Shanghai University, Year 2012～2013, Spring Semester, Final Exam Paper A

Course Name：Microprocessors and Embedded Microcontrollers

Score
答案卷

Course Code：_23325032_ Credit：_6_

应试人声明：

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Student Name_____ Student number_____

PROBLEM	1	2	3	4	5	6	7	8	9
Score									

Notes to candidates:

1) Write your answer on the examination paper using pen or ball point pen and return it at the end of the examination.

2) The following SFRs might be used in this exam.

SFR	D7	D6	D5	D4	D3	D2	D1	D0
IE	EA	-	ET2	ES	ET1	EX1	ET0	EX0
IP	-	-	PT2	PS	PT1	PX1	PT0	PX0
SCON	SM0	SM1	SM2	REN	TB8	RB8	TI	RI
TCON	TF1	TR1	TF0	TR0	IE1	IT1	IE0	IT0
TMOD	GATE	C/T	M1	M0	GATE	C/T	M1	M0

Problem 1 (20 points):

*Problem 1 contains **TEN** questions. Candidates should answer **ALL** the questions. (**2 marks for each question**)*

1. If a microcontroller is with an 24-bit address bus, then the data space which can be addressed by the computer is 2^{24} bytes, namely, __16__ megabytes?

2. Which of the following are **TRUE** statements about the 8051 microcontroller?__2__

1) 0 and 5 V digital pulses can be transferred on the telephone without being converted (modulated).

2) Dynamic RAM It must be refreshed periodically. While it is being refreshed, the data cannot be accessed.

3) The data bus and control buses are bidirectional.

4) All the ports upon RESET are configured as output ports.

5) The longer the cable, the higher the data transfer baud rate.

3. In the 8051 addressing mode, the offset of the relative address is from __-128__ to __127__.

4. Which of the following instructions are legal ?__1__
1) MOV 25H, #25H   2) ADD R7, R4
3) MOV R9, #50H   4) MOVX A, 80H
5) ADDC A, #500   6) MOV @R3, #03H

5. Suppose SP=0AH originally and internal RAM locations 09H and 0AH contain the values 30H and 01H respectively. After the instruction RETI is executed, the SP will be __08H__ and PC will be __0130H__.

6. Every 8051 family member wakes up at address __0000H__ when it is powered up.

7. In 8051 assembly programming, after adding packed BCD numbers, the result is no longer BCD, therefore, the instruction __DA A__ must be used after the addition of BCD operands.

8. If an 8051 is rate as 25MHz, which of the following frequency can be connected to the microcontroller ? __1,2__
1) 15MHz   2) 25MHz
3) 35MHz   4) 50MHz

9. The hexadecimal number of the decimal number **2022** is __7E6__. The 2's complement of the hexadecimal number **4A** is __36H (00110110)__.

10. The decimal number -23 is represented by the assembler as __2__. The decimal number -128 is represented by the assembler as __5__.
1) 10001100   2) 11101001   3) 11100100
4) 100010111   5) 10000000   6) 01111111

Problem 2 (24 points):

*Problem 2 contains six questions. Candidates should answer **ALL** questions.* (**4 marks for each question**)

1) Assume accumulator A contains 56H. What are the results in accumulator A after the following instructions execute, respectively?

   1) XRL A, 0FF   **2) ANL A, 0FH**

   3) ORL A, 0FH   **4) CPL   A**

Solution:

    A9H   06H   5FH   A9H

                                (1 point each)

2) Assuming XTAL = 12MHz, indicate when the TF0 flag is raised for the following program.

```
MOV     TMOD, #01
MOV     TL0, #1BH
MOV     TH0, #FFH
SETB    TR0
```

Solution: FFFFH-FF1BH+1H=00E5H=229; T=1/f=1us; 229*1us=229us

        The TF0 flag is raised after 229us

3) Find the time delay for the delay subroutine shown to the right, if the system frequency is 12 MHZ.

```
DELAY:    MOV   R2, #100
AGAIN:    MOV   R3, #150
HERE:     NOP
          NOP
          DJNZ   R3, HERE
          DJNZ   R2, AGAIN
          RET
```

Answer:

        T=12*1/f=1μs

    The delay time is 1+100*(1+150*4+2)+1=60302 machine cycles=60302μs

4) For the instruction

        LCALL LOC_SUB

If SP=0AH initially and the label "LOC_SUB" is at program memory location 0300H, after executing the instruction at location 0102H, what values are in the SP, PC, and internal RAM locations 0BH and 0CH.

Solution: SP = 0CH,   PC = 0300H,

(0BH) = 05H,   (0CH) = 01H (1 point each)

5) Write down the priority of the six interrupts in 8051 after the instruction **MOV IP , #00001010B** is run.

Solution: RST   T0   T1   INT0   INT1   Serial

6). Find the CY and AC flags for each of the following.

