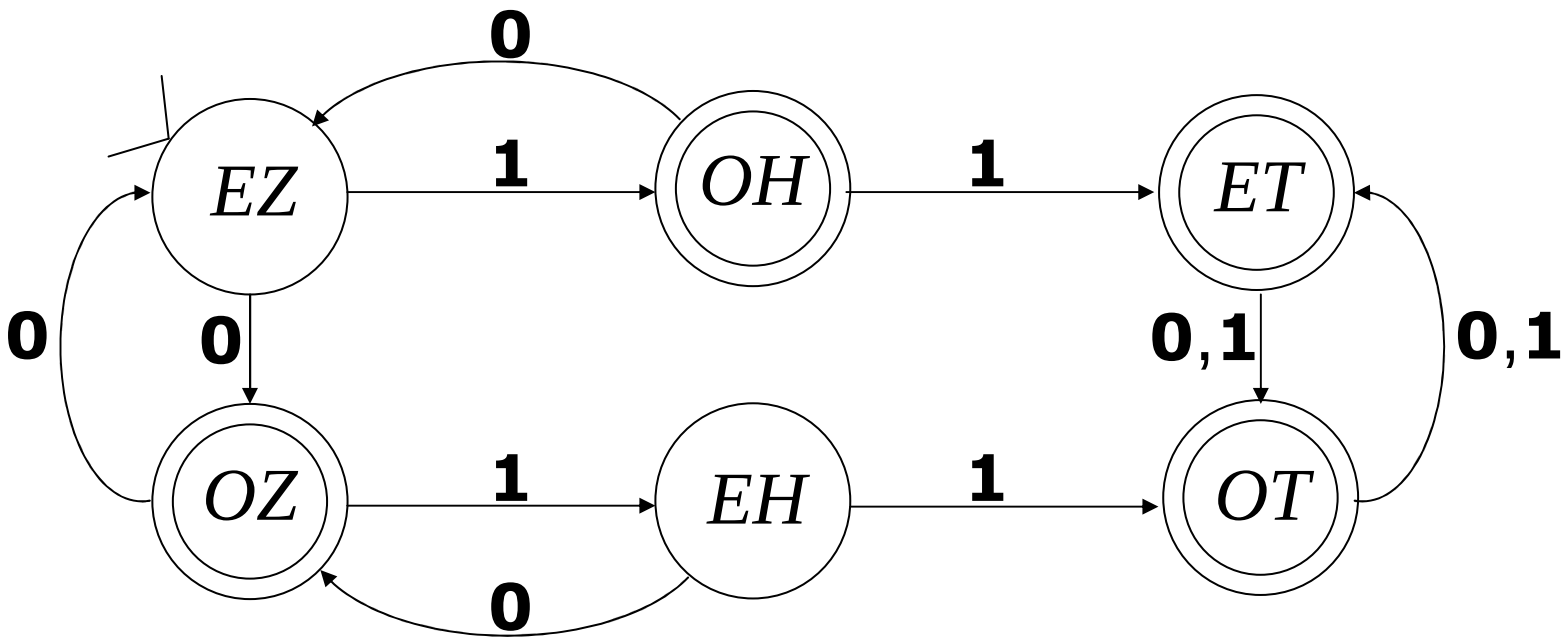
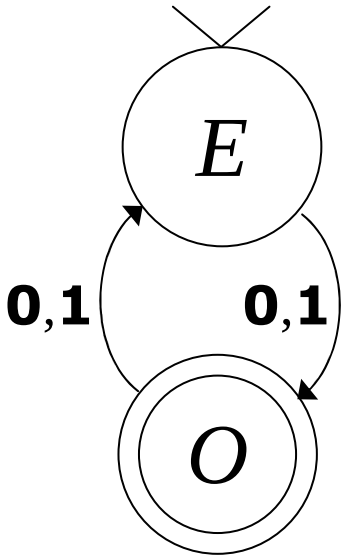
