

**EE 308 – Homework 6**

1. The table below shows the contents of memory an MC9S12. Identify the return address to the main program if:

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
<b>1FD0</b>	AC	23	65	87	23	92	BA	E5	3A	12	90	42	22	50	91	23
<b>1FE0</b>	B2	A6	C1	25	90	F2	C2	69	99	01	B2	C2	76	23	22	54
<b>1FF0</b>	75	43	20	C4	21	D0	23	24	A5	29	BC	B1	21	70	32	61
<b>2000</b>	B5	2D	24	DC	82	A3	5B	9A	CA	3A	9F	2C	60	11	4C	4F

(a) The MC9S12 is in subroutine sub2 which was called by subroutine sub1. The subroutines did not put anything else onto the stack. The stack pointer has a value of 0x1FF2. What is the return address to the main program (from where sub1 was called)?

(b) The MC9S12 is in an interrupt service routine my\_isr that interrupted the main program. The stack pointer has a value of 0x1FF5. What is the return address to the main program? What were the values of the X, Y, A and B registers at the time of the interrupt? What was in the condition code register?

(c) The MC9S12 is in a subroutine sub3 that pushed both X and Y onto the stack (in that order). The stack pointer has a value of 0x1FD8. What is the return address the main program (from where sub3 was called? What were the values of the X and Y register when sub3 was called?

3. The prescaler bits of the TSCR2 register are set to PR2:0 = 100. The first time the TCNT register is read the value is 0xA23C. The next time the TCNT register is read, the value is 0x251A. Assuming the time between reads was less than the overflow period of the counter, how much time (in seconds) passed between the two reads?

4. An MC9S12 has the following data in its memory:

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
<b>FFC0</b>	AC	23	65	87	23	92	BA	E5	3A	12	90	42	22	50	91	23
<b>FFD0</b>	B2	A6	C1	25	90	F2	C2	69	09	01	B2	C2	76	23	22	54
<b>FFE0</b>	75	43	20	C4	21	D0	23	24	A5	29	BC	B1	21	70	32	61
<b>FFF0</b>	25	2D	24	DC	82	A3	5B	9A	CA	3A	9F	2C	60	11	20	4F

(a) What happens to the program counter when the MC9S12 is powered up or reset? What is the address of the first instruction the MC9S12 will execute after a reset?

(b) What is the address of the first instruction the MC9S12 will execute when it receives a Timer Overflow interrupt?

(c) What is the address of the first instruction the MC9S12 will execute when it receives a SPI0 interrupt?

(d) What is the address of the first instruction the MC9S12 will execute when it receives a Real Time interrupt?

5. Below are the values of some timer registers in the MC9S12:

TSCR1	TSCR2	TIE	TCLT1	TCTL2	TCTL3	TCTL4	TFLG1	TFLG2
00	87	05	C2	A4	5F	76	15	00

(a) Is the Timer enabled?

(b) Is the Timer Overflow Interrupt enabled?

(c) Is the Timer Overflow Flag set?

(d) What is the overflow time for the TCNT register; i.e., how long does it take for the TCNT register to count from 0x0000 to 0xFFFF, then back to 0x0000?

6. Write some assembly language code which will enable the timer subsystem, set the timer overflow rate to about 87 ms, and enable the timer overflow interrupt.

7. Write some C code which will enable the real time interrupt and set the real time interrupt rate to about 57 ms.