Tentative Syllabus

The following is a tentative syllabus for EC330. The actual material covered may be only a subset of this syllabus, depending on class intangibles, such as average student background and progress, and may follow a different order.

I. FUNDAMENTALS
   - C++
     - syntax
     - Object-Oriented Programming
       - classes, inheritance, polymorphism
     - Standard Template Library
   - Software Engineering
     - design patterns
     - version control
     - testing
     - concurrency
   - Analysis
     - Basic math
       - Summations
       - Counting
       - Probability
     - Asymptotic notation
     - Iteration/recursion
     - Recurrences
   - Algorithm types
     - Brute force
     - Divide-and-conquer
     - Dynamic programming
     - Greedy
     - Amortized
o Simple Data Structures
  ▪ Arrays, Stacks, Queues
  ▪ Linked lists
  ▪ Deques, trees

II. SORTING AND SEARCHING
  o Comparative
  ▪ information theory bounds
  o Non-comparative
  o Median statistics
    ▪ min, max, selection
  o String matching
  o Hashing
    ▪ collision resolution
    ▪ addressing

III. GRAPHS
  o Definitions
    ▪ Planarity, connectivity, trees
  o Data representations
  o Spanning trees
    ▪ Kruskal, Prim, Boruvka
    ▪ Application to networks
  o Search trees
    ▪ Balanced: AVL, B, red-black
    ▪ Application to databases
  o Topological sorting
  o Traversals
  o Shortest paths
    ▪ Single-source
      ▪ Dijkstra, Bellman-Ford
    ▪ All-pairs
      ▪ Floyd-Warshall
      ▪ Johnson
  o Flow networks
    ▪ Ford-Fulkerson
    ▪ Edmonds-Karp

IV. OPTIMIZED DATA STRUCTURES
  o Disjoint-union
  o Priority queues
    ▪ Heaps
      ▪ Binomial
      ▪ Fibonacci
    ▪ lazy updating
- amortized analysis
  - Tries

V. ADVANCED TOPICS
  - Numerical methods
  - Parallel programming
  - Security
  - NP-completeness
    - approximation