Linear Bounded Automata
LBAs

Linear Bounded Automata (LBAs)

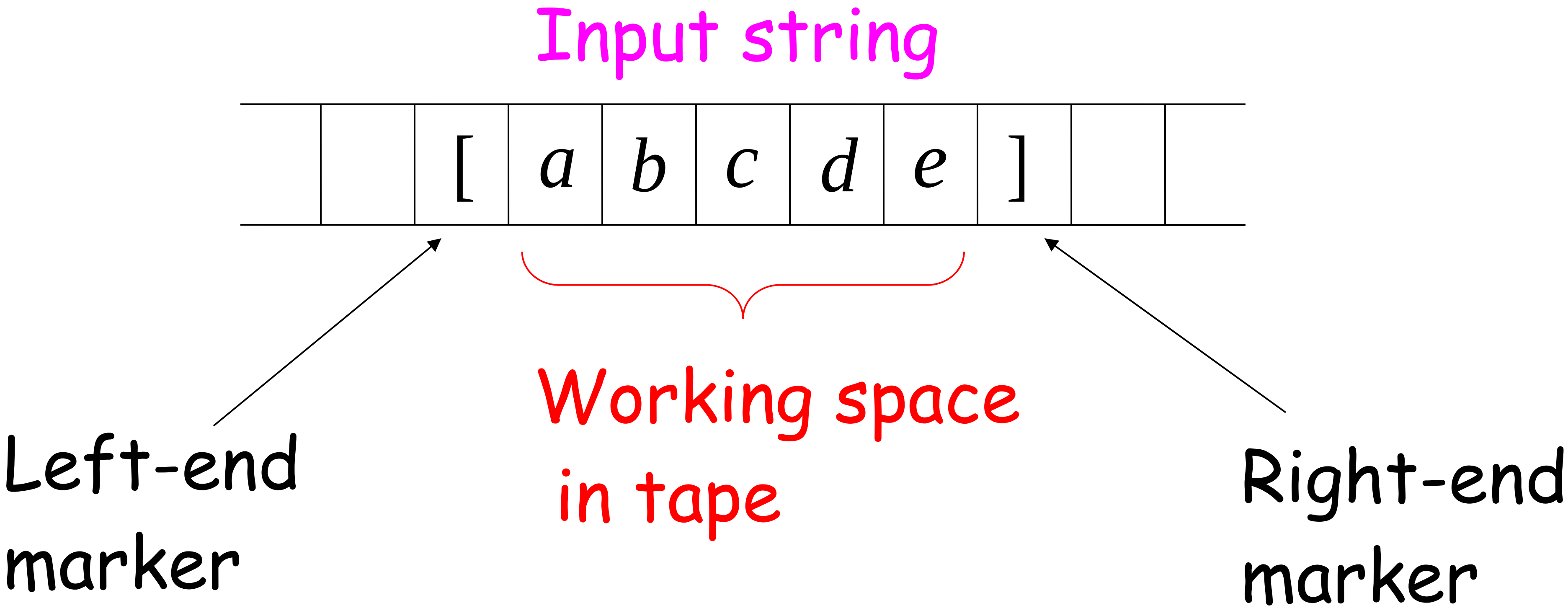
are the same as Turing Machines

with one difference:

The input string tape space

is the only tape space allowed to use

Linear Bounded Automaton (LBA)



All computation is done between end markers

We define LBA's as NonDeterministic

Open Problem:

NonDeterministic LBA's
have same power with
Deterministic LBA's ?

Example languages accepted by LBAs:

$$L = \{a^n b^n c^n\}$$

$$L = \{a^{n!}\}$$

LBA's have more power than NPDA's

LBA's have also less power
than Turing Machines

The Chomsky Hierarchy

Unrestricted Grammars:

Productions

$$u \rightarrow v$$

String of variables and terminals

String of variables and terminals

Example unrestricted grammar:

$$S \to aBc$$

$$aB \to cA$$

$$Ac \to d$$

Theorem:

A language L is recursively enumerable if and only if L is generated by an unrestricted grammar

Context-Sensitive Grammars:

Productions

$$u \rightarrow v$$

String of variables and terminals

String of variables and terminals

and: $|u| \leq |v|$

The language $\{a^n b^n c^n\}$

is context-sensitive:

$$S \to abc \mid aAbc$$

$$Ab \to bA$$

$$Ac \to Bbcc$$

$$bB \to Bb$$

$$aB \to aa \mid aaA$$

Theorem:

A language L is context sensistive
if and only if
L is accepted by a Linear-Bounded automaton

Observation:

There is a language which is context-sensitive but not recursive

The Chomsky Hierarchy