# Ars Digita University
# Theory of Computation
# Recitation 9, 05/15/01

## Topics

- How many languages are there?
- Nondeterministic Pushdown Automata.
- Deterministic Pushdown Automata.
- Converting Context Free Grammars to Pushdown Automata.

## Problems to work on

### Languages

1. Could I ever write a computer program that enumerated (listed) all the possible languages? What about one that enumerated all the regular languages? What about one that enumerated all the context-free languages?

### Pushdown Automata Warmup

2. What is the difference between a Nondeterministic Pushdown Automaton and a Deterministic Pushdown Automaton. Do you think they generate the same languages?
3. (Warm up) Construct a PDA that accepts the language {0,1}*.
4. (Warm up from last time:) Construct a PDA that accepts the language $\{0^n1^n \mid n >= 0\}$. Is your answer deterministic or not?
5. Construct a PDA that accepts the language $\{0^n1^n \mid n >= 2\}$.

### More Pushdown Automata

6. Construct a PDA that accepts the language $\{0^m1^n \mid n > m >= 0\}$
7. (From last time:) Construct a PDA that accepts the language $\{0^n1^m0^m1^n \mid n,m >= 0\}$.
8. Construct a PDA that accepts the language { w | w is not a palindrome}

### And/Or

9. Construct a PDA that accepts the language { w | w is not a palindrome and w ends with a zero}
10. Give a PDA that accepts the language $\{a^i b^j \mid i <= j <= 2i\}$

## Deterministic vs Nondeterministic PDA's

11. Construct a NPDA that accepts the language of strings with the same number of zeros and ones.
12. Construct a DPDA that accepts the language of strings with the same number of zeros and ones.

## Converting Grammars to PDA's

13. Convert the following Grammar to a PDA.

```
S --> AB
A -->  0
B -->  1
```

14. Convert the following Grammar to a PDA.

```
A --> BAB | B | epsilon
B --> 00 | espilon
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