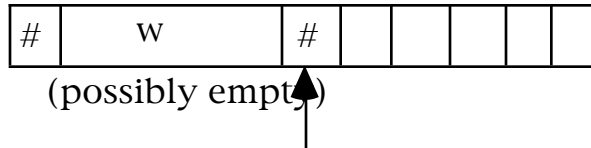


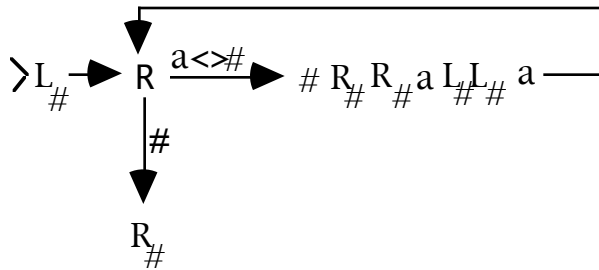
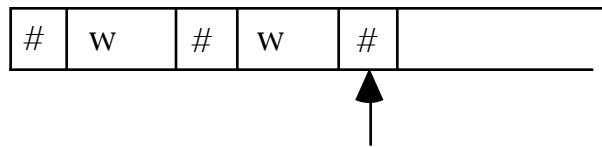
## Lecture 25 addendum

### Copying machine C

Transforms:



Into



### Left- and Right-Shifting TMs

$S_L$  transforms  $\#w\#$  into  $w\#$  (assumes  $w$  contains no blanks)

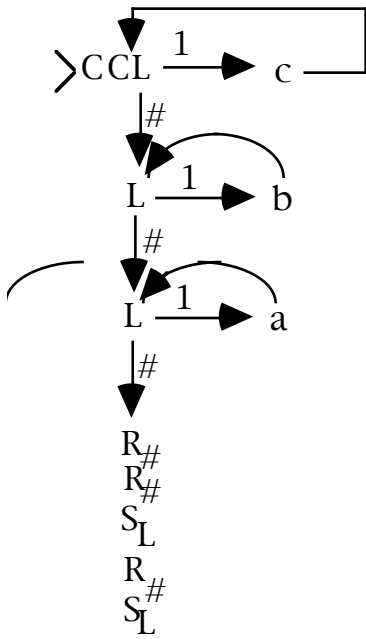
$S_R$  transforms  $\#w\#$  into  $\#\#w\#$

Note the starting position of the r/w head for each of the three machines just mentioned!!!

Example. Design a TM that computes

$$f(n) = a^n b^n c^n, n \geq 1 \quad (\text{where } n \text{ is rep in unary})$$

sample initial config might be  $\#111\#$



[Note: the TM given is almost right – but not quite. What’s wrong with it?]

Another example. How might you construct a multiplication machine?