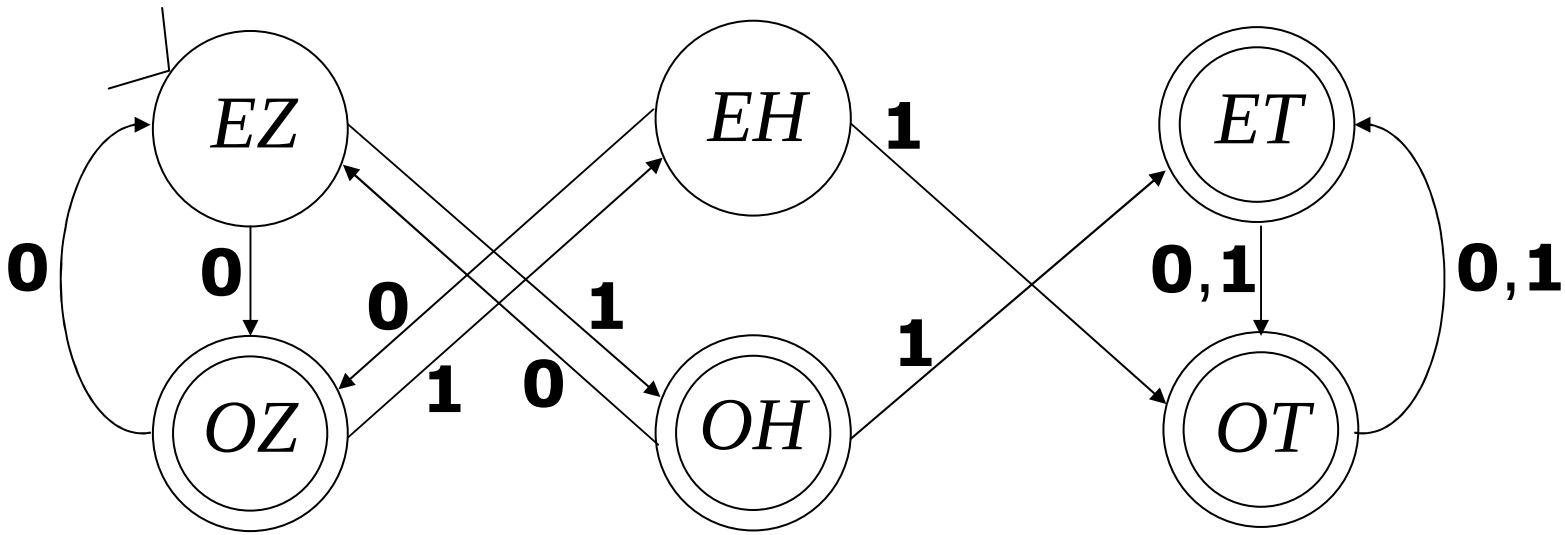
$$M_{AB} = M_A \cup M_B$$

