Print FAMILY name, first initial:______________________________

Examination 1

Formal Languages and Theory of Computation

23 October 2003

Instructions Read all instructions. Failure to follow instructions will result in loss of points.

1. This is a closed-book examination.
2. You are permitted one 8.5 by 11 inch sheet of notes, both sides, that you have prepared.
3. You are permitted 50 minutes to complete this examination.
4. **Do not start** the exam until the proctor has told you to start.
5. **Answer all questions.** All questions are of equal value.
6. **Leave sufficient room in the upper lefthand corner for the staple** and staple your answer sheets in the room you have left.
7. Start the answer to each question on a new page (i.e., do **not** put the answer to more than one question on the same page).
8. Use exactly one page of paper (both sides is OK) to hold the answer to each question, and please write legibly.
9. Show your work.
10. Put the question number in the top center of each answer page and label each part of the question answer.
11. Include your last name and page number in the upper right hand corner of each answer page.
12. Assemble your answers in numerical order of the questions when you submit them.
13. Print your family name and first initial in the upper right hand corner of this page, and complete the honor statement affirmation below.

Read and sign the following statement. This page **MUST** be attached to your examination answers and **MUST** be completed to obtain credit for this examination.

On my honor, I have neither given nor received unauthorized aid on this examination.

Signed:

Printed Name:

UFID:

1. (10) Give a regular expression for all binary strings equal to 2 modulo 3. Show your work.

2. Classify the following languages as (A) Regular, (B) Context-free but not Regular, or (C) not Context-free. Justify each classification with proof.

   (a) (5) $L_1 = \{x = x_1x_2x_3x_4x_5 \mid x_2 = x_4^R, \text{ and } \forall i, x_i \in \{a,b\}^*\}$

   (b) (5) $L_2 = \{0^i 1^{i^2} \mid i \geq 0\}$

   (c) (5) $L_{m,b} = \{w \in \Sigma^* | top(w) = i \text{ and } bot(w) = mi + b \ \forall i = 0,1,2,...\}$
   where $\Sigma = \{\begin{bmatrix}0\\0\end{bmatrix}, \begin{bmatrix}0\\1\end{bmatrix}, \begin{bmatrix}1\\0\end{bmatrix}, \begin{bmatrix}1\\1\end{bmatrix}\}$, and for $w = \begin{bmatrix}t_1\\b_1\end{bmatrix}\begin{bmatrix}t_2\\b_2\end{bmatrix}...\begin{bmatrix}t_n\\b_n\end{bmatrix}$, $top(w)$ returns $t_1, t_2, ..., t_n$ and $bot(w)$ returns $b_1, b_2, ..., b_n$ interpreted as binary numbers.