Here are the topics I plan to cover, with the approximate time devoted to each. Unadorned numbers in brackets refer to sections in Kleinberg and Tardos. Letter codes indicate supplementary readings listed on the back of this page.

1. **Background.** (1 week)
   - Fibonacci numbers: a motivating example [DPV 0]
   - Review of algorithm analysis and running times [2.1, 2.2, 2.4]

2. **Divide and Conquer.** (2 weeks)
   - Sorting by merging [5.1]
   - Counting inversions [5.3]
   - Closest pairs [5.4]
   - Integer and matrix multiplication [5.5, B 7.3.4]
   - Fast Fourier transform and applications [5.6]

3. **Greedy Methods.** (2 weeks)
   - Review of graph theory [3.1–3.5]
   - Dijkstra shortest path algorithm [4.4]
   - Kruskal minimum spanning tree algorithm [4.5]
   - Interval graphs and scheduling problems [4.1, 4.2]

4. **Dynamic Programming.** (3 weeks)
   - Weighted interval scheduling [6.1]
   - Segmented least squares [6.3]
   - Subset sum and knapsack problems [6.4]
   - Vertex cover on trees [EB]
   - Longest increasing subsequence [W]
   - Edit distance and sequence alignment [6.6]
   - Bellman-Ford shortest path algorithm [6.8]

5. **Randomization.** (2 weeks)
   - Contention resolution [13.1]
   - Minimum cuts [13.2]
   - Median finding and quicksort [13.5]
   - Rabin-Karp string matching [CLRS 32.2]

6. **Flows and Duality.** (2 weeks)
   - Flows in networks [7.2.1, 7.2.2]
   - Augmentation and combinatorial duality [7.2.1, 7.2.2]
   - Efficient maximum flow algorithms [TBA]
   - Applications (as time permits): bipartite matching, project selection, baseball elimination, etc. [7.5, 7.11, 7.12]

7. **Inherent Complexity.** (3 weeks)
   - Lower bounds from information theory [DPV pp. 52-53]
   - Adversary strategies [B 3.1-3.3]
   - P vs. NP [8.1-8.4]
   - Examples of NP-complete problems [8.5-8.8]
For topics not found in Kleinberg and Tardos, please see the following.


[EB] E. Bach, Lecture notes for CS 577, 3/2/16. This is on our course web site.


[W] K. Wayne, Course slides for COS 423, Princeton Univ., Spring 2013. This is on our course web site.