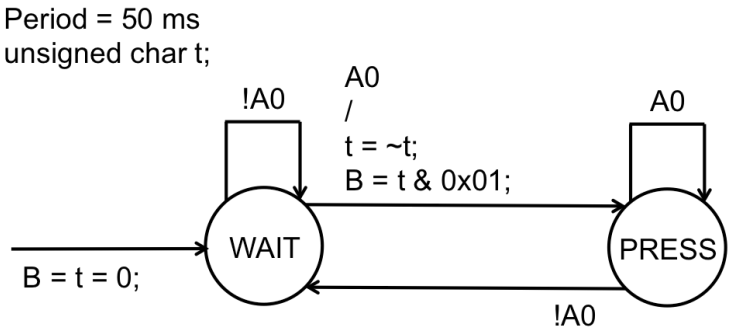
Name: _____

PES, Sections 4.11 – 4.13
Sampling of inputs, Latency, Input Conditioning

1. The SynchSM below shows a toggle system, wherein a first button press on A0 sets B0 to 1, a second sets B0 to 0, a third to 1, etc. Assume the button may bounce for up to 20 ms. Assume the maximum latency between a press and toggle should be 50 ms. Assume button presses last at least 250 ms and are separated by at least 500 ms.

   Choose a good period for the synchSM. Also describe why a much smaller period or a much larger period would be bad.



Debouncing: **period >= 20 ms (>= 50 ms as stated in the slides)**
Latency: **period <= 50 ms**
Button Press Length: **period <= 250 ms**
Inter-event Separation Time: **period <= 500 ms**

The allowable period range is: [20ms, 50ms]. To minimize microcontroller utilization, a period of 50ms is chosen.

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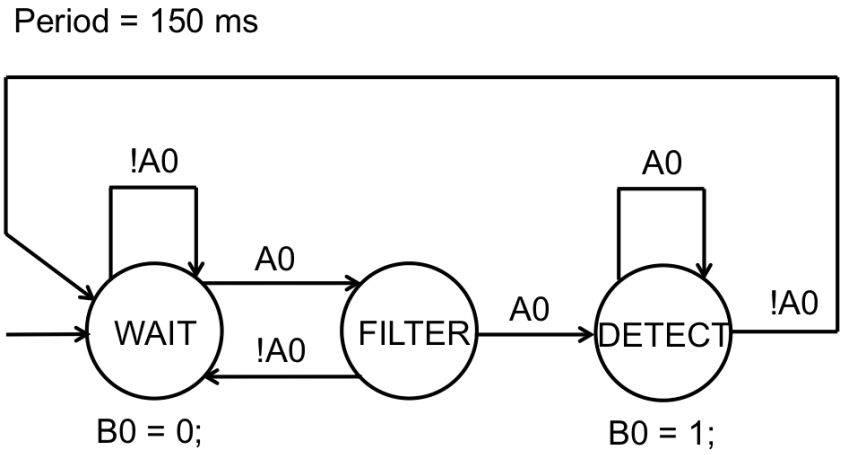
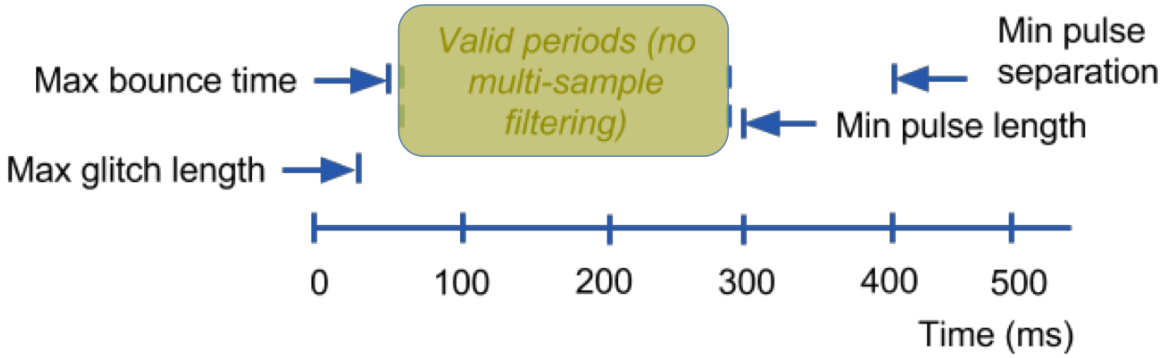
2. The SynchSM below shows a motion detection system whose only purpose is to condition the signal on input A0 coming from a motion sensor (A0 being 1 should mean motion is sensed), into a clean signal on output B0 such that B0=1 indicates motion.



