

A TM for the Dyck language

$[[\downarrow [\downarrow [[\downarrow]]]) [\downarrow [[\downarrow]]]$

Mark the first $]$, move L & mark the first (unmarked) $[$.

mark them all as X

eg:

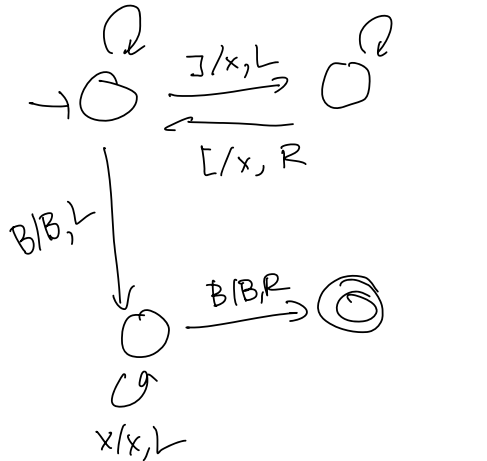
[[] [[]]]

$$[[x[[[]]]]]$$
$$[\times \times [[3]]]$$
$$[x \times [x]]$$
$$[x \times [x \times x]]$$

Move R past any [,
mark].

Move L past any X,
mark a $\perp$.

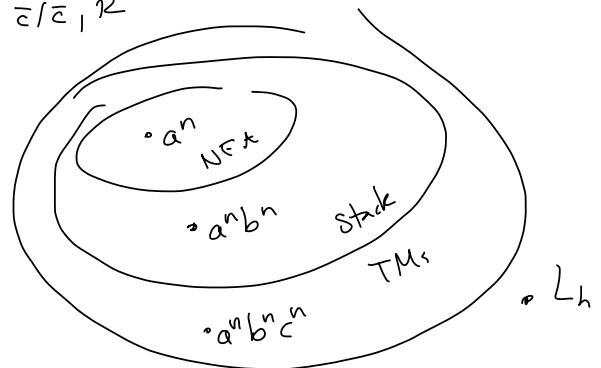
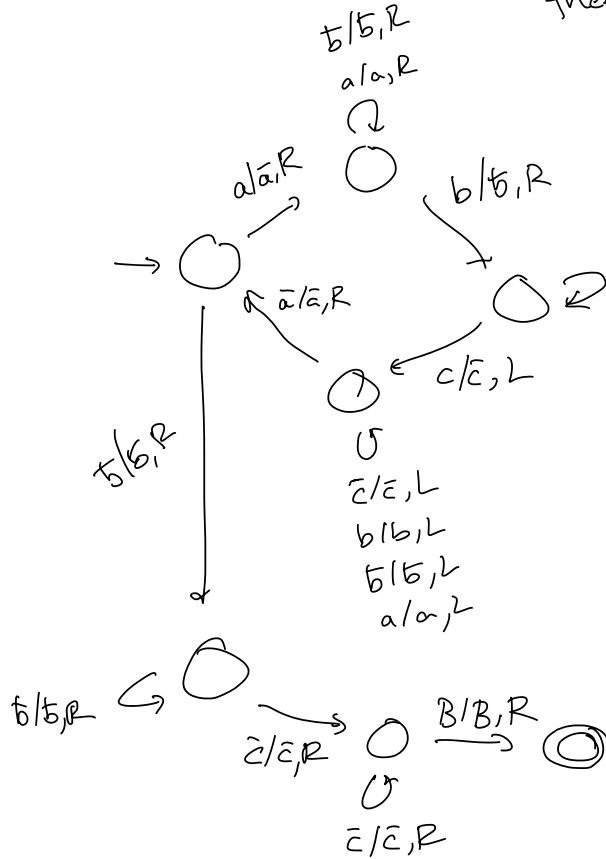
etc.

$$\begin{array}{l} \times / \times, \mathbb{R} \\ \square / \square, \mathbb{R} \end{array}$$
$$x/x, L$$


$a^n b^n c^n$

$\bar{a}\bar{a}\bar{a}b\bar{b}\bar{b}\bar{c}\bar{c}\bar{c}$

mark $a \rightarrow \bar{a}$,
 then move R & mark b,
 then move R & mark c,
 then move L & repeat.



