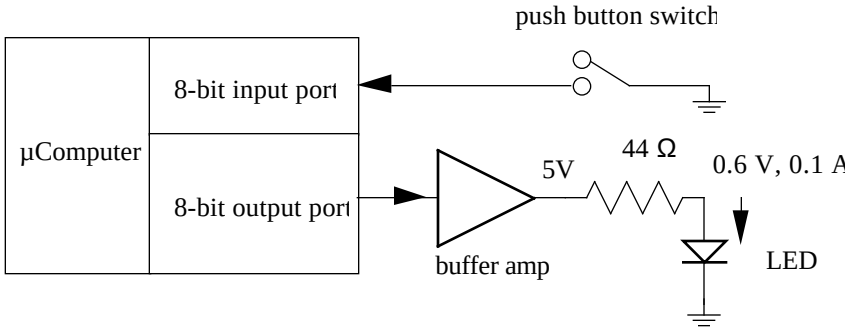
Solutions for Midterm #1 - EECS 145M Spring 2000

1a



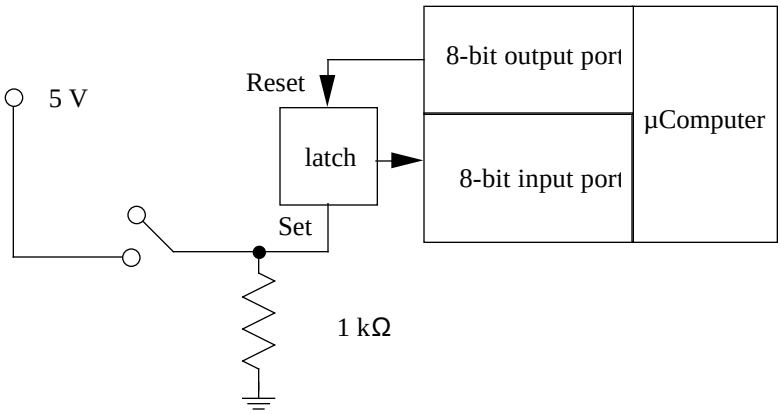
The push button should be connected to the input port and the LED should be driven by the output port and amplifier.
[2 points off for no series resistor to limit LED current]
[1 point off if resistor shown but value not given]
[3 points off if input and output ports not shown]

1b.

1 Computer waits for button to be pressed
2 User presses the button, grounding the input line
3 Computer senses low signal
4 Computer uses system clock to wait a random 5-10 sec time
5 Computer puts output line to amplifier high
6 Computer reads system time T1 (ms)
7 LED lights
8 Computer waits for low input line
9 Human recognizes LED and presses button a second time
10 Computer recognizes low line and reads system time T2
11 Computer subtracts system times (T2 - T1), converts to seconds, displays and stores results, and turns off LED

[2 points if hardware steps such as button press and LED lighting not given]
[2 points off if time difference not calculated and stored]

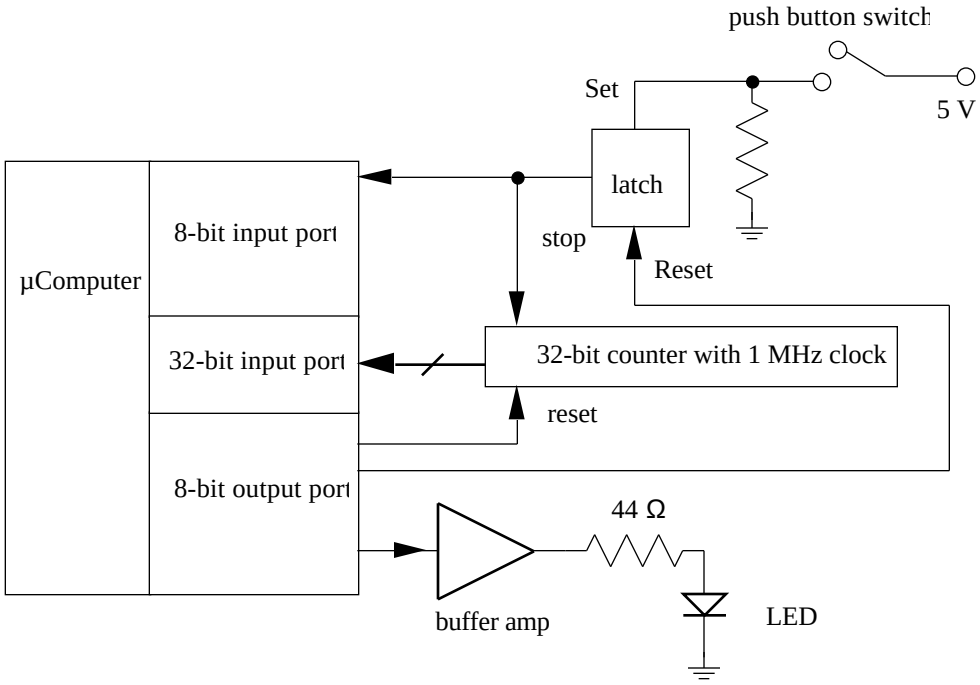
2



Te essential features of the solution are (1) button sets latch (2) latch output goes to computer input port (3) output port resets latch [3 points off for each missing feature]

With this solution, the latch is set by the push button and is certain to remain set until the computer detects and resets it.

