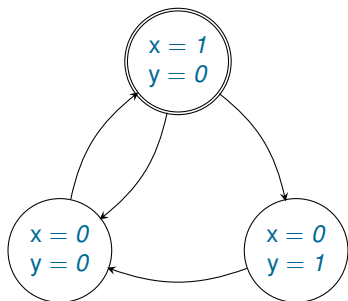


Outline

Exercise 11 Problem 1

Exercise 11. Problem 1

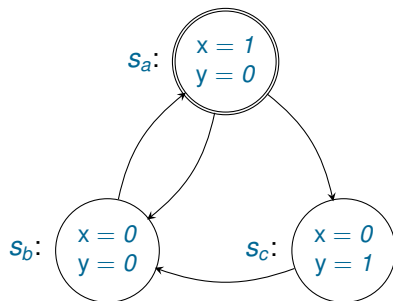
Consider a transition system with the following state transition graph.



The initial state is the top one. Let S_1 be the set of states symbolically represented by the formula $x = 1$ and S_2 be the set of states symbolically represented by the formula $x = 0 \wedge y = 1$.

1. State whether or not S_1 coincides with the set of initial states.
2. Find a symbolic representation of the set of states reachable from S_2 in exactly two steps.
3. Find a symbolic representation of the set of states backward reachable from S_2 in exactly three steps.

Solution

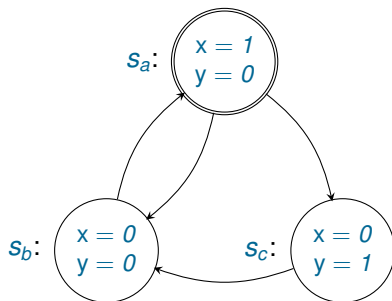


$$S_1 = \{s \mid s \models x = 1\}$$

$$S_2 = \{s \mid s \models x = 0 \wedge y = 1\}$$

State whether or not S_1 coincides with the set of initial states.

Solution



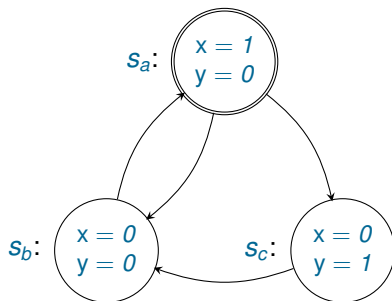
$$S_1 = \{s \mid s \models x = 1\}$$

$$S_2 = \{s \mid s \models x = 0 \wedge y = 1\}$$

State whether or not S_1 coincides with the set of initial states.

S_1 does not coincide with the set of initial states: the state in which $x = 1 \wedge y = 1$ belongs to S_1 but is not an initial state.

Solution

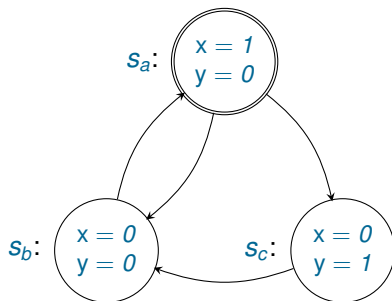


$$S_1 = \{s \mid s \models x = 1\}$$

$$S_2 = \{s \mid s \models x = 0 \wedge y = 1\}$$

Find a symbolic representation of the set of states reachable from S_2 in exactly two steps.

Solution



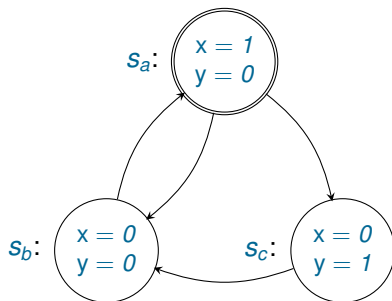
$$S_1 = \{s \mid s \models x = 1\}$$

$$S_2 = \{s \mid s \models x = 0 \wedge y = 1\}$$

Find a symbolic representation of the set of states reachable from S_2 in exactly two steps.

It is easy to see that $S_2 = \{s_c\}$. The only state reachable from s_c in exactly two steps is s_a , which can be symbolically represented by the formula $x = 1 \wedge y = 0$.

Solution

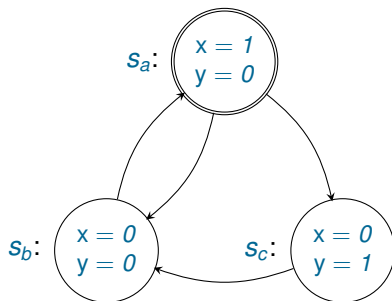


$$S_1 = \{s \mid s \models x = 1\}$$

$$S_2 = \{s \mid s \models x = 0 \wedge y = 1\}$$

Find a symbolic representation of the set of states backward reachable from S_2 in exactly three steps.

Solution



$$S_1 = \{s \mid s \models x = 1\}$$

$$S_2 = \{s \mid s \models x = 0 \wedge y = 1\}$$

Find a symbolic representation of the set of states backward reachable from S_2 in exactly three steps.

Again, we know that $S_3 = \{s_c\}$. There are two states backward reachable from s_c in exactly three steps: s_a and s_c itself. The set $\{s_a, s_c\}$ can be symbolically represented in several ways, for example by any of the following two formulas:

$$(x = 1 \wedge y = 0) \vee (x = 0 \wedge y = 1);$$
$$x = 1 \leftrightarrow y = 0.$$