Exam 2 Review

Any topic we discussed in class or that is contained in chapter 0 or 1 or 2 in your book is fair game for the exam.

List the pieces of the tuple used to define a PDA.

List the pieces of the tuple used to define a CFG.

Prove that the following language is or is not context free: $\sum = \{A,B\}$

M ={ w | w contains an even number of As and an odd number of Bs}
N = { w | w contains an unequal number of As and Bs}
T = { w | the length of w is a power of 3 } (0, 3, 9, 27, 81...) $\sum = \{A\}$

Describe, using a few English sentences, the main concept that allows the 2nd pumping lemma to work (or, why is pumping two variables involved at all?) and how it's different from the 1st pumping lemma (why you only pump one variable).

Why is the following string, s, useless in applying the pumping lemma for the following language $L= \{c^n a^n b^n | \ n >=0\}$ s = ccaabb

Show that the following language is or is not context free. $\sum = \{A,B\}$

L = {w | w contains more As than Bs}
M = {w | w contains an unequal number of As and Bs, and twice as many Cs as Ds}
Q = L ∩ M [First, describe in English the language Q]

Build a PDA that recognizes the language $L = \{a^{2n} b^n | \ n>=0\}$

Build a CFG that recognizes the above language. Using your grammar, build the parse tree for **aaaabb**

Build a PDF and CFG that recognizes the following language or show that you cannot.
$L = \{a^{2n} b^n | \ n>=0 \text{ AND } n \%2 =1\}$

Build a PDA and CFG for the following language or show that you cannot.

$L = \{a^{2n} b^n a^q b^{2q} | \ n > 0, q>0\}$

Imagine that instead of a stack you used a queue in your PDA (a queue pushes on one end and pops from the other end; First In, First Out). Does this change the set of languages you can accept with a PDA?
1) Give an example of a language that you could accept with either a stack or a queue in your PDA
2) Give an example of a language that you could only accept with a stack in your PDA
3) Give an example of a language that you could only accept with a queue in your PDA.
4) Could a PDA with a queue accept all regular languages?

Change the following grammar into CNF. First, list all of the nullable variables.
S → ABC | ε
A → CB | ba | a | ε
B → aB | bB | b
C → cCC | cc

If A and B are languages, define A Ѫ B = { xy | x ∈A and y ∈B and |x| = 2* |y| }. Show that if A and B are regular languages, then A Ѫ B is a CFL.

Build a grammar for the following language or show that the language is not a CFL:
L = { w | w is not a palindrome} ∑ = {a,b}

Show that the following language **is or is not** a **CFL**.
L = { w | zwy^Rykw^R ; z ∈ {0, 1}*,k ∈ {0, 1}*, y ∈ {0, 1}* , w ∈ {0, 1}*}

The following restriction is part of the CFL pumping lemma:
|vxy| <= p

v and **y** are the pump-able parts of the string.

The equivalent restriction in the regular language pumping lemma is |xy| <= p, with x being the prefix of the string.

1) Why does the regular language pumping lemma include the prefix of the string in the restriction **|xy| <= p**?

2) Why does the CFL pumping lemma **not** include the prefix (*u*)of the string in the restriction **|vxy| <= p**?

L = { w | w is $a^{2n}b^{n}$; n >= 1}

Build a grammar for L and prove that your grammar represents the language L correctly. For this proof to go smoothly, you really need to make sure your grammar is as minimal as possible.

Pick any grammar you wrote and turn that grammar into a PDA.

From your book: 2.24, 2.30 2.31, 2.32, 2.33, 2.36, 2.39, 2.41, 2.45
The starred problems are especially hard and likely more difficult than your exam questions.