## Week10 friday

Model of Computation	Class of Languages
Deterministic finite automata: formal definition, how to design for a given language, how to describe language of a machine? Nondeterministic finite automata: formal definition, how to design for a given language, how to describe language of a machine? Regular expressions: formal definition, how to design for a given language, how to describe language of expression? Also: converting between different models.	Class of regular languages: what are the closure properties of this class? which languages are not in the class? using pumping lemma to prove nonregularity.
Push-down automata: formal definition, how to design for a given language, how to describe language of a machine? Context-free grammars: formal definition, how to design for a given language, how to describe language of a grammar?	Class of context-free languages: what are the closure properties of this class? which languages are not in the class?
Turing machines that always halt in polynomial time  Nondeterministic Turing machines that always halt in polynomial time	P NP
<b>Deciders</b> (Turing machines that always halt): formal definition, how to design for a given language, how to describe language of a machine?	Class of decidable languages: what are the closure properties of this class? which languages are not in the class? using diagonalization and mapping reduction to show undecidability
<b>Turing machines</b> formal definition, how to design for a given language, how to describe language of a machine?	Class of recognizable languages: what are the closure properties of this class? which languages are not in the class? using closure and mapping reduction to show unrecognizability

Given	a	language,	prove	it	is	regui	ar
Given	а	language,	prove	ւլ	$\mathbf{IS}$	regu	aı

Strategy 1: construct DFA recognizing the language and prove it works.

Strategy 2: construct NFA recognizing the language and prove it works.

Strategy 3: construct regular expression recognizing the language and prove it works.

"Prove it works" means . . .

**Example**:  $L = \{w \in \{0,1\}^* \mid w \text{ has odd number of 1s or starts with } 0\}$ 

Using NFA

Using regular expressions

**Example**: Select all and only the options that result in a true statement: "To show a language A is not regular, we can..."

- a. Show A is finite
- b. Show there is a CFG generating A
- c. Show A has no pumping length
- d. Show A is undecidable

**Example**: What is the language generated by the CFG with rules

$$S \rightarrow aSb \mid bY \mid Ya$$
 
$$Y \rightarrow bY \mid Ya \mid \varepsilon$$



Example: Prove that the class of decidable languages is closed under concatenation.								