Model Checking – Exercise sheet 9

Exercise 9.1
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).

Exercise 9.2

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 $\phi$.

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

Exercise 9.3
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 $T$. 

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