

Final

Introduction to Embedded System Programming

NAME:

STUDENT ID:

SFR	7	6	5	4	3	2	1	0
IE	EA			ES	ET1	EX1	ET0	EX0
TCON	TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0
TMOD	GATE	C/T	M1	M0	GATE	C/T	M1	M0

Description	Interrupt #
EX0	0
T0	1
EX1	2
T1	3

- (8 pts) Draw the schematic for the following 8051 with the minimum connections and components necessary to start up. Please label (give values) for all components. The following system requirements are necessary: Power and Ground (include proper bypass/decoupling), Power-On Reset, 11.0592Mhz Crystal Circuit, Programming Voltage

1	P1.0	VCC	40
2	P1.1	P0.0/AD0	39
3	P1.2	P0.1/AD1	38
4	P1.3	P0.2/AD2	37
5	P1.4	P0.3/AD3	36
6	P1.5/MOSI	P0.4/AD4	35
7	P1.6/MISO	P0.5/AD5	34
8	P1.7/SCK	P0.6/AD6	33
9	RST	P0.7/AD7	32
10	P3.0/RXD	$\overline{EA}/VPP$	31
11	P3.1/TXD	ALE/ $\overline{PROG}$	30
12	P3.2/ $\overline{INT0}$	$\overline{PSEN}$	29
13	P3.3/ $\overline{INT1}$	P2.7/A15	28
14	P3.4/T0	P2.6/A14	27
15	P3.5/T1	P2.5/A13	26
16	P3.6/ $\overline{WR}$	P2.4/A12	25
17	P3.7/ $\overline{RD}$	P2.3/A11	24
18	XTAL2	P2.2/A10	23
19	XTAL1	P2.1/A9	22
20	GND	P2.0/A8	21

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2) (2 pt) For the following instruction, list the timer being used and It's mode.

MOV TMOD, #A0H

Timer#: _____

Mode# and Name of Mode: _____

3) (2 pt) Given that an 10Mhz crystal is connected to the 8051 and you are using Timer 0 in Mode 1 - 16bit. What value would have to be written to TH0 and TL0 in order to cause an overflow after 7.5ms from when the timer is started?

TH0 = _____ TL0 = _____

4) (2 pt) Given that a 16Mhz crystal is connected to the 8051 and you are using Timer 0 in Mode 1 - 16bit. If TH0 and TL0 were initialized as follows:

TH0 = A5H, TL0 = 42H

How long would it take for the Timer to overflow (specify units in ms)? _____ms

5) (2 pt) Short Answer - What is the best reason to use an interrupt versus polling?

6) (3 pts) Write 1 line of C code to set P0.5 without affecting any other bits and it must use a logical shift.

7) (3 pts) Write 1 line of C code to clear P1.2 without affecting any other bits without using a logical shift.

8) (6 pts) Write 1 line of C code to toggle P0.6 without affecting any other bits.

9) (6 pts) Write the C code to set P1.4 and clear P1.3 in one line, without affecting any other bits.

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10) (8 pts) Write a for-loop(s) using only unsigned chars that executes a piece of code 65538 iterations. Label where the instruction would execute 65538 times with a comment that says "critical section".

11) (10 pt) Write the complete program for an 8051 with a 11.0592Mhz clk to generate a square wave of 4.6KHz on pin P1.2. You must use the Timer 0 interrupt and the Timer should be used in 8-bit mode.

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12) (20pts) Period Measurement of External Square Wave

We want an 8051 MCU running from a 12Mhz crystal to measure and display the period of an incoming Square Wave. The Square Wave is 0v to 5v and may range from 0Hz to 15Hz, it could come from a function generator or any other source. The display is handled by 16 LEDs connected to P0 and P1, where the 8 Upper Bits are on P1 and the 8 Lower Bits are on P0. The Square Wave is connected to P3.2 (External Hardware Interrupt 0). Timer0 should be used in 16-bit mode. Write a program where the External Hardware Interrupt will trigger on the falling edge of the Square Wave. Write the Main function that initializes the Peripherals, also write the ISR that grabs the Timer0 value, resets the timer for the next cycle, takes the value and displays it on the 16 LEDs.

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13) (6pt) Convert 56506_{10} to Hex (You MUST Show your work):

14) (6pt) Convert $ABCD_{16}$ to Dec (You MUST Show your work):

15) (4pt) What is the frequency of a clock with a period of 25uS _____

16) (4pt) What is the period of a 78Khz clock? _____

17) (4pt) A crystal generates what kind of a wave _____

18) (4pt) This type of a circuit converts a crystal to a usable clock _____

19) (4pts) Create and label two columns, then list the differences between Microprocessors and Microcontrollers.

20) (4pts) Define an Embedded System.