Theory of Computation, CSCI 438 spring 2022
Exam 2 review, March 11

New material is in yellow.

Regular Languages

- Know the definition of a DFA.
- Be able to convert:

Conversion	Using What
Picture ⇒ M= (…), i.e. the formal definition	Definition
Picture ⇐ M= (…)	

- Be able to convert:

Language description ⇒ DFA	Problem solving
Language description ⇐ DFA	

- Know the signature of δ* for a DFA and be able to use it to define what it means for a DFA to accept a string, and therefore for the DFA to recognize a language
- Know the definition of a regular language
- Be able to prove that regular languages are closed under complementation, union and intersection

Nondeterminism

- Know the definition of an NFA
- Be able to convert:

DFA ⇒ NFA	Theorem: A language is regular iff some NFA recognizes it
DFA ⇐ NFA	

- Be able to prove that a language is regular iff some NFA recognizes it.
- Be able to prove closure of regular languages under concatenation and star-closure

Regular Expressions

- Know the definition of regular expressions
- Know situations where regular expressions are used
- Be able to convert:

Language description ⇒ Reg-ex	Problem solving
Language description ⇐ Reg-ex	

- Be able to convert:

NFA ⇒ Reg-ex	Problem solving. Once you have a solution you could prove that your solution works via induction on the length of the string, but I won't ask you to do this.
NFA ⇐ Reg-ex	

- Know the pumping lemma for regular languages and be able to prove that a language is not regular using the pumping lemma for regular languages

Context-Free Languages

- Know the definition of a context-free grammar
- Know situations where context-free grammars are used
- Know what it means for a variable to be able to "**derive**" a string
- Know the definition of a context free language
- Know what it means for a grammar to be "**ambiguous**" and what it means for a language to be "**inherently ambiguous**"
- Be able to prove that context-free languages are closed under union, concatenation and star-closure
- Be able to convert:

Language description ⇒ CFG	Problem solving
Language description ⇐ CFG	

- Know the definition of a PDA.
- Be able to convert:

Language description ⇒ PDA	Problem solving
Language description ⇐ PDA	

- Know the format of a grammar which is in Chomsky Normal Form.
- Be able to convert:

CFG ⇒ CFG in Chomsky normal form	Theorem 2.29: Any context-free language is generated by a context-

	free grammar in Chomsky normal form.

- Be able to convert:

PDA ⇐ CFG	Theorem 2.20: A language is context-free iff some PDA recognizes it. For both directions you only need to be able to do the conversion

- Know the pumping lemma for context-free languages and be able to prove that a language is not context-free using the pumping lemma for context-free languages