Day1

The CSE 105 vocabulary and notation build on discrete math and introduction to proofs classes. Some of the conventions may be a bit different from what you saw before so we'll draw your attention to them.

For consistency, we will use the notation from this class' textbook¹.

These definitions are on pages 3, 4, 6, 13, 14, 53.

¹Page references are to the 3rd edition of Sipser's Introduction to the Theory of Computation, available through various sources for approximately \$30. You may be able to opt in to purchase a digital copy through Canvas. Copies of the book are also available for those who can't access the book to borrow from the course instructor, while supplies last (minnes@ucsd.edu)

Term	Typical symbol or Notation	Meaning
A1 1 1 4	D D	A
Alphabet	Σ, Γ	A non-empty finite set
Symbol over Σ	σ, b, x	An element of the alphabet Σ
String over Σ	u, v, w	A finite list of symbols from Σ
(The) empty string	arepsilon	The (only) string of length 0
The set of all strings over Σ	Σ^*	The collection of all possible strings formed from symbols from Σ
(Some) language over Σ	L	(Some) set of strings over Σ
(The) empty language	Ø	The empty set, i.e. the set that has no strings (and no other elements either)
The power set of a set X	$\mathcal{P}(X)$	The set of all subsets of X
(The set of) natural numbers	\mathcal{N}	The set of positive integers
(Some) finite set		The empty set or a set whose distinct elements can be counted by a natural number
(Some) infinite set		A set that is not finite.
Reverse of a string w	$w^{\mathcal{R}}$	write w in the opposite order, if $w = w_1 \cdots w_n$ then $w^{\mathcal{R}} = w_n \cdots w_1$. Note: $\varepsilon^{\mathcal{R}} = \varepsilon$
Concatenating strings x and y	xy	take $x = x_1 \cdots x_m$, $y = y_1 \cdots y_n$ and form $xy =$
String z is a substring of string w		$x_1 \cdots x_m y_1 \cdots y_n$ there are strings u, v such that $w = uzv$
String x is a prefix of string y		there is a string z such that $y = xz$
String x is a proper prefix of string y		x is a prefix of y and $x \neq y$
Shortlex order, also known as string order over alphabet Σ		Order strings over Σ first by length and then according to the dictionary order, assuming symbols in Σ have an ordering

Write out in words the meaning of the symbols below:

$$\{a, b, c\}$$

$$|\{a, b, a\}| = 2$$

$$|aba| = 3$$

Circle the correct choice:

A **string** over an alphabet Σ is an element of Σ^* OR a subset of Σ^* .

A language over an alphabet Σ is <u>an element of Σ^* OR a subset of Σ^* .</u>

With $\Sigma_1 = \{0,1\}$ and $\Sigma_2 = \{a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x,y,z\}$ and $\Gamma = \{0,1,x,y,z\}$

True or False: $\varepsilon \in \Sigma_1$

True or False: ε is a string over Σ_1

True or False: ε is a language over Σ_1

True or False: ε is a prefix of some string over Σ_1

True or **False**: There is a string over Σ_1 that is a proper prefix of ε

The first five strings over Σ_1 in string order, using the ordering 0 < 1:

The first five strings over Σ_2 in string order, using the usual alphabetical ordering for single letters: