# Computer Science 320: Midterm Examination

March 14, 2002

You have 1.5 hours to answer the following six questions. This midterm is closed book/closed notes. For partial credit, show all work. Put your name on every page. Write out and sign the Honor Code pledge before turning in the test.

*"I pledge my honor that I have not violated the Honor Code during this examination."*

**Problem 1: (12%)**
Build a *Deterministic Finite Automaton* (DFA) that recognizes the following regular expression:

```
(aa)* | (aaa)*
```

**Problem 2: (11%)**

Derive a context free grammar for the regular expression in Problem 1.

**Problem 3: (11%)**

Derive a regular expression describing all possible sequences of entries (`E`) and exits (`X`) for a room that can hold no more than three people. The room begins and ends empty and can be empty many times in between. Use the alphabet: {`E, X`}.

**Problem 4: (11%)**

Prove that the following grammar is ambiguous:

$S \rightarrow$ a $S$ | $S \rightarrow$ a $S$ b $S$
$S \rightarrow$ c

**Problem 5: (11%)**

Is the following grammar in LR(0)? Prove your answer in an organized manner.

$S' \rightarrow S$ \$ | $T \rightarrow$ b
$S \rightarrow T$ | $T \rightarrow T$ c b
$S \rightarrow S$ a $T$

**Problem 6: (11%)**

Is the Problem 5 grammar in LR(1)? Prove your answer in an organized manner.

**Problem 7: (11%)**

Is the Problem 5 grammar in SLR(1)? Prove your answer in an organized manner.

**Problem 8: (11%)**

Is the Problem 5 grammar in LALR(1)? Prove your answer in an organized manner.

**Problem 9: (11%)**

Is the Problem 5 grammar in LL(1)? Prove your answer in an organized manner.