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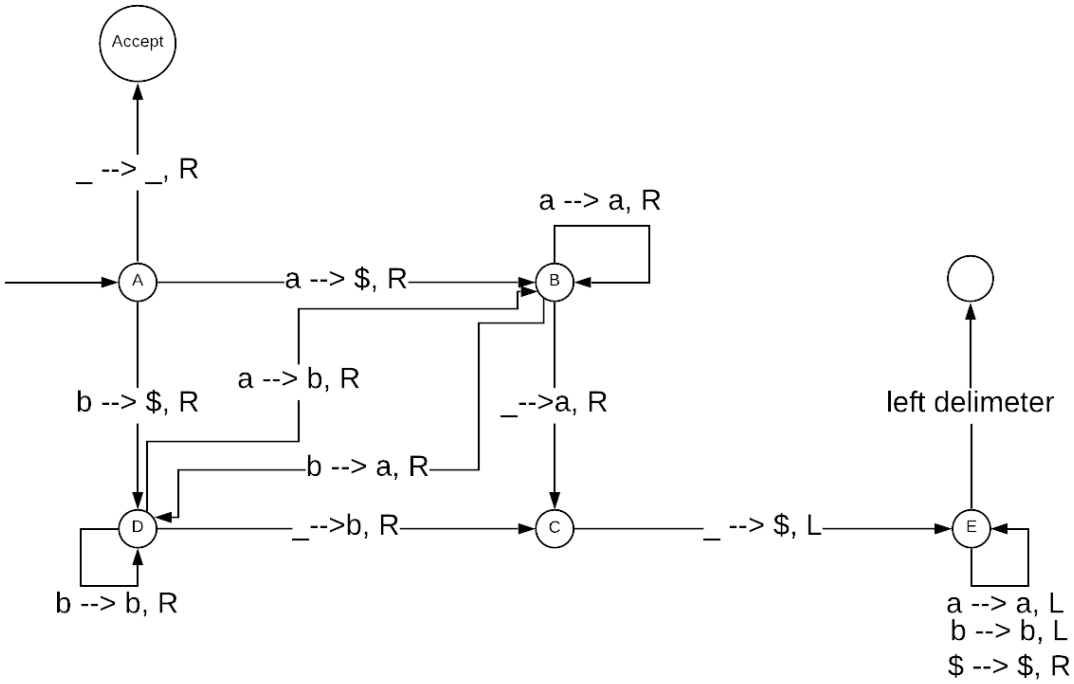
Homework 12

1. *Describe a Turing machine accepting the language* $\{ww: w \in \{a,b\}^*\}$. *The machine cannot loop.*
Simulate its work for the word abbabb
It's hard to explain the whole mechanism with words so I'lluse the diagram (state machine)
Algorithm:
Dividing the tape into 2 parts (finding middle of string).
At the initial state, we shift all the symbol one place to the right, putting the symbol $ at the beginning of string.
We move the head to the right until first blank. Write the symbol $ in this place.
Then we shift all the symbol one place to the right, putting the symbol $ at the beginning of string
We then have the new string with $ at the beginning and ending.
We move the head to the lft until reach the left delimeter and enter stage 2.



