) Office party — no employee and direct supervisor $\Theta(\qquad)$
4. Matrix multiplication self-checker

5. Hash functions
   (a) Operations
   (b) Methods for handling collisions
      i. Chaining
         A. Insert $\Theta(\qquad)$
         B. Find $\Theta(\qquad)$
         C. Delete $\Theta(\qquad)$
      ii. Open addressing
         A. Insert $\Theta(\qquad)$
         B. Find $\Theta(\qquad)$
         C. Delete $\Theta(\qquad)$
6. Sorting real numbers in 0 comparisons $\Theta(\qquad)$
7. Bucket Sort $\Theta(\qquad)$
8. Radix Sort $\Theta(\qquad)$
9. Greedy
   (a) Fractional Knapsack $\Theta(\qquad)$
   (b) Making change with U.S. coins $\Theta(\qquad)$
10. Stable Marriage $\Theta(\qquad)$
11. Stable Roommate

Definitions

1. protocol
2. fair
3. memoization
4. program checker
5. load factor
6. perfect hashing
7. universal hashing
8. ϵ-almost universal hashing

Math

1. expectation
2. nth Harmonic number, H_n
3. sum of a geometric series
4. $\lg(n!)$

5. $\sum_{i=1}^{n} i$
6. $\sum_{i=1}^{n} \frac{1}{i}$
7. set notation, especially set of functions notation
8. computing under a modulus
9. induction
10. properties of logarithms and exponents
11. Stirling's approximation
12. L'Hôpital's rule

Concepts

1. Divide and Conquer
2. O, Θ, Ω
3. Master method
4. Expected time worst case analysis
5. Tree method / Iteration method
6. Lower bounds
7. Decision trees
8. Parallel algorithms
9. Dynamic Programming – Two necessary conditions
   (a)
   (b)
10. Program Checking
11. Hashing
12. Greedy algorithms – Two necessary conditions
   (a)
   (b)