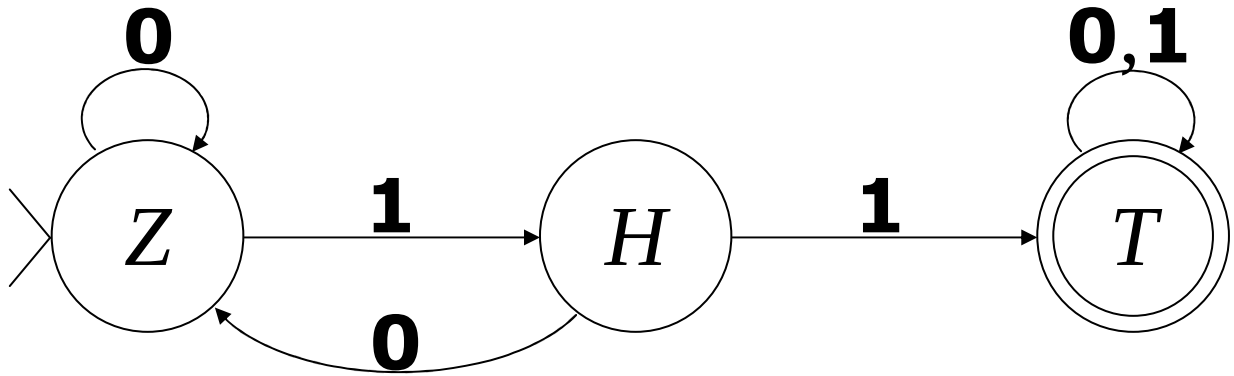


$$M_{AB} = M_A \cup M_B$$



M_A

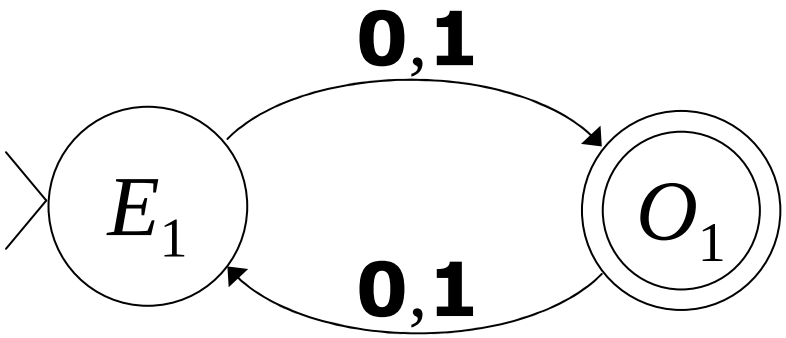




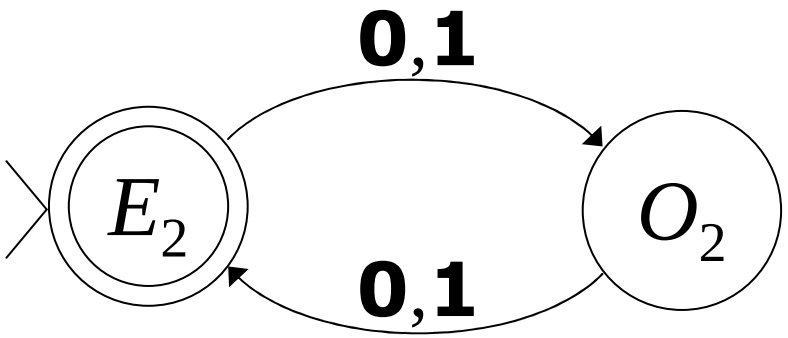
M_B

More Facts About FSA Unions

- The construction algorithm guarantees a machine that models the union of two languages. It doesn't guarantee a *good* one.
- For example:
  - $A = \{s \mid \text{the length of } s \text{ is odd}\}$
  - $B = \{s \mid \text{the length of } s \text{ is even}\}$