Simulate its work for the word abbabb

a	b	b	a	b	b	_	_

We then read first letter a and write $ there and move to right

$	b	b	a	b	b	_	_

We then read letter b and write a there and move to right

$	a	b	a	b	b	_	_

We then read letter b and write b there and move to right

$	a	b	a	b	b	_	_

We then read letter a and write b there and move to right

$	a	b	b	b	b	_	_

We then read letter b and write a there and move to right

$	a	b	b	a	b	_	_

We then read letter b and write b there and move to right

$	a	b	b	a	b	_	_

We then read letter _ and write b there and move to right

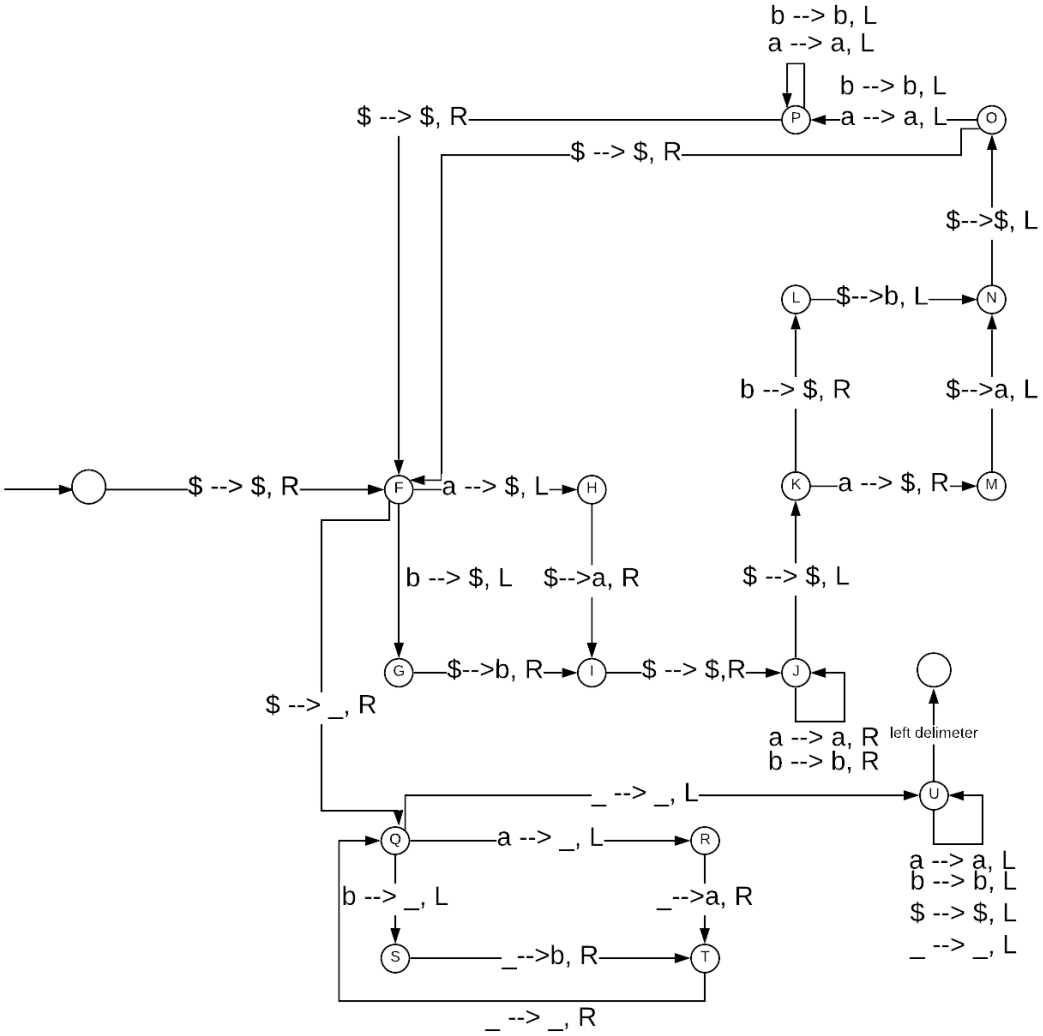
$	a	b	b	a	b	b	_

We then read letter _ and write$ there and move to left

$	a	b	b	a	b	b	$

We then read and move head to the left until we see left delimeter and move to the right

In stage 2:
We then keep interchanging the left $ with the symbol to the right of it and right $ with the symbol on the left of it, until there is no more symbols between them.
We delete second of two $ and then move all symbol of the right side on step to left.
We will leave with string that have $ in the middle.
We move back to the left until we reach left delimeter. We move to stage 3.



We read first symbol $ and move to the right

$	a	b	b	a	b	b	$

We read symbol a and write $ and move to the left

$	$	b	b	a	b	b	$

We read symbol $ and write a and move to the right

a	$	b	b	a	b	b	$

We read $ and move to the right, the same with b, b, a, b, b,
We read symbol $ and move to the left
We read symbol b, write $ there and move to the right

a	$	b	b	a	b	$	$

We read symbol $, write b there and move to the left

a	$	b	b	a	b	$	b

We read $ and move to the left, the same with b, a, b, b
We read symbol $ and move to the right
We read symbol b, write $ there and move to the left

a	$	$	b	a	b	$	b

We read symbol $, write b there and move to the right

a	b	$	b	a	b	$	b

We read $ and move to the right, the same with b, a, b
We read symbol $ and move to the left
We read symbol b, write $ there and move to the right

a	$	b	b	a	$	$	b

We read symbol $, write b there and move to the leftt

a	b	$	b	a	$	b	b

We read $ and move to the left, the same with a, b
We read symbol $ and move to the right
We read symbol b, write $ there and move to the left