Easy to adapt to
 get $a^n b^n c^n d^n$

check for
 $\bar{a}\bar{a}\bar{a}b\bar{b}\bar{b}\bar{c}\bar{c}\bar{c}$

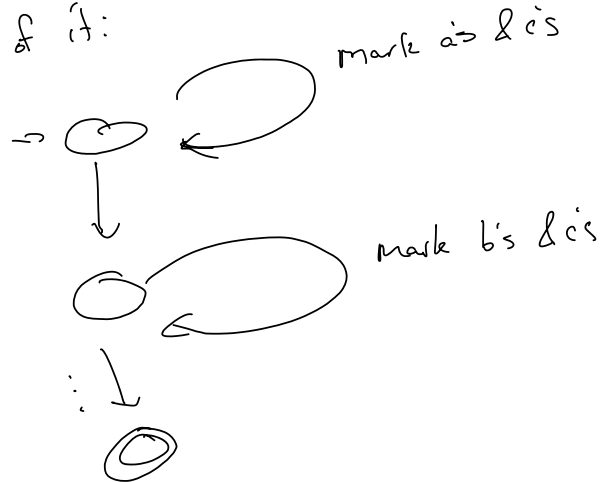
vs $b\bar{b}\bar{c}b\bar{c}\bar{c}$

$$a^n b^m c^{n+m}$$

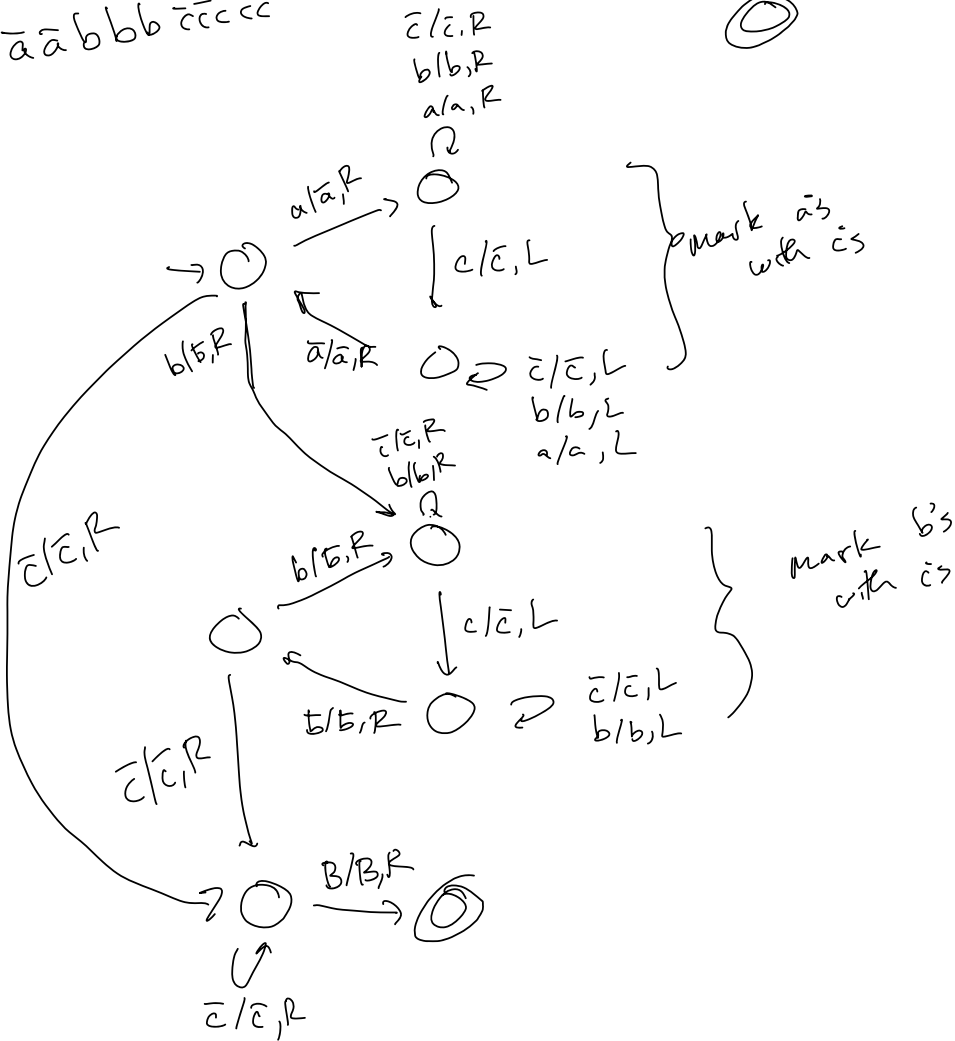
Mark a's & matching c's
Then mark b's & matching c's

$aabccc$
 $\bar{a}abccc$
 $\bar{a}ab\bar{c}cc$
 $\bar{a}\bar{a}b\bar{c}\bar{c}c$
 $\bar{a}\bar{a}\bar{b}\bar{c}\bar{c}\bar{c}$

Shape of it:



$\bar{a}\bar{a}b\bar{b}\bar{b}\bar{c}\bar{c}\bar{c}$



$$\{ \# \text{ of } a\text{'s} = \# \text{ of } b\text{'s} \}$$

abaabb
bbaa

Mark 1st letter, then
find a matching "other" letter,
repeat.

different behaviors if we saw a first
vs b first.

