MA/CSSE 474   Day 21 Summary

1) Space for notes about Exam 2:

1. Nonterminal A is *nullable* iff A $\Rightarrow$ * ε. Algorithm for finding nullable nonterminals is similar to others we've seen.
   a) If A→ ε, then A is nullable.
   b) If A → α, where every symbol in α is nullable, then A is nullable.
2. Given G, we can easily find a grammar with no ε-rules that generates L(G) – { ε }.
3. Do this for

$$S \to aTa$$
$$T \to ABC$$
$$A \to aA \mid C$$
$$B \to Bb \mid C$$
$$C \to c \mid \varepsilon$$

4. We can eliminate symmetric recursive rules by adding new intermediate nonterminals.

$$S^* \to \varepsilon$$
$$S^* \to S$$
$$S \to SS_1$$
$$S \to S_1$$
$$S_1 \to (S)$$
$$S_1 \to ()$$

5. Another example: Arithmetic expressions:

$$E \to E + T$$
$$E \to T$$
$$T \to T * F$$
$$T \to F$$
$$F \to (E)$$

6. A normal ***form*** F for a set C of data objects is a form, i.e., a set of syntactically valid objects, with the following two properties:
   a) For every element c of C, except possibly a finite set of special cases, there exists some element f of F such that f is equivalent to c with respect to some set of tasks.
   b) F is simpler than the original form in which the elements of C are written.
      i) By "simpler" we mean that at least some tasks are easier to perform on elements of F than they would be on elements of C.

7. **Chomsky Normal Form**, in which all rules are of one of the following two forms:
   a) $X \to a$, where $a \in \Sigma$, or
   b) $X \to BC$, where B and C are elements of V - Σ.

8. Converting a grammar to CNF is straightforward; read about it in the book or slides and figure it out.

9. **Greibach Normal Form**, in which all rules are of the form $X \to a\ \beta$, where $a \in \Sigma$ and $\beta \in$ N*.
   a) You are not required to look at the algorithm for converting to GNF.