Microprocessors and Interfacing — Model Answer
Midterm #1 - November 2011

Solve As Much As You Can – Maximum Grade:100 points

Part 1. Answer the following questions by marking the best answer among the choices given: [3 points each]

1. Indexed addressing mode is useful in …
    a. Jump or branching instructions
    b. Data transfer from a look-up table (*)
    c. Arithmetic instructions.
2. For a microcontroller application in which timing accuracy is important, a system clock based on … is used.
    a. RC oscillator
    b. Crystal oscillator (*)
    c. The microcontroller's own internal oscillator
3. Microcontroller watchdog timer can be used to …
    a. Schedule periodic check on the status of a process
    b. Reset the microcontroller when it runs out of control (*)
    c. Measure the number of particular events of interest
4. Using a 3.3V microcontroller, a GPIO pin can provide high current output using …
    a. A push-pull output mode
    b. An open-drain output mode with internal weak pull-ups
    c. An open-drain output mode with external pull-ups. (*)
5. C8051F020 microcontroller memory location 0A4H when accessed using direct addressing mode refers to a …
    a. Special function register (*)
    b. General purpose RAM location
    c. External RAM location
6. For human interface devices based on C8051F020 applications, a system clock based on … is used.
    a. RC oscillator
    b. Crystal oscillator
    c. The microcontroller's own internal oscillator (*)
7. Watchdog timer must be … in order for the program to not use it.
    a. Restarted
    b. Disabled (*)
    c. Checked
8. The instruction to be used to transfer data from external RAM is …
    a. MOV
    b. MOVX (*)
    c. MOVC
9. Using a 3.3V microcontroller, one can make a GPIO work as an input pin using …
    a. An open-drain output mode and a pull-up resistor
    b. A push-pull output mode and an amplifier at the output of the pin
    c. A push-pull output mode and an internal weak pull-up (*)
10. For multiple microcontrollers to be synchronized, a clock source for C8051F020 based on … is used.
    a. RC oscillator
    b. CMOS clock (*)
    c. Internal clock

Part 2. Mark the following statement as either True (T) or False (F): [1 Point each]

11. Relative addressing is rarely used in C8051F020 assembly language programming. (F)
12. 8-bit microcontrollers are sufficient and cost-effective for many embedded applications. (T)
13. All data memory locations are bit addressable. (F)
14. For internal crystal oscillators, only certain values can be programmed with C8051F020. (T)
15. The C8051F020 must start with an internal oscillator upon reset. (T)
16. Logical instructions perform Boolean operations on a bit-by-bit basis. (T)
17. C8051F020 can be considered as a system-on-a-chip. (T)
18. The data memory locations below 080H can only be accessed using direct addressing. (F)
19. C8051F020 is a mixed-signal microcontroller because it can handle analog and digital data. (F)
20. The C8051F020 instruction `MOV` can be used with indirect addressing. (T)

Part 3. Denote the following C8051F020 microcontroller instructions as either being true (T) or false (F) assembly instructions: [1 point each]

21. `ADDC R2, F0H` (F)
22. `ORL 70H, #070H` (T)
23. `MOV 040H, 0FFH` (T)
24. `ADD A, #30H` (T)
25. `CLR P1.1` (T)
26. `CPL C` (T)
27. `JNZ @R1` (F)
28. `DIV AB` (T)
29. `SUBB A, 0A2H` (T)
30. `XRL C, /P2.1` (T)
31. `XCH A, 040H` (T)
32. `DEC R0` (T)
33. `CPL A` (T)
34. `DJNZ 070H, 070H` (T)
35. `ADD A, @R7` (F)

Part 4. Determine the number of bytes required to represent the following instructions in assembly: [2 points each]

36. `MOV  A,0ADh (2)`
37. `AJMP  LOOP (2)`
38. `LCALL COUNT (3)`
39. `JNZ  GoBack  (2)`
40. `CLR  P2.1 (2)`
41. `ANL  P2,#40h (3)`
42. `CLR  A (1)`
43. `RR  A (1)`
44. `MOV  A,R4  (1)`
45. `LJMP  MAIN  (3)`

Part 5. Compute the output of the following operations in a C Language program for a C8051F020 device: [2 points each]

```
46.     (00100100b & 00000001b)     (ans: 0)
47.     (090H - 080H) | 00FH        (ans: 01FH)
48.     0F0H / 04H                  (ans: 036H)
49.     00FH<<4                     (ans: 0F0H)
50.     (0FE20H || 080H)            (ans: TRUE)
51.     01000100b && 10100001b      (ans: TRUE)
52.     (0F0H ^ 00AH)&& 011H        (ans: TRUE)
53.     ~(0AAH)                     (ans: 055H)
54.     (0F0H ^ 0A0H)               (ans: 050H)
55.     0FFH | 10101010b            (ans: 0FFH)
```

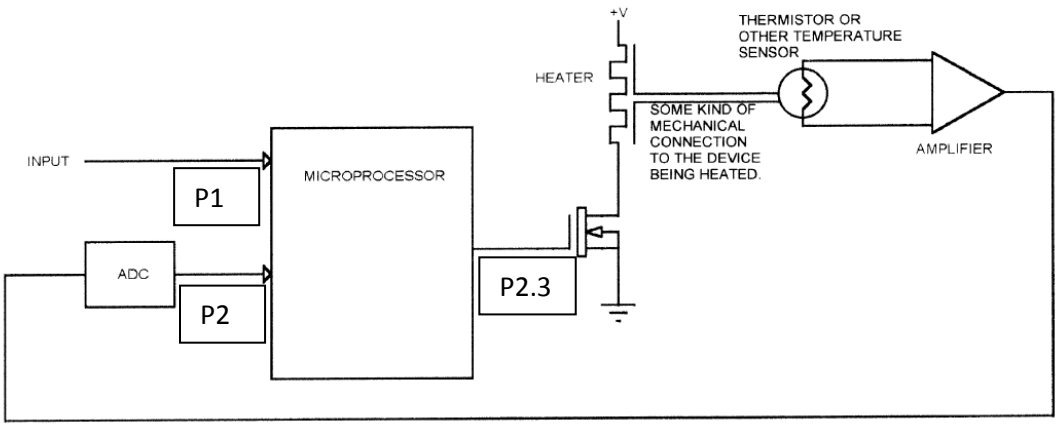
Q6. Write C8051F020 assembly code lines to do the following: [4 Points each]

a. Delay of 1 s when using an internal oscillator clock running at 2 MHz.
b. Configuration of P1.3 to be a push-pull output.
c. Configuration of external crystal oscillator working at 10 MHz.

Answers: To Be Discussed in LAB

Part 7. [10 points] Consider the simple C8051F020 microcontroller-based temperature control shown below. The user selects the value of the temperature and puts it as an 8-bit INPUT that is connected to PORT 1 while the temperature measured is converted to an 8-bit digital value and connected to PORT 2. The microcontroller can turn the heater ON by setting pin P2.3 and OFF by resetting the same pin. Design a project that would enable the ON/OFF control of the heater to adjust the temperature to exactly the value read by INPUT. Control should work as follows:

1. Read INPUT
2. Read ADC
3. Compare INPUT to ADC
4. Turn Heater ON if INPUT > ADC
5. Turn Heater OFF if INPUT < ADC



Answer: To Be Discussed in LAB
