

## DM517 – Fall 2014 – Weekly Note 5

### Lecture in week 39, 2014:

We covered the proof on pages 117-124 that the set of context-free languages is exactly the set of languages recognized by pushdown automata. In other words: a language is context-free if and only if it is the language accepted by some PDA. We also discussed a bit more on how to use the pumping lemma for CFL. Key points:

- PDAs are equivalent to context-free grammars, since, for any PDA  $A$ , one can construct a grammar  $G$  such that  $L(A) = L(G)$ , and vice versa.
- The class of context-free languages is closed under union, concatenation, and star, but **not** under intersection and complement. Note that this is NOT the same as saying that the complement of a context-free language is never context free. For example both  $\Sigma^*$  and its complement, the empty set are context-free (they are also regular). Also  $L = \{a^n b^n | n \geq 0\}$  and its complement are context-free (but not regular).
- Every regular language is context free.
- The intersection of a context free language  $L$  with a regular language  $R$  is again a context-free language.

### Lecture September 29, 2014:

- Section 3.1 on Turing Machines.
- Section 3.2 on variants of Turing Machines.

### Exercises October 1, 2014:

- Problem 3 (b)-(d), January 2004.
- Problem 2 October 2011
- 2.43 and 2.56
- Problem 2 January 2008.
- Problem 3, January 2005.
- Problem 4, January 2007.
- Problem 3, January 2009 except (e) (the definition of Chomsky normalform was different in the old book).