In this problem, we are given a 4 state transition diagram.

We know that it represents a Moore machine because the output is a function of only the current state. We are also given a partially filled out truth table and our first job is to fill in the missing entries in the truth table.

In order to do this, we need to find the correlation between states A -- D and their S1S0 encoding.

We begin by looking at the output column. We know that only state A has an output of 1, so state A's encoding must be 00 and OUT=1 regardless of the input because it is a Moore machine. We also know that from state A on a 1 input, the FSM moves to state B. According to the truth table from state 00 (which is A), on a 1 input, we move to state 01.

That means that state B's encoding is 01. We continue in this manner, now following the transitions from state B. According to the diagram, when IN = 0, we move to state D. So looking up that transition in our truth table, tells us that state D's encoding is 10.

We also see in our state diagram that starting at state B when IN=1, we move back to state A which we now know to be 00. So we can fill in the next missing entry in our truth table. Now that we have determined the encoding for states A, B, and D. We know that the remaining encoding is for state C and that is 11. At this point, we have all the information we need to complete filling out the missing entries in the truth table.

Looking at the row where the current state is 10 (state D) and IN = 1 and the corresponding transition in the state diagram, shows us that in this case we go back to state D.

Since the encoding of state D is 10, the S0' entry is 0.

Because this is a Moore machine, we also know that the output associated with current state D, regardless of the input, is 0, so the missing output entry is 0.

Finally, from state 11 (which is state C), when IN = 1, we see from the state diagram that we transition to state A which is state 00, so the remaining missing S0' value is 0. We now want to determine whether or not there are any equivalent states in this FSM. In a Moore machine, equivalent states have the same output, and the same input transitions. This rules out state A because it is the only one that has a 1 output. Taking a closer look at states B, C, and D, we can see that both states B and C transition to state D on a 0 input, and to state A on a 1 input. In addition, the output value is 0 for both of them. This means that states B and C are equivalent and can be merged into 1 to turn this into a 3 state FSM.