Review Topics for Math 145

Chapter 2

1. addition principle, subtraction principle, multiplication principle
2. permutations and combinations
3. permutations of multisets
4. combinations of multisets (stars and bars)

Chapter 5

1. Pascal's formula and Pascal's triangle
2. combinatorial identities
   a. sums of rows of Pascal's triangle
   b. alternating sums of rows of Pascal's triangle
   c. sums of left and right diagonals of Pascal's triangle (hockey stick identities)
3. combinatorial proofs
4. Binomial theorem

Chapter 6

1. Inclusion-Exclusion principle
2. combinations with repetition
3. derangements

Chapter 7

1. finding recurrence relations
2. solving linear homogeneous recurrence relations
3. generating functions
4. exponential generating functions

Topics that we covered which will not be included on the final:

1. the pigeonhole principle (and the strong form of the principle)
2. minimum weight spanning trees (Kruskal's algorithm and Prim's algorithm)
3. the 5-color theorem

Chapter 11

1. basic properties of graphs
   a. degrees of vertices
   b. walks, trails, paths, cycles
2. Eulerian trails
   a. open Eulerian trails
   b. closed Eulerian trails
3. Hamilton paths and cycles
   a. Ore's theorem
   b. Dirac's theorem
4. bipartite graphs
5. trees
   a. equivalent characterizations of trees (with n vertices)
      i) G is connected and has no cycles
      ii) G is connected and has n-1 edges
      iii) G is connected, and every edge of G is a bridge
      iv) G has n-1 edges and no cycles
      v) G has no cycles, but adding an edge creates a cycle
      vi) Every pair of distinct vertices is joined by a unique path
   b. finding nonisomorphic trees of order n
   c. Prufer codes and Cayley's formula

Chapter 12

1. coloring vertices of graphs
   a. chromatic number
      i) finding the chromatic number of a graph
      ii) greedy coloring algorithm
      iii) lower and upper bounds for the chromatic number
   b. chromatic polynomial
2. planar graphs
   a. Euler's formula
   b. relations between edges and faces in a planar graph
3. matchings in bipartite graphs
   a. maximal matchings and M-augmenting paths
   b. Hall's theorem

Chapter 13

1. flows in networks
   a. values of flows and capacities of cuts
   b. maximal flows and flow-augmenting paths
   c. finding maximal flows (max-flow min-cut theorem)