Lab 10 Rubric (60 points total)

10.1 A primitive flip-flop: NAND Latch (5 points)

2 points for screenshot of S, R, and Q all on the screen during operation (Make sure the scope is on “auto/roll”, and your sweep rate is low enough such that you can see the output. Please push the buttons in this order: Reset, set, set, reset.)
2 points for completing the operation table based on your screenshot.
1 point for indicating which of the four combinations define the memory state and relating it to the screenshot you took

10.2 Watching Switch Bounce (6 points)

2 points for screenshot of the switch bounce with S, R, and Q all on the screen. Trigger on the “set” input as a high sweep rate This part is tricky
2 points for screenshot of S, R, and Q all on the screen during operation (use a modest sweep rate and show all three channels when you switch the ground back and forth between set and reset.)
1 point for whether or not your circuit is working correctly (In other words, what is the normal operation of this circuit, and how does your screenshot show that?)
1 point for "Why does the latch ñ a circuit designed to “remember” work as a debouncer?"

10.3 ñ D flip-flops (8 points)

1 point for screenshot of the D flip-flop ignoring the input when there is no clock. D, Q, Q∗, and C should all be on seperate channels.
1 point for screenshot of the D flip-flop in normal operation with a clock from the de-bounced switch. D, Q, Q∗, and C should all be on seperate channels.
1 point for screenshot of trying to input data with the reset∗ pin grounded. D, Q, Q∗, and C should all be on seperate channels.
1 point for why bounce is harmless in this scenario
1 point for screenshot of trying to input data with both the set∗ and the reset∗ pins grounded. D, Q, Q∗, and C should all be on seperate channels.
1 point for discussing what happens to the Q and Q∗ outputs
2 point for "What determines what state the flip-flop rests in after you release both?" Discuss why you would not want to assert (ground) both the set∗ and reset∗ pins in a circuit.

10.4 A toggle ñ D flip-flop with feedback (10 points)

2 points for screenshot of manual clocking. D and C should be on two channels.

2 points for screenshot of the input and output of the comparator

circuit driven by the audio generator

2 points for screenshot of clocking with the comparator circuit based clock. D and C should be on two channels.
1 point for relation between fclock and fQ
2 points for screenshot of your measurement of the propagation delay
1 point for "what is propagating" and explaining how to see that from your screenshot

10.5 Shift register (31 points)

A. Shift-register (14 points)

2 points for screenshot of QA, DA, and C with frequency measurement of D and C both on the screen
1 point for explaining the jitter in QA
2 points for a screenshot of QA, DA, C, and QB with frequency measurements of DA and C both on the screen
2 points for a screenshot of QA, DA, C, and QC with frequency measurements of DA and C both on the screen
2 points for a screenshot of QA, DA, C, and QD with frequency measurements of DA and C both on the screen
5 points for additional screenshot(s) demonstrating what happens when you change fclock. Take as many screenshots as you need to explain.

B. "Double-Barreled" one-shot (17 points)

2 points for screenshot of DA, C, OUT A, OUT B with frequency measurement C on the screen
1 point for mentioning the effect of changing fclock
2 points for building the LED circuits and noting their behavior.
6 points for three screenshots of QA, DA, C, and {QB, QC, or QD} with frequency measurement C on the screen
4 points for your drawing of the timing diagram. It would be nice if you draw it on the computer using paint or some other program that can draw lines.
2 points for discussion of the strengths and weaknesses of the double-barreled one-shot relative to an analog RC one-shot