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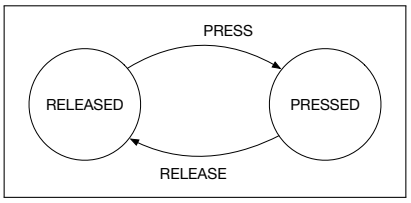
Below is the definition of the `struct` I use for representing a finite state machine. In order to make it as generic as possible, I allow a function pointer to be specified so that additional behaviour may be implemented for particular state transitions. The function takes 3 arguments: the previous state, the event that caused the state transition, and the new state.

```
struct finite_state_machine {
    int current_state;
    struct transition *transitions;
    int num_transitions;
    void (*transition_function)(int, int, int);
};
```

Below is a state diagram illustrating the FSM I used for detecting button presses on `INT0`. It is very simple, with only 2 states and 2 events. It uses the state transition function described earlier for both transitions; when the button is pressed, it records the current system time, and when the button is released, it computes the time difference and sends either a dot or dash to the pattern-matching FSM as appropriate.



To implement debouncing, I use a small array to keep track of the 3 most recent values of `INT0`. Every 20 milliseconds, my debouncer pushes the most recent value for `INT0` into this array and checks the values of each element. If they are all equal to 1, it sends the `BUTTON_PRESS` event to my button FSM, and likewise for 0 and `BUTTON_RELEASE`.

Below is a state diagram illustrating the FSM I use for detecting the morse code pattern. It allows any sequence of dots and dashes to be pressed before the desired pattern, and also loops back for prefixes as appropriate. Note that once my FSM reaches its final accepting state, it will not continue to recognize patterns; this is an intentional design choice, as the specification did not state what the behaviour should be. The only behaviour in its state transition function is to display "CORRECT" when transitioning to the final state.