a	b	$	$	a	$	b	b

We read symbol $, write b there and move to the right

a	b	b	$	a	$	b	b

We read $ and move to the right, the same with a
We read symbol $ and move to the left
We read symbol a, write $ there and move to the right

a	b	b	$	$	$	b	b

We read symbol $, write a there and move to the left

a	b	b	$	$	a	b	b

We read $ and move to the left, we read $ and move to the right. We read $ and write thereand move to right

a	b	b	$	_	a	b	b

We read symbol a, write _ there and move to the left

a	b	b	$	_	_	b	b

We read symbol _, write a there and move to the right

a	b	b	$	a	_	b	b

We read symbol _ and move to the right
We read symbol b, write _ there and move to the left

a	b	b	$	a	_	_	b

We read symbol _, write b there and move to the right

a	b	b	$	a	b	_	b

We read symbol _ and move to the right
We read symbol b, write _ there and move to the left

a	b	b	$	a	b	_	_

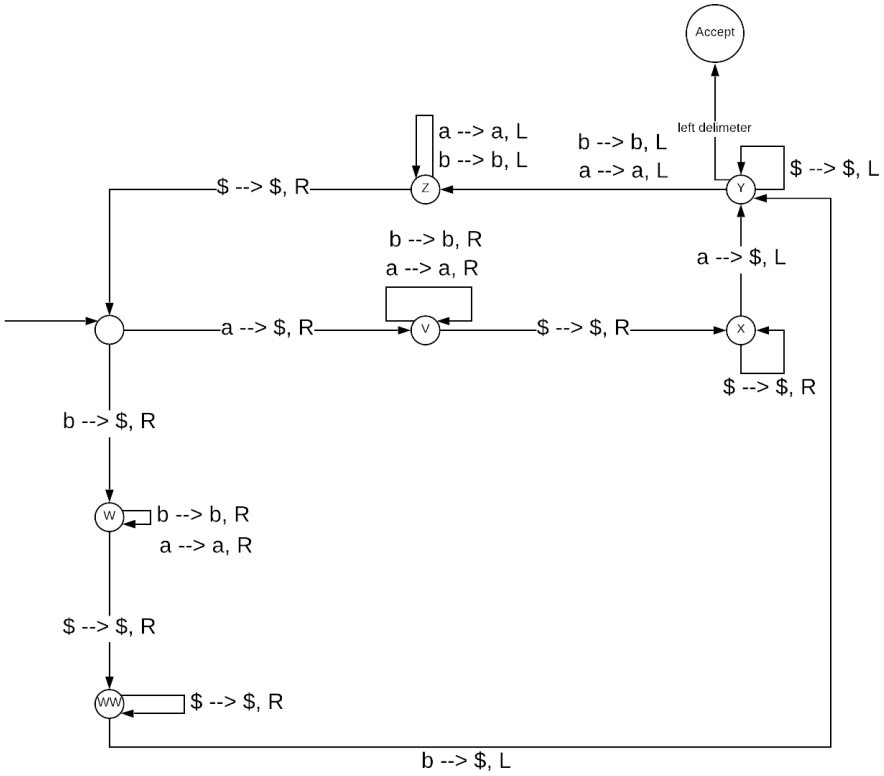
We read symbol _, write b there and move to the right

a	b	b	$	a	b	b	_

We read symbol and move to the right.
We read symbol _ and move to the left, we move the same way untill we reach left delimator.

In stage 3:

We check if the letter reading from left delimeter is matching the one reading from first $ in the middle.
We then replace those letter with symbol $
Until there is no more letter between two block of $, then we can end and accept the word..
As this is deterministic machine, if the is missing state then it'sautomatically go to reject state.



We read symbol a, write $ there and move to the right.

$	b	b	$	a	b	b	_

We read other symbol b, b and don't change them until we reach $. read and move to right
We check if symbol is a, write $ there and move to the left.

$	b	b	$	$	b	b	_

We read $ and move to left, the same with b, b until we reach $, we read it and move to right.
We read symbol b, write $ there and move to the right.

$	$	b	$	$	b	b	_

We read b and move to right, the same with next $, $
We check if symbol is b, write $ there and move to the left.

$	$	b	$	$	$	b	_

We read $ and move to left, the same with $, b until we reach $, we read it and move to right.
We read symbol b, write $ there and move to the right.

$	$	$	$	$	$	b	_

We read $ and move to right, the same with next $, $
We check if symbol is b, write $ there and move to the left.

$	$	$	$	$	$	$	_

We read $ and move to left, until we reach left delimeter and to accept state.