

Outline

Exercise 10

Problem 1

Problem 2

Problem 3

Exercise 9. Problem 1

Express in **LTL** the following properties: if F occurs at least twice, then F occurs infinitely often.

Solution.

$$\diamond(F \wedge \bigcirc \diamond F) \rightarrow \square \diamond F.$$

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Exercise 9. Problem 2

Show that the formulas $\Box(A \rightarrow \bigcirc A)$ and $\neg A \mathbf{U} \Box A$ are not equivalent by giving a path that satisfies one of them but does not satisfy the other one.

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Note. As far as the truth value of A is concerned, there is no other path distinguishing these two formulas.

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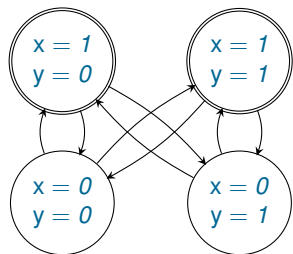
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Exercise 9. Problem 3

Let the formula x symbolically represent the set of initial states and the formula $x \leftrightarrow \neg x'$ the transition relation of a transition system \mathbb{S} over the set of two boolean variables $\{x, y\}$.

- ▶ Draw the state transition graph of \mathbb{S} .
- ▶ Which of the following formulas are true along all paths in \mathbb{S} ?
 1. $\square(x \leftrightarrow \bigcirc \neg x)$;
 2. $\square(x \leftrightarrow \bigcirc \bigcirc \neg x)$;
 3. $\square(y \leftrightarrow \bigcirc y)$.

Solution

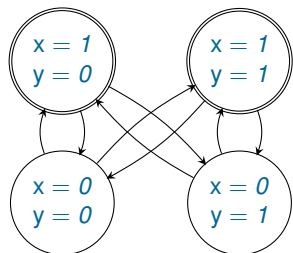


1. $\Box(x \leftrightarrow \bigcirc \neg x)$ is true along all paths.
2. $\Box(x \leftrightarrow \bigcirc \bigcirc \neg x)$ is false on some paths, for example



3. $\Box(y \leftrightarrow \bigcirc y)$ is false on some paths, for example the above path.

Solution



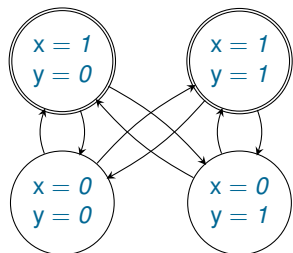
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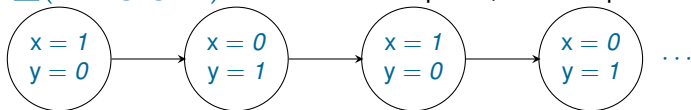


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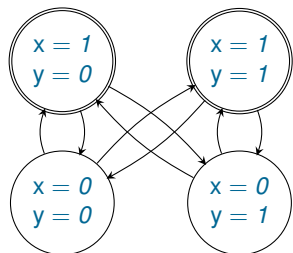


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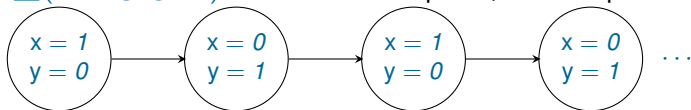


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