Problem session, week 5

10. (Chapter 3, new exercise) Consider the state machine in figure 2. It implements CodeRecognizer, but has more states than the one in figure 1. Show that it is equivalent by giving a bisimulation relation with the machine in figure 1.

11. (Chapter 3, new exercise) Consider the state machine in figure 3. Suppose that the alphabets are

\[ \begin{align*}
\text{Inputs} &= \{1, a\} \\
\text{Outputs} &= \{0, 1, a\},
\end{align*} \]

where \( a \) (short for absent) is the stuttering element. State whether each of the following is in the set \( \text{Behaviors} \) for this machine. In each of the following, the ellipsis “\( \cdots \)” means that the last element is repeated forever. Also, in each case, the input and output signals are given as sequences.

(a) \( ((1, 1, 1, 1, \cdots), (0, 1, 1, 0, 0, \cdots)) \)
(b) \( ((1, 1, 1, 1, \cdots), (0, 1, 1, 0, a, \cdots)) \)
(c) \( ((a, 1, a, 1, a, \cdots), (a, 1, a, 0, a, \cdots)) \)
(d) \( ((1, 1, 1, 1, \cdots), (0, 0, a, a, a, \cdots)) \)
(e) \( ((1, 1, 1, 1, \cdots), (0, a, 0, a, a, \cdots)) \)
Figure 2: A machine that implements CodeRecognizer, but has more states than the one in figure 1.

Figure 3: State machine for problem