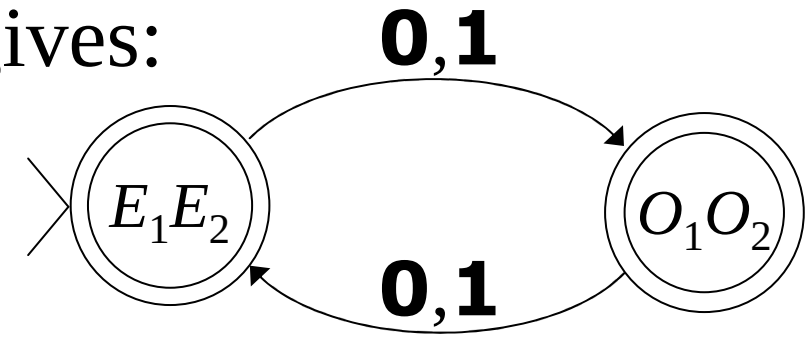
M_A



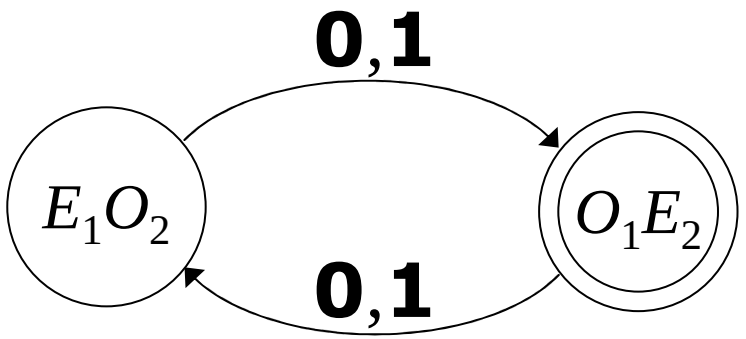
M_B

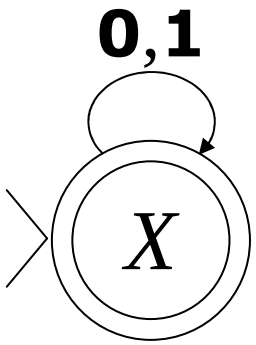
More Facts About FSA Unions

- The construction algorithm gives:



- ...which is clearly not the easiest way to model the language {*s* | the length of *s* is either even or odd}.





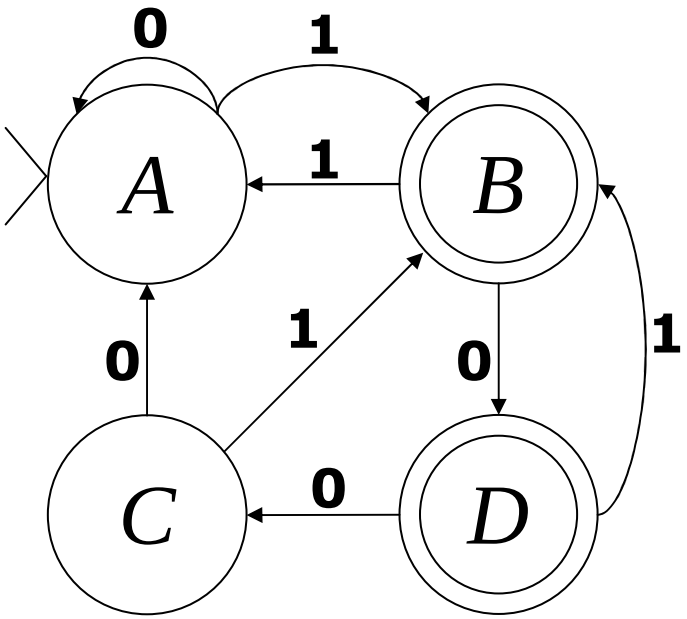
- But it works.

Tips on Minimizing States

- Suppose you have:
  - $Q = \{A, B, C, D\}$
  - $\Sigma = \{\mathbf{0}, \mathbf{1}\}$
  - $\delta =$

	0	**1**
A	A	B
B	D	A
C	A	B
D	C	B

  - $s = A$
  - $F = \{B, D\}$



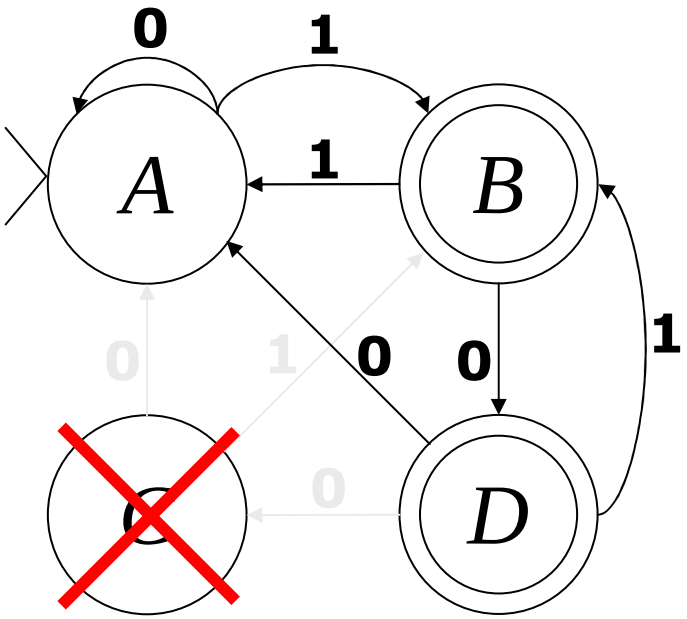
- This can be done in three states.
- How?

