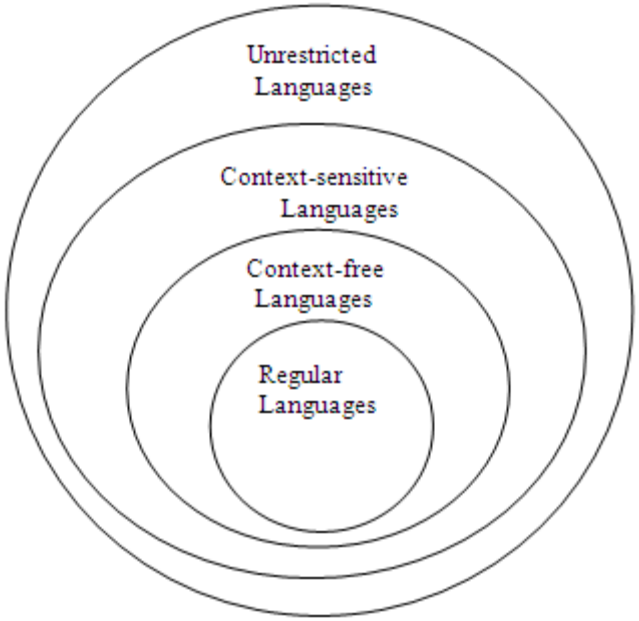
Chapter 5

Chomsky's Hierarchy

Chomsky's hierarchy



Context-sensitive produtions

S -> bSc

bS -> beA (replaces S with eA)

Ac -> Aec (replaces A with Ae)

Ae -> Aee (replaces A with Ae)

eAe -> ede (replaces A with d)

Also allowed productions like

BC -> CB

Context-sensitive grammar

Any essentially non-contracting grammar. Context-sensitive productions are allowed as long as they are non-contracting

Theorem

All context-free languages are context sensitive.

Proof:
Eliminate lambda productions.
Reinsert lambda if in original language.
Result is an equivalent CSG.

Example

Convert to CSG:

S -> bS

S -> λ

Eliminate lambda production

S -> bS

S -> b

Reinsert null string. Get CSG:

S' -> S

S' -> λ

S -> bS

S -> b

Unrestricted grammars

No restriction on productions except left side must be non-null.

Can define a language with an unrestricted grammar if and only if it can be defined by a Turing machine.