

Solutions to Quiz 2

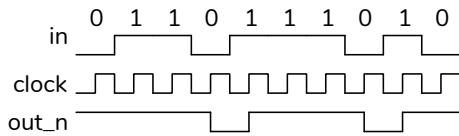
There were two versions of each question. The values and the answers for the two versions are given below.

Question 1

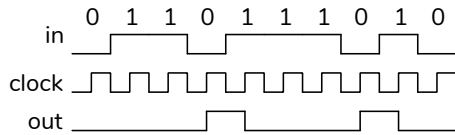
A state machine detects sequences on a one-bit input named **in**. These sequences consist of a **0**, followed by two or three **1**'s, followed by one **0**. The inputs are present on **in** on the rising edge of a clock.

An output named **out_n** (or **out**) should be set to **0** (or **1**) for one clock period when one of these sequences is detected. Otherwise **out_n** (or **out**) should be set to **1** (or **0**).

An example of the **in**, **clock** and **out_n** (or **out**) waveforms is:



or:

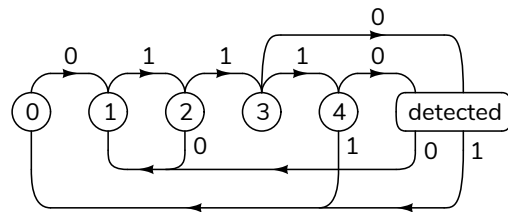


- What is the maximum length (in bits) of these sequences?
- What is the minimum length (in bits) of these sequences?
- Draw the state transition diagram. Label each state transition with the required value(s) of **in**.
Hint: Use the number of values detected in the sequence, including zero, and a 'detected' state as the states.
- For which state(s) is the value of **out_n** (or **out**) equal to **0** (or **1**)?

Answers

- The longest sequence is 01110 which has a length of **5 bits**.
- The shortest sequence is 0110 which has a length of **4 bits**.

- Following the hint and using the answers above, there can be up to 6 states. These correspond to **in** taking on between 0 and 5 of the values in a sequence. Labelling each state with the number of values seen, except for a 'detected' for the state when a complete sequence has been detected, we can draw the following state transition diagram.



- The value of **out_n** (or **out**) is equal to **0** (or **1**) in **the detected state**.

Question 2

An input to a Verilog module is named **hot_n** (or **hot**). The current value of **hot_n** (or **hot**) indicates that something is currently hot (true).

- Is this input currently high or low?
- What is the value of the Verilog expression **!hot_n** (or **!hot**)?

Answers

- An active-low signal is low when the input is true so **hot_n would be low**. An active-high signal is high when the input is true so **hot would be high**.
- A low input is read as **0** so the expression **!hot_n would have the value 1** (**!0**). A high input is read as **1** so the expression **!hot would have the value 0** (**!1**).