EE 308 - Exam 2

March 7, 1997

Name: _____

You may use any of the Motorola data books. No calculators allowed. Show all work. Partial credit will be given. No credit will be given if an answer appears with no supporting work.

1. Consider the timer subsystem of an HC11 with a 2 MHz E-clock.

   (a) Without adjusting the prescaler, what is the longest time interval the HC11 can measure (without the timer wrapping around)? _____

   (b) If you change the prescaler, what is the longest time interval the HC11 can measure (without the timer wrapping around)? _____

   (c) What value does the prescaler have to have to measure this length of time? What special consideration do you need to observe when adjusting the prescaler? _____

   (d) Write some C code which will set the prescaler to the value needed in the above part.

   (e) Write some C code which will capture the time of a rising edge on Port A Bit 0, and generate an interrupt when this happens. This code should not affect any of the other timer subsystem functions.

   (f) What physical pin on the HC11 (on your EVBU) does Port A Bit 0 correspond to? _____

   (g) Write some C code to clear the Output Capture 3 flag. This code should not clear any of the other timer flags.

2. The following tables show the values of an HC11's registers and some of its memory.

Reg	-	-
	S X H I N Z V C	
CCR	1 0 0 0 0 1 0 1	
A:B	A3	92
X	82F2	
Y	12F7	
SP	208D	
PC	31F4	

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2070	14	00	B7	23	B4	67	30	18	8F	FE	22	02	5C	E7	03	26
2080	0F	CC	A6	04	1B	9D	3F	12	20	EC	02	BD	00	1E	3C	96
2090	73	10	03	86	40	B7	10	25	3B	38	9A	05	F2	20	A5	ED
20A0	7A	10	04	86	80	B7	10	25	3B	38	9A	05	F2	20	A5	ED
FFD0	20	20	20	30	20	40	20	50	20	60	20	70	20	80	20	90
FFE0	21	A0	21	B0	30	D0	32	F0	21	00	21	10	21	20	21	30
FFF0	20	A0	21	50	21	60	21	70	21	80	21	90	21	A0	30	00

PACTL	TMSK1	TMSK2	TCTL1	TCTL2
02	41	83	4E	1B

(a) What is the address of the first instruction the HC11 will execute after a reset? _____

(b) How often will the timer overflow? _____

(c) How often will the RTI flag be set? _____

(d) Which timer interrupts are enabled? _____

(e) What will happen to Port A Bit 6 when `TCNT = TOC2`? _____

(f) What will happen to Port A Bit 5 when `TCNT = TOC3`? _____

(g) What will happen to Port A Bit 4 when `TCNT = TOC4`? _____

(h) Will `TIC1` capture the time of a changing edge on Port A Bit 2? If so, what edge?
_____

(i) Will `TIC2` capture the time of a changing edge on Port A Bit 1? If so, what edge?
_____

(j) Will `TIC3` capture the time of a changing edge on Port A Bit 0? If so, what edge?
_____

(k) Write down the instructions in the RTI interrupt service routine.

(l) Write down the instructions in the TOI interrupt service routine.

(m) Assume the Real Time Interrupt Flag is set when the memory and registers are as shown above.. Show what will be in the HC11's memory and registers when the HC