(e)   MOV A, #0EFH   (f)   CLR C

     SETB C   MOV A, #0FEH

     ADDC A, #0   ADDC A, #17

                              ADDC A, #0

Solution:

(e) CY: 0   (f) CY: 0

    AC: 1   AC: 1

Problem 3 (6 points)

Find the result at points (1), (2), and (3) in the following code?

```
        CJNE A, #AAH, COMP
              …                    ;point (1)
COMP:   JNC NEXT
              …                    ;point (2)
NEXT:     …                        ;point (3)
```

Solution:

    Point(1)   A = #AAH

    Point(2)   A < #AAH

    Point(3)   A > #AAH

Problem 4 (15 points)

The following program is used to add the augend 55 and 66 in RAM locations 40H and 41H with the addend 66 and 88 in RAM locations 50H and 51H, and then store the sum of the addition into RAM locations 50H、51H and 52H. Fill in the following blanks. (1 point for each blank in the code, 0.5 point for each blank in the results)

Source code		Address	The results	
			The first cycle	The second cycle
ORG	0000H			
START:MOV	R0,#40H	0000H	(R0)= 40H	
MOV	R1,#50H	0002H	(R1)= 50H	
MOV	R2,#2	0004H	(R2)= 02H	
<u>CLR</u>	C	0006H	(CY)= 0	
LOOP: MOV	A,@R0	0007H	(ACC)= 55H	(ACC)= 66H
<u>ADDC</u>	A,@R1	0008H	(ACC)= BBH	(ACC)= EFH
DA	<u>A</u>	0009H	(ACC)= 21H	(ACC)= 55H
MOV	@R1,A	000AH	((R1))= 21H	((R1))= 55H
INC	R0	000BH	(R0)= 41H	(R0)= 42H
INC	R1	000CH	(R1)= 51H	(R1)= 52H
DJNZ	R2,<u>LOOP</u>	000DH	(R2)= 01H	(R2)= 00H
CLR	A	000FH	(ACC)= 00H	
ADDC	A,#0	0010H	(ACC)= 01H	(CY)= 1
MOV	@R1,A	0012H	((R1))= 01H	
NOP				
END				

Problem 5 (6 points)

Assuming XTAL = 12 MHz, write a 8051 program to generate a square wave on pin P1.3 using timer 0 in mode 2.

```
        ORG   0000H
MAIN:   MOV   SP, #60H
        MOV   TMOD, #02H    (0.5point)
        MOV   TL0, #E7H
        MOV   TH0, #E7H
LOOP:   SETB    TR0         (0.5point)
```

LOOP1: <u>JNB   TF0, LOOP1</u>   (1point)
      CLR   TR0
      <u>CPL   P1.3</u>   (0.5point)
      CLR   <u>TF0</u>   (0.5point)
      SJMP   <u>LOOP</u>   (0.5point)
      <u>END</u>   (0.5point)

The frequency of the square wave is: (2 points)
  N = 25, f = 1/(50us) = 20KHz

Problem 6 (5 points)

Program timer 1 to be an event counter. Set the initial count to 10. Use mode 1 and display the binary count on P1 and P2 continuously until the count reaches 0000H.

```
        MOV   TMOD , #50H     (1point)
        MOV   TH1, 00H        (0.5point)
        MOV   TL1, 0AH        (0.5point)
        SETB   TR1            (1point)
LOOP:   MOV   A, TL1
        MOV   P1, A
        MOV   A, TH1
        MOV   P2, A
        JNB   TF1, LOOP       (1point)
        CLR   TR1             (0.5point)
        CLR   TF1
        END                  (0.5point)
```

Problem 7 (4 points)

Calculate the total number of bits transferred if 100 pages of ASCII data are sent using asynchronous serial data transfer. Assume a data size of 8 bits, 1 stop bit, no parity. Assume each page has 48×20 of text characters. How long will the data transfer take if the baud rate is 9600?

Solution:
  100*48*20*(8+2)=960000 bits (2 points)
  T = 960000/9600 =100s (2 points)

Problem 8 (10 points)

The following program is written for the 8051 to get data from P1 and send it to P2 continuously while incoming data from the serial port is send to P0. Assume crystal frequency to be 11.0592MHz and SMOD = 1. Set the baud rate at 4800. Calculate the initial value in TH1. Fill in the following blanks. (Hint: SMOD = 0, baud rate at 9600, then TH1 = FD).

```
        ORG   0000H
        LJMP  MAIN            1 point
        ORG   0023H
        LJMP  SP_ISR          1 point

        ORG   0030H
MAIN: MOV   IE, #10010000B    0.5 point
        MOV   P1, #0FFH        0.5 point
        MOV   TMOD, #20H       0.5 point
        MOV   TH1, #0F4H
        MOV   SCON, #50H       0.5 point
        SETB  TR1             0.5 point
HERE: MOV   P2, P1
        SJMP  HERE

 SP_ISR:JB_TI, TRANS          0.5 point
        MOV   P0, SBUF         0.5 point
        CLR   RI               0.5 point
        RETI
TRANS:  CLR   TI               0.5 point
        RETI                   0.5 point
        END
```

The initial value in TH1 should be: (3 points)
$TH1 = -12 = F4H$

Problem 9 (10 points):
Answer the following questions:
(1) In the 8051 which port provides the A0 – A7 address bits? (1 points)
(2) In the 8051 which port provides the A8 – A15 address bits? (1 points)
(3) In the 8051 which port provides the D0 – D7 data bits? (1 points)
(4) Which signal must be used in fetching data from external RAM? (a) RD (b) WR (c) PSEN (1 points)

(5) Write a program to transfer 100 bytes of data from external data ROM to external data RAM. The external data ROM address is 3000H, and the external data RAM starts at 8000H. (Hint: the address of DPL is 82H) (6 points)

Solution:
(1) P0 provides the A0 – A7 address bits.
(2) P2 provides the A8 – A15 address bits.
(3) provides the D0 – D7 data bits.
(4) It's RD
(5)
```
            ORG 0000H
            MOV R0, #00H
LOOP:       MOV DPH, #30H
            MOV 82H, R0          ; the address of DPL is 82H
            CLR A
            MOVX A, @DPTR
            MOV DPH, #80H
            MOVX @DPTR, A
            INC R0
            CJNE R0, #100, LOOP
            END
```