Timing features are summarized in the following figure, which is *not* a timing diagram, but rather plots the various timing specifications and features of a system and shows the valid range of synchSM periods. The filtering requires two consecutive '1' samples, and has a latency constraint of 300ms (i.e., the action must be taken at most 300 ms after the first '1' sample is read, when the sample is legitimate).



Choose an appropriate period for the SynchSM. Explain your reasoning.

The latency constraint imposes a 150ms period, as two ticks are needed to confirm the sample.

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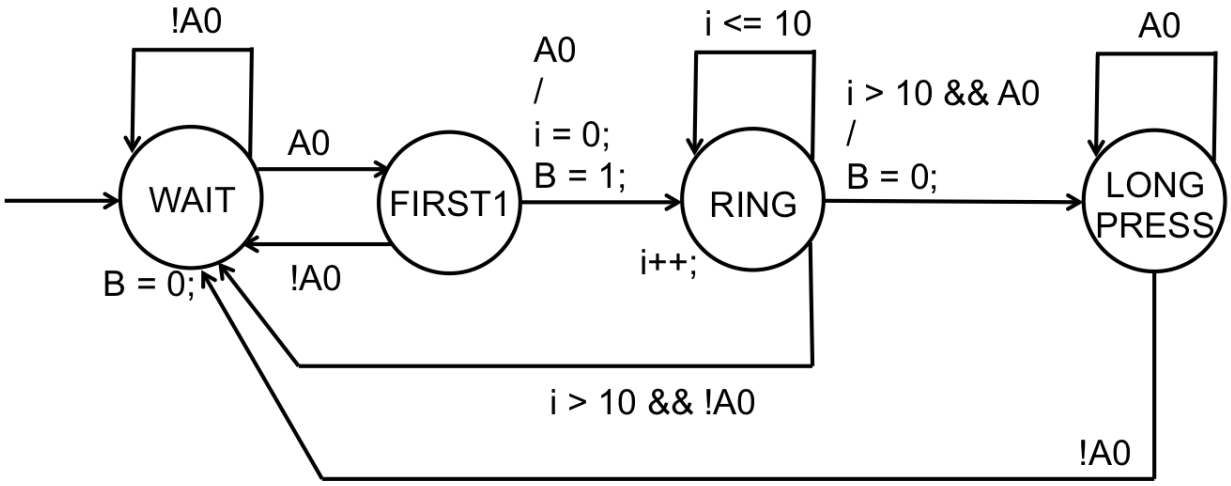
3. The following SynchSM implements electronic doorbell in RIMS:
   - A button is connected to A0.
   - B0 actuates the bell.
   - The minimum button press length to be considered is 400 ms.
   - The minimum separation between presses (from release to next press) is 500 ms.
   - The maximum latency between a press and the start of the bell ringing is 200 ms.
   - With a 10-20 ms debounce time, the minimum allowable period is 50 ms.
   - A button press is considered to be valid if two consecutive '1's are read.
   - When a valid button press is detected, the bell should ring (B0 = '1') for 1 second and then stop ringing until the next distinct button press.

Period = 100ms
unsigned char i;



Select an appropriate period and explain your reasoning.

Minimum Button Press Length:	**period <= 400 ms**
Inter-event Separation Time:	**period <= 500 ms**
Debouncing:	**period >= 50 ms**
Latency:	**period <= 100 ms**
	(two Ticks to read consecutive '1's for a valid press).

The allowable period range is: [50ms, 100ms]. To minimize microcontroller utilization, a period of 100ms is chosen