Nonregular Languages, Part Two
Supplement for Preparatory Viewing

Closure Properties

If $L_1, L_2 \subseteq \Sigma^\star$ for some alphabet Σ, and L_1 and L_2 are both regular languages, then the following languages are regular languages as well.

(a) $L_1 \cup L_2$

(b) $L_1 \circ L_2$

(c) $L_1^\star$

(d) L_1^C

Closure Properties (Flipped Around)

Since $P \implies Q$ implies that $\neg Q \implies \neg P$, the above closure properties imply the following.

(a) For all languages $L_1, L_2 \subseteq \Sigma^\star$, for any alphabet Σ, if $L_1 \cup L_2$ is ***not*** a regular language then *at least one* of L_1 or L_2 is ***not*** a regular language either.

(b) For all languages $L_1, L_2 \subseteq \Sigma^\star$, for any alphabet Σ, if $L_1 \circ L_2$ is ***not*** a regular language, then *at least one* of L_1 or L_2 is ***not*** a regular language either.

(c) For every language $L \subseteq \Sigma^\star$ over any alphabet Σ, if $L^\star$ is ***not*** a regular language then L is ***not*** a regular language either.

(d) For every language $L \subseteq \Sigma^\star$ over any alphabet Σ, if L^C is ***not*** a regular language then L is ***not*** a regular language either.