1. Consider the synchronous component shown as an extended state machine in the figure below: 8pts

For each of the properties specified below, state whether the property is an inductive invariant with a brief justification, and if it is not an inductive invariant, but is an invariant, find a stronger property that is inductive.

(a) \( x \geq 0 \).
(b) \( y \geq 0 \).
(c) \( x \geq y \).
(d) \((\text{mode} = \text{off}) \rightarrow (x \geq y)\).

2. Consider a transition system \( T \) with two integer variables \( x \) and \( y \). The transitions of the system correspond to executing the statement:

\[
\text{if } (x > y) \text{ then } x := 2y + 1.
\]

Write the transition formula for this system. Consider a region \( A \) of the above transition system described by the formula

\[
(0 \leq x \leq 5) \land (1 \leq y \leq 3).
\]

Compute the formula describing the post-image of \( A \).

3. Exercise 3.18 from the textbook. 8pts

4. Consider the Boolean formula \((x_1 \lor \neg x_2) \leftrightarrow x_3\). That is, the formula evaluates to 1 exactly when the value of \( x_3 \) is the same as the value of the expression \( x_1 \lor \neg x_2\). Draw the ROBDD for this formula with respect to the variable ordering \( x_1 < x_2 < x_3 \).