Name: ....
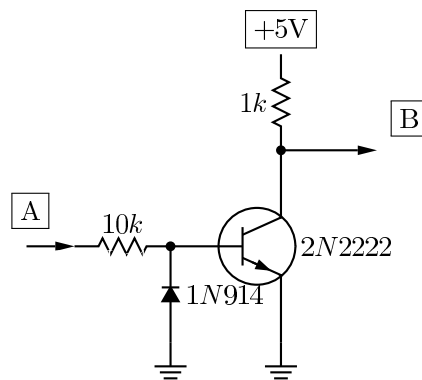
The exam has **??** questions for a total of **??** points.
Answer All Questions

Open Book

Show all your work.

1. [5pt] The function of the circuit shown below is to convert RS232 signals into TTL signals. Connect RS232 to pin [A] and TTL to pin [B].

   1. Demonstrate that RS232 levels "+5 to +15" and "-5 to -15" are converted to the proper TTL levels.
   2. What is the function of the diode?

2. [5pt] The function of the circuit shown below is to convert TTL signals into RS232 signals. Connect TTL to pin [A] and +5V to pin [B]. Show how do you connect pins [C], [D], and [E] and demonstrate that TTL levels "0" and "1" are converted to the proper RS232 level.
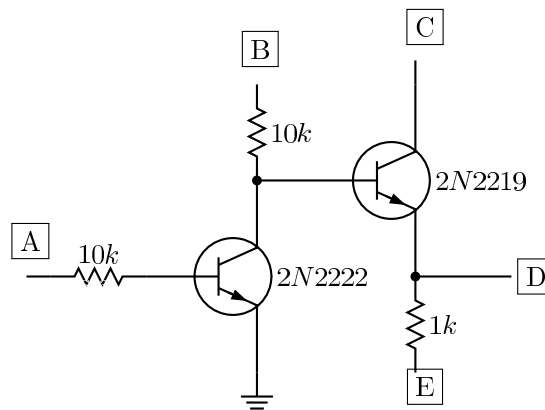

3. [10pt] We want to apply +25V to a device for few μ seconds and +5V for the rest of the time. Use the suggested 4N33 optocoupler shown below and control it using pin RA1/ 16F84 to do the required action. Write "only" the necessary assembly language instructions to do so. Assume RA1 is an output pin. Show all your connections.
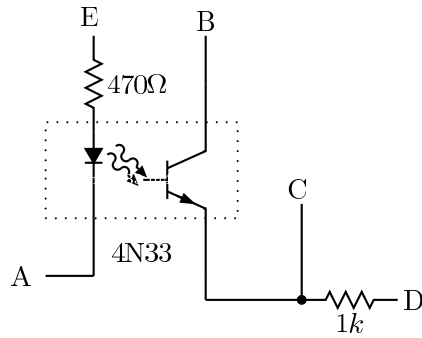
4. 5pt Use assembly language to configure the serial port on 16F877 to run 8-bit, asynchronous mode, speed 28800 BPS using 12 MHz crystal, and enable transmission and the serial port.

5. 5pt Use assembly language to configure the A/D on 16F877 that uses 6 MHz crystal to acquire the signal from analog channel 7 and collect two samples and return them in locations 0x30, 0x31.

6. 10pt The Centronics interface for parallel printers has 8 input data lines $D_7 \cdots D_0$, $\overline{Strobe}, Busy, \overline{Acknlg}$ lines (among other lines). Connect portB of 16F84 to the data lines $D_7 \cdots D_0$ and to portA the handshake lines $\overline{Strobe}$ and Busy.

Write a subroutine that prints on the printer one character in register W and returns in W the character 'T' if printing was successful or 'F' if not. Printing is successful if the busy line returned low (or if you prefer the $\overline{Acknlg}$ line goes high) in a reasonable time, say 100 ms from the time of sending the strobe pulse. Assume that a delay routine of 10 ms called 'del10' is available to you.

Note that the data must be stable on the data lines before sending the strobe pulse by at least 0.5 μs and after the rising edge of the strobe pulse by the same amount of time 0.5 μs. With the rising edge of the $\overline{Strobe}$ line, the printer responds by putting a high on its busy line. The printer is ready for printing when the Busy line is low.
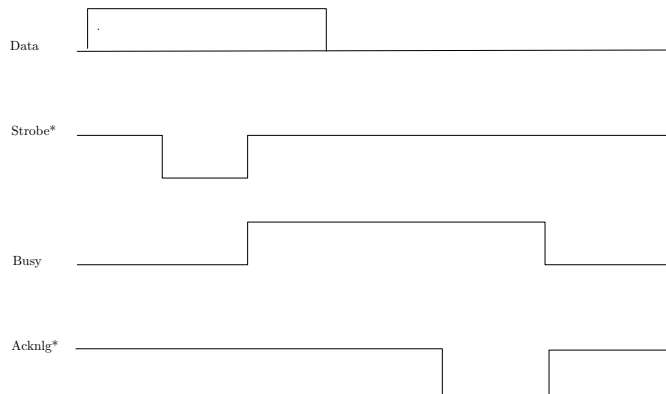
Timing Diagram for a Centronics parallel Printer