MEDICAL ELECTRONICS IV
SHEET #1

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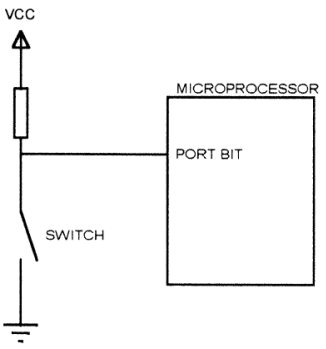
1. Write 8051 microcontroller code to implement the following functions:
    a. A loop from 0 to 100
    b. A loop from 0 to 1000
    c. Sum of numbers from 0 to 100
    d. Sum of numbers from 100 to 300
    e. Sum of numbers in an array of bytes stored from memory address ox20 to 0x30.
    f. Sum of numbers whose memory addresses are stored in locations 0x20 to 0x30.

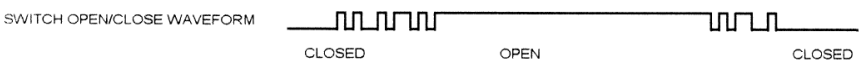
2. Given an 8051 microcontroller with a clock of 15 MHz, how can you implement a 10 ms delay within your program? Please consider the two cases when you have other processes running within this delay period and when you do not have any other processes running.

3. Estimate the memory space and clock cycles required to run the following 8051 assembly code:

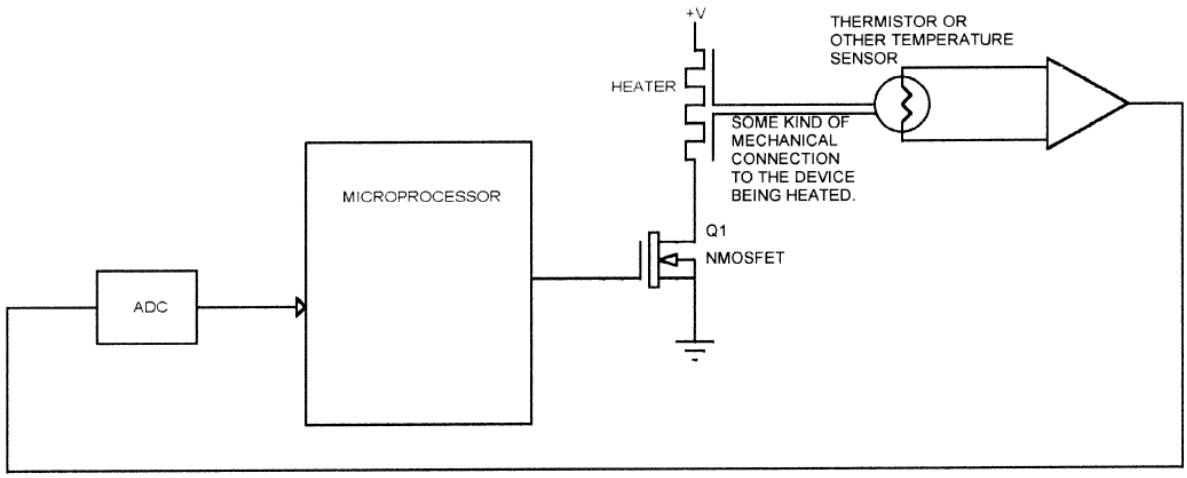
```
                orl   P1MDIN, #40h
                orl   P1MDOUT,#40h
                clr   P1.6
Loop2:          mov   R7, #03h
Loop1:          mov   R6, #00h
Loop0:          mov   R5, #00h
                djnz  R5, $
                djnz  R6, Loop0
                djnz  R7, Loop1
                cpl   P1.6
                jmp   Loop2
```

4. Given a mechanical switch connected to Port 1 pin 5 of an 8051 microcontroller as shown in the figure. Design a switch debouncing 8051 assembly code to work with both the opening and closing of the switch.





5. Consider a microcontroller-controlled heater shown below. Design an 8051 assembly code that would enable the ON/OFF control of the heater to adjust the temperature to a predefined value T_o. Assume that the ADC used is of 8-bit FLASH type (i.e., requires no clock and its digital reading corresponds to the temperature value whenever it is read). Assume also that the control of the heater is such that when the microcontroller pin is 1 the heater is ON and vice versa. Let the ADC reading port be the entire P2 and the output pin be P1.6.



6. It is desired to use a microcontroller to control a stepper motor with the control waveforms shown below. Consider the period of each of the pulses below to be 10 ms. Design a microcontroller-based interface that enables the forward and backward control of the motor. Assume any missing information (i.e., clock rate, available ports, other running tasks, etc.)