length of a string

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Defines	equality of strings
Defines	empty string

Suppose we have a string w on alphabet Σ. We can then represent the string as $w = x_1x_2x_3 \cdots x_{n-1}x_n$, where for all x_i ($1 \leq i \leq n$), $x_i \in \Sigma$ (this means that each x_i must be a "letter" from the alphabet). Then, the length of w is n. The *length of a string* w is represented as $\|w\|$.

For example, if our alphabet is $\Sigma = \{a, b, ca\}$ then the length of the string $w = bcaab$ is $\|w\| = 4$, since the string breaks down as follows: $x_1 = b$, $x_2 = ca$, $x_3 = a$, $x_4 = b$. So, our x_n is x_4 and therefore $n = 4$. Although you may think that *ca* is two separate symbols, our chosen alphabet in fact classifies it as a single symbol.

A "special case" occurs when $\|w\| = 0$, i.e. it does not have any symbols in it. This string is called the *empty string*. Instead of saying $w =$, we use λ to represent the empty string: $w = \lambda$. This is similar to the practice of using β to represent a space, even though a space is really blank.

If your alphabet contains λ as a symbol, then you must use something else to denote the empty string.

Suppose you also have a string v on the same alphabet as w. We turn w into $x_1 \cdots x_n$ just as before, and similarly $v = y_1 \cdots y_m$. We say v is *equal* to w if and only if both $m = n$, and for every i, $x_i = y_i$.

For example, suppose $w = bba$ and $v = bab$, both strings on alphabet $\Sigma = \{a, b\}$. These strings are not equal because the second symbols do not match.