1. Explain the difference between unconditional data transfer from a keypad and conditional data transfer from a keypad.

Unconditional data transfer from keypad will output whenever there is changes from the switch and conditional will output (display on bargraph) until we push one of the keys on keypad.

2. Why is it important that the 74HC74 flip-flop serving as a “valid data” flag be cleared after reading each key scan code? What would happen in your system if this flip-flop is not cleared?

It is important because the flip flop debounces the bounces occurring from the keypad and if we do not clear the flip flop then the output from the flipflop(Q) will remain 1 until we clear it.

3. An input from VPORTC_IN provides two kinds of information, a 4-bit value corresponding to the DIP switch positions and a 4-bit key scan code corresponding to the key pressed. After input- ting a byte from VPORTC_IN, what operations must be used to “remove” the unwanted data so that all you have is a right justified 4-bit scan key code in r16? Write a sequence of instructions that efficiently accomplish this.

If we want to remove the values from DIP switches, we simply use AND function to clear the four least significant bits from the final output value which will be

Andi r16, 0xF0

And it will clear the four least significant bits and leave the values from the keypad. Then we shift the bits to the right 4 times.

Lsr r16

Lsr r16

Lsr r16

Lsr r16

4. Assume that we input a byte from VPORTC_IN and we are interested in only the binary value represented by the 4-bit DIP switch, write a sequence of instructions that inputs the data from VPORTC_IN and then leaves r16 with only the right-justified binary value represented by the 4- bit DIP switch.

We just need to switch the values for r16 from the last question. Therefore,

Andi r16, 0x0F

And we do not need to shift the bits because it is already placed in the least significant bit.

5. If you use a 0.1uF capacitor from MM74C922 pin OSC to ground, what will be the scan frequency for each key? How did you determine this value?

The scan frequency is about 600Hz and I can measure it from the graph for typical scan frequency vs. COSC.

6. For capacitors of values 0.1, 1 and 10 uF for the KBM capacitor at MM74C922 pin KBM to ground, what will be the debounce time provided by the MM74C922 for each key press? How did you determine this value? Discuss the responsiveness of your system with values of 0.1, 1 and 10 uF for the KBM capacitor. Particularly make note of bouncing or loss of input with these different capacitor values.

For 0.1uF the debounce time will be 0.001 seconds, for 1uF the debounce time will be 0.01 seconds, and for 10uF the debounce time will be 0.1 seconds. I could determine this value from the graph of typical Debounce Period vs. CKBM. If we use smaller capacitor like 0.1uF, because the debounce time might be too fast, it might not completely debounce the key. On the other hand, if we use a larger capacitor like 1uF, because the debounce time might be too slow, we have to press the pushbutton or key longer in order to completely input as we intended.