CMPS 201 Final Review Information, Fall 2004

The Final will be on Wednesday December 8 from 4 to 7 pm in the lecture room. Like the midterm, the final will be closed book, but you may have one 3-by-5 (inch) card of handwritten notes. The final will be comprehensive (see also the midterm review sheet), but will (perhaps slightly) emphasize the post-midterm material. I will hold a “question and answer” review session Tuesday December 7 from 3-4:30 in Baskin Engineering 330.

Topics Covered After the Midterm

1. Optimization problems, decision problems and languages, issues of polynomial time.
2. (polynomial time) reductions between languages
3. deterministic recognizers and nondeterministic recognizers (or verifiers)
4. The classes P, NP, and co-NP, and their relationships
5. reductions
6. What it means to be NP-complete
7. Circuit-sat and why Circuit-sat is NP-complete.
8. basic NP-complete problems: 3-CNF-SAT, clique, vertex cover, subset sum.
9. Dynamic programming – recursion to memoizing to iteratively building a table
10. Dynamic programming algorithms for matrix chain multiplication and longest common subsequence.
11. Dynamic programming for Knapsack and issues of polynomial time
12. Shortest paths and Floyd-Warshall algorithm
13. (last lecture) Backtracking and Branch and Bound
14. (last lecture) Greedy Algorithms

This includes material from chapters 34, 15, 16, and 25.2 of the text.
Here are some sample problems and exercises:

1. On a telephone, the 10 digits appear in a 3-column, 4-row grid with the "0" being being the only digit in the bottom row. A *Knights-move telephone number* is a sequence of digits such that each pair of adjacent digits are a knights move apart (with respect to the grid). For example, (276) 161-8343 is a length 10 knights-move telephone number. Construct a dynamic programming algorithm that given \( n \) efficiently calculates how many length \( n \) knights-move telephone numbers there are.

2. Exercise 15.3-2 (8 elements probably suffices) on page 349.

3. Exercise 15.3-3 on page 349.

4. Exercise 15.4-5

5. Printing neatly: problem 15-2 on page 364. (You can assume that each word contains the following space, so that the number of extra spaces is

\[
M - \sum_{k=i}^{j} l_k.
\]

6. Exercise 34.1-3 and 34.1-6 on page 978-979,

7. exercise 34.2-3 and 34.2-9 and 34.2-10 on page 983,

8. exercise 34.3-6 and 34.3-7 on page 994,

9. exercise 34.4.6.

10. problem 34-2 on page 1018.

11. exercise 35.1-1 on page 1027.

12. Describe why finding a longest path in a graph does not have the optimal substructure property.