## Week3 friday

**Theorem**: For an alphabet  $\Sigma$ , For each language L over  $\Sigma$ ,

L is recognized by some DFA iff L is recognized by some NFA iff L is described by some regular expression

If (any, hence all) these conditions apply, L is called **regular**.

**Prove or Disprove**: There is some alphabet  $\Sigma$  for which there is some language recognized by an NFA but not by any DFA.

**Prove or Disprove**: There is some alphabet  $\Sigma$  for which there is some finite language not described by any regular expression over  $\Sigma$ .

**Prove or Disprove**: If a language is recognized by an NFA then the complement of this language is not recognized by any DFA.

Set	Cardinality
$\{0,1\}$	
$\{0,1\}^*$	
$\mathcal{P}(\{0,1\})$	
The set of all languages over $\{0,1\}$	
The set of all regular expressions over $\{0,1\}$	
The set of all regular languages over $\{0,1\}$	

**Pumping Lemma** (Sipser Theorem 1.70): If A is a regular language, then there is a number p (a pumping length) where, if s is any string in A of length at least p, then s may be divided into three pieces, s = xyz such that

- |y| > 0
- for each  $i \ge 0$ ,  $xy^iz \in A$
- $|xy| \leq p$ .

True or False: A pumping length for  $A = \{0, 1\}^*$  is p = 5.

**True or False**: A pumping length for  $A = \{1, 01, 001, 0001, 00001\}$  is p = 4.

True or False: A pumping length for  $A = \{0^j 1 \mid j \ge 0\}$  is p = 3.

**True or False**: For any language A, if p is a pumping length for A and p' > p, then p' is also a pumping length for A.