1. Show that the following language is recursive:

\[ \{ w w^R w \mid w \in \{0, 1\}^+ \} \].

2. A queue machine consists of a finite-state control and a FIFO queue. Initially, the queue contains the input string. A transition of the machine is determined by the symbol at the front of the queue and the current state. The result of a transition is to remove the symbol from the front of the queue, append a string of symbols from the queue alphabet (which must contain the input alphabet) to the back of the queue, and enter a new state. The machine is deterministic, but transitions may be undefined for certain pairs of states and queue symbols. In particular, we will assume that no transitions are defined from final states. Furthermore, no transition is defined if the queue is empty. A queue machine accepts its input if it reaches a final state.

Show that a language is RE iff there is a queue machine that accepts it.