Medical Electronics I Mid-Term Exam – Solution Guide

Time Allowed: 1 Hour – Open-Book/Open-Notes

December 1, 2008

Solve as Much as You Can – Maximum Grade: 100 Points

Q1. Answer the following questions by marking the best answer among the choices given (2 pts each):

1. C8051F020 microcontroller memory location 0F0H when accessed using indirect addressing mode refers to a …
   a. Special function register
   b. General purpose RAM location (*)
   c. Far address
2. For reliable timing in C8051F020 applications, one should use a system clock based on …
   a. RC oscillator
   b. Crystal oscillator (*)
   c. The microcontroller's own internal oscillator
3. Watchdog timer must be periodically … in order for the program using it to run correctly.
   a. Restarted (*)
   b. Disabled
   c. Checked
4. Using a 3.3V microcontroller, one can make a GPIO pin provide high current output 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.
5. GPIO pins can be used for input data transfer when they are configured as …
   a. Open-drain mode with internal weak pull-ups (*)
   b. Open-drain mode with external pull-ups
   c. Push-pull mode
6. When the microcontroller running from an external crystal oscillator finds out that its external clock source is invalid, …
   a. It switches automatically to internal oscillator
   b. It can be configured to reset (*)
   c. It causes a flag to be raised for the program to repair the problem.
7. Lowest cost clock source for C8051F020 is based on …
   a. RC oscillator
   b. CMOS clock
   c. Internal clock (*)
8. To enable synchronization between multiple devices, a … source is used.
   a. CMOS clock (*)
   b. RC oscillator
   c. Crystal oscillator

Q2. Mark the following statement as either True (T) or False (F) (1 point each):

1. The C8051F020 can be configured to start using an external crystal oscillator upon reset. (F)
2. UART serial communication requires the microcontroller to use an external crystal oscillator (T)
3. The output from logical operations is always a Boolean value. (T)
4. The operands of a relational operation must be Boolean. (F)
5. The memory locations above 080H can only be accessed using indirect addressing. (T)

6. SiLabs Virtual tools can be used in assembly language programs to debug the code. (F)
7. Default C8051F020 GPIO state upon reset is Push-Pull (F)
8. Any C8051F020 microcontroller program must run at least a short while with a clock speed of 2MHz. (T)
9. C8051F020 is a mixed-signal microcontroller because it can accommodate different logic levels. (F)
10. The C8051F020 instruction `MOV` can be used to move 16 bit data from its source to its destination. (T)

Q3. Denote the following C8051F020 microcontroller instructions as either being true (T) or false (F) assembly instructions. [2 point each]

1.	`ADD`	`A, F0H`	(T)
2.	`MOV`	`70H, 060H`	(T)
3.	`MOV`	`@R0, A`	(T)
4.	`ADD`	`A, #300H`	(F)
5.	`RLC`	`R0`	(F)
6.	`DJNZ`	`#30H, 70H`	(F)
7.	`CPL`	`P2.4`	(T)
8.	`COUNT`	`EQU R3`	(F)
9.	`PUSH`	`A`	(T)
10.	`XCH`	`A, 05AH`	(T)

Q4. Compute the output of the following operations in a C Language program for a C8051F020 device [2 point each]

1. `00100100b & 10100001b` (ans: 00100000b)
2. `0F0H ‖ 05AH` (ans: Logic 1 (Boolean))
3. `055H >= 0A0H` (ans: Logic 0)
4. `~0AAH` (ans.: 55H)
5. `00100100b ^ 10100001b` (ans: 10000101b)
6. `!(00100100b | 00000001b)` (ans: Logic 0)
7. `(0F0H & 080H) >= 0` (ans: Logic 1)
8. `0F1H % 02H` (ans: numerical 1)
9. `17<<2` (ans: 17x4= 68)
10. `(0FEA0H && 080H)` (ans: Logic 1)

Q5. [10 points] Write a C8051F020 assembly code part that configures the clock source to be an external crystal clock source with frequency 22.1184 MHz.

Block diagram on page 9 of Lecture 5. Implementation of the 4 parts of the block should be straight forward.

Q6. [8 Points] Write C8051F020 assembly code lines to do the following tasks:

a. Delay of 5 clock cycles. (5 NOP statements)
b. Configuration of P4.3 to be an open-drain with internal weak pull-up. (similar to lab1 but for P4.3)
c. Configuration of internal oscillator to generate a frequency of 8 MHz. (IFCN0-1 should be 10)
