CS 4114
Final Exam

Given: May 9, 2000, 10:05–12:05

Name: 

Signature: 

Instructions

1. Before you start answering questions, fill in your name above. Before you turn in your exam, sign above testifying that you have neither given nor received aid on this exam. **Unsigned exams will not be accepted!**

2. The exam consists of three problems worth a total of 250 points.

3. Put your answers in the space provided on the exam sheets.

4. You may consult the textbooks, your notes, or the handouts.

5. Each solution must include an explanation of how the given solution was obtained or why it is correct. An answer, correct or incorrect, without an explanation is worth no credit.

Good luck!
[80] 1. Let $L_1$ be the language

$$L_1 = b^+a^*\{a^ib^i \mid i \geq 9\}(ab)^+.$$

Determine which of the following is true:

1. $L_1$ is regular;
2. $L_1$ is context-free, but not regular; or
3. $L_1$ is not context-free, but is r.e.

Prove your answer.

Space for your solution to Problem 1:
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Yet more space for your solution to Problem 1:
[90] 2. Let $G_2$ be the context-free grammar:

\[
S = ABA## | aaba## \\
A \rightarrow aBa | bA \\
B \rightarrow bBB | ba
\]

and let $L_2$ be the language generated by $G_2$.

1. Give a PDA that parses strings generated by $G_2$.

2. Prove that $G_2$ is not a strong LL$_1$ grammar.

3. Is $G_2$ strong LL$_2$? Justify your answer.

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Space for your solution to Problem 2:
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[80] 3. Let $M_3$ be the Turing machine with input alphabet $\Sigma_3 = \{0, 1\}$ and state diagram

1. What language $L_h$ does $M_3$ accept by halting?
2. What language $L_f$ does $M_3$ accept by final state?
3. Determine whether $L_h$ is context-free.
4. Determine whether $L_f$ is context-free.

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Space for your solution to Problem 3:
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