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Model Checking – Exercise sheet 10

Exercise 10.1

Let $a = a_2a_1a_0$, $b = b_2b_1b_0$, and $c = c_3c_2c_1c_0$ be 3-bit, 3-bit, and 4-bit unsigned integers, respectively.

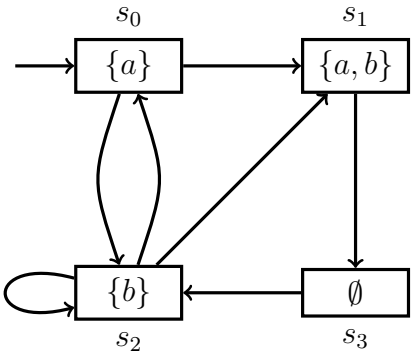
(a) Draw a BDD that represents $a + b = c$. Write down your variable ordering.

(b) Draw a BDD that represents $a = 2 \cdot b$. The BDD should contain every possible value of b such that $2 \cdot b$ is representable using 3 bits. The variable ordering of a and b must be the same as in (a).

(c) Use the BDDs from (a) and (b) to construct a BDD that represents $3 \cdot b = c$.

(d) Use the BDD from (c) to construct a BDD that represents $c \bmod 3 = 0$.

Exercise 10.2



For the given transition system,

(a) Construct a BDD representing the transition system.

(b) Using the BDD from (a), construct the BDD representing

(i) $Img(b)$ where $Img(\phi)$ is the set of successors of states which satisfy the formula ϕ.

(ii) $Pre(a)$ where $Pre(\phi)$ is the set of predecessors of states which satisfy ϕ.

Exercise 10.3

For a given transition system as a BDD T and a set of states as a BDD S, give an algorithm to compute the set of all reachable states from S. Also, Give an algorithm to compute the shortest path between two given states s_1 and s_2 using T.