Tips on Minimizing States

- $Q = \{A, B, C, D\}$
- $\Sigma = \{\mathbf{0}, \mathbf{1}\}$
- $\delta =$

	0	**1**	
A	A	B	←
B	D	A	
~~C~~	~~A~~	~~B~~	←
D	A	B	

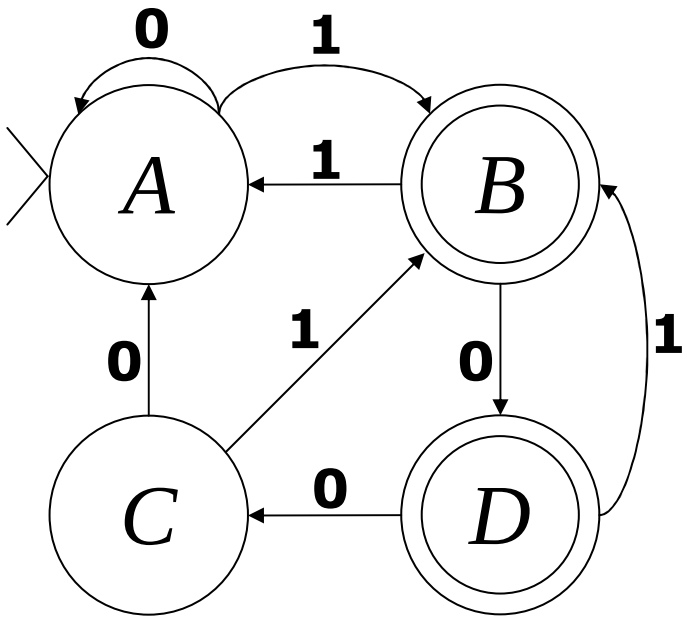
- $s = A$
- $F = \{B, D\}$

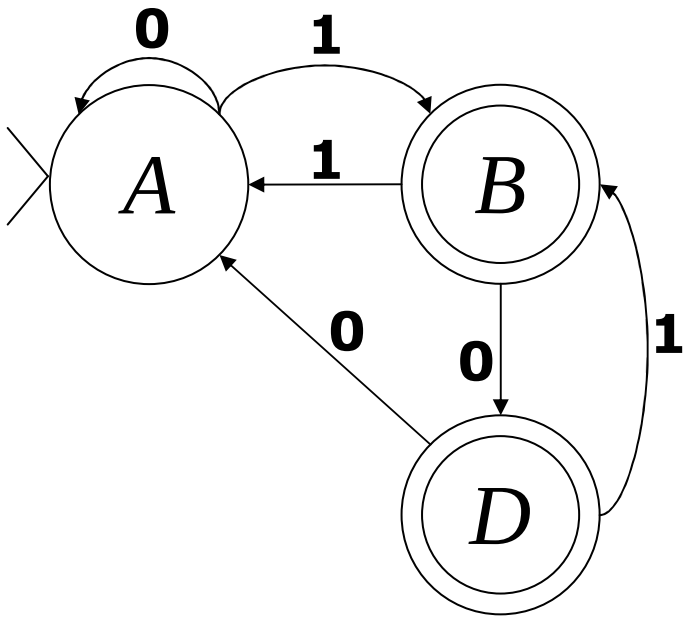


- These two states are doing the same work!
  - Both of them indicate: if you see a **0**, go to *A*; if you see a **1**, go to *B*.
- Therefore...

Tips on Minimizing States

- You can verify that both machines model the same language.





- This may not eliminate every extra state, but it can help.