CS 310 Midterm 2 Review
Fall 2006

PDA

Build a PDA for the following languages or prove that you cannot

$\{ a^n b^m \mid n > m \}$
$\{ a^n b a b^n \mid n >= 1 \}$
$\{ a^i b^k c^k \mid i > k > 1 \}$

CFG

Build a CFG for the following languages or prove that you cannot

$\{ w \mid w$ contains an odd number of 1s $\}$ $\Sigma = \{ 0, 1 \}$
$\{ a^n b a b^n \mid n >= 1 \}$
$\{ w \mid$ contains exactly three # $\}$ $\Sigma = \{ 0, \# \}$

Proof

Prove that $\{ a^i b^k c^n \mid i > k > n > 1 \}$ is not regular
Prove that $\{ a^i b^k c^n \mid i > k > n > 1 \}$ is not context free
Prove that $\{ a^n b^n c^n d^n \mid n > 1 \}$ is not context free

CNF

Convert the following CFG, *G*, to CNF:

$S \rightarrow ABA \mid aB$
$A \rightarrow bA \mid aB$
$B \rightarrow C \mid b$
$C \rightarrow c$

True or false:

$A \dashrightarrow^* c$
$S \dashrightarrow^* a$

Write an English sentence to describe the language produced by:

$S \rightarrow AA$
$A \rightarrow \#\# \mid B\#$
$B \rightarrow 0B \mid B1 \mid 2$

Convert the grammar *G* to a PDA. Using the PDA, show what is on the stack for each step of the derivation of acbbbac.

Parsing

Using the above grammar *G* (before turning it into CNF), build a parse tree for the following strings:

bbaccbbac
ab
abbab

LL(1)

Calculate FIRST and FOLLOW for each variable in the above grammar *G*. Build the LL(1) parse table. Is the grammar ambiguous?

Calculate FIRST and FOLLOW for each variable in the above grammar *G* after converting it to CNF. Build the LL(1) parse table. Is the grammar ambiguous?

Turing Machines

Build completely (full state diagrams) the following Turing Machines. You may use 1, 2 or 3 tape machines.

$\{ a^i b^k c^n \mid i > k > n > 1 \}$
$\{ w\#w^R \mid w \in \{0 , 1\}^* \}$

Essays

Use at least one English sentence to explain the difference between Turing decidable and Turing recognizable. Why is this difference important?

Using a few English sentences, explain what the 1 in LL(1) means.

Using a few English sentences, explain why or why not yacc is the best thing since sliced (wheat) bread.