1. The two DFAs do not accept the same language, DFA R accepts the string ab and DFA S does not.

Proof:

Diagram

Description automatically generated

These are the two DFAs that I am trying to prove are different, DFA with r0-r2 is DFA R. The other one is DFA S. If you enter the string ‘ab’ into DFA R you reach the accepting state r2. If you enter the same string ‘ab’ into DFA S you reach the *non*-accepting state s0. Since the DFAs have at least one string that is different in their language then they do not accept the same language.

2. The two DFAs do accept the same language

Proof:

Diagram

Description automatically generated with medium confidence

These are the two DFAs that I am trying to prove are the same, DFA with r0-r4 is DFA R. The other one is DFA S.

|  |  |  |
| --- | --- | --- |
| States | a | b |
| +r0,s0 | r1,s0 | r4,s1 |
| +r1,s0 | r1,s0 | r2,s1 |
| +r4,s1 | r3,s2 | r4,s1 |
| +r2,s1 | r3,s2 | r2,s1 |
| r3,s2 | r3,s2 | r3,s2 |

This is a product table of the two DFAs above, the ‘+’ means that state is an accepting state.   
r0,r1,r4,r2,s0,s1 are all accepting states. All of the product table accepting states are pairs from r0,r1,r4,r2,s0,s1. This means that when you do the symmetric difference on the two DFAs you do not come up with any accepting states, therefore the two DFAs are equal.

3. The language accepted by the DFA R is a subset of the language accepted by the DFA SDiagram

Description automatically generated  
These are the two DFAs that I am trying to prove are the same, DFA with r0-r2 is DFA R. The other one is DFA S.

|  |  |  |
| --- | --- | --- |
| States | a | b |
| r0,s0 | r1,s1 | r2,s0 |
| +r1,s1 | r1s1 | r2,s0 |
| r2,s0 | r1,s1 | r2,s0 |

This is a product table of the two DFAs above, the ‘+’ means that state is an accepting state.

r1,s1 are all accepting states. All of the product table accepting states are pairs from r1,s1. This means that when you do the symmetric difference on the two DFAs you do not come up with any accepting states, therefore the two DFAs are equal. And because they are equal that means they are subsets of each other, therefore the language accepted by DFA R is a subset of the language accepted by DFA S.

4. No, in order to prove this I am going to use the following method

1. Mark the start state
2. Highlight all edges that the Marked states lead to
3. Remove all Marked states
4. The highlighted states are now the marked states
5. Repeat steps 2-4 until you reach an accepting state
6. If you reach an accepting state then you found a string that is accepted, if you don’t then the DFA doesn’t accept any string

using this method

1. Mark = r0
2. Highlight = r4,r5
3. Mark = r4,r5
4. Highlight = none
5. Mark = none
6. No accepting state found