3a



Using a simple push button switch was accepted here.
[3 points off if push button does not stop counter]

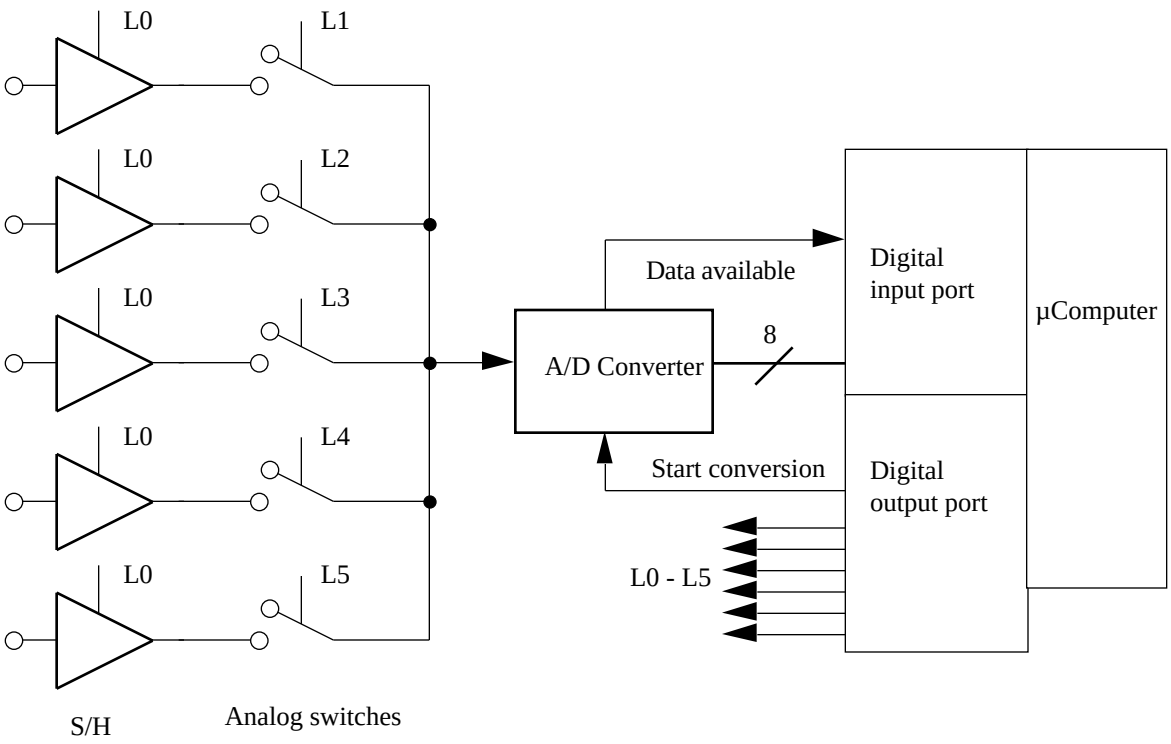
3b

1 Computer resets counter and puts LED driver output low
2 Computer waits for button to be pressed
3 User presses the button, grounding the input line (this incidentally stops counter)
4 Computer senses low signal
5 Computer waits a random 5-10 sec time
6 Computer resets and starts counter
7 Computer puts output line to amplifier high
8 LED lights
9 Human recognizes LED and presses button a second time
10 pulse from button stops counter and signals computer
11 Computer reads counter and converts to seconds

Timing between first button push and lighting LED is not critical and can be done in software. Timing between LED prompt and second button push is critical and should be done using the counter.

[2 points off if push button stops counter but does not signal computer when to read counter]
[2 points off if counter is not reset when LED is turned on]
[3 points off if computer stops counter]

4a



4b

1 Computer puts all 5 S/H into sample mode and opens all analog switches
2 Computer puts all 5 S/H into hold mode simultaneously (within a few ns)
3 Computer closes analog switch i and makes start conversion high
4 computer waits until A/D is complete (data available goes high), and then reads data into location i
5 Computer opens switch i and makes start conversion low, which makes data available low
6 Loop back to step 3 for i=1 to 5

[5 points off if all five S/H are not put into hold mode with the same signal]

Midterm #1 class statistics:

Problem	max	average	rms
1	30	28.1	0.9
2	10	8.6	2.2
3	30	28.1	2.1
4	30	27.7	2.5
total	100	92.5	4.1

Grade distribution:

Range	number	*approximate* letter grade
81-85	1	C
86-90	3	B
91-95	8	A-B
96-100	3	A