† The context sensitive languages are the non-deterministic linear bound automaton languages—$\{\epsilon\}$. It is not known whether the deterministic linear bounded automaton languages are equal to the non-deterministic lba languages or are a proper subset.

Figure E.I-1: Inclusion relations of the classes of formal languages

	Operation					
Class of languages	∪	∩	comple-mentation	•	*	∩ with a regular language
Regular	yes	yes	yes	yes	yes	yes
Det. pda	no	no	yes	no	no	yes
Context free	yes	no	no	yes	yes	yes
Context sensitive	yes	yes	?	yes	no†	yes
Recursive	yes	yes	yes	yes	yes	yes
Recursively enumerable	yes	yes	no	yes	yes	yes

† The context sensitive languages do not contain ϵ and therefore are never equal to Σ^*

Table E.I-1: Summary of closure properties of classes of formal languages

	Question					
Class of languages	$x \in L(G)$?	$L(G) = \emptyset$?	$L(G) = \Sigma^*$?	$L(G_1) \subseteq L(G_2) = \emptyset$?	$L(G_1) = L(G_2)$?	$L(G_1) \cap L(G_2)$?
Regular	yes	yes	yes	yes	yes	yes
Det. pda	yes	yes	yes	no	?	no
Context free	yes	yes	no	no	no	no
Context sensitive	yes	no	yes‡	no	no	no
Recursive	yes	no	no	no	no	no
Recursively enumerable	no	no	no	no	no	no

‡ This case is trivially decidable (the answer is always no) because the context sensitive languages do not contain ϵ.

Table E.I-2: Summary of decidability properties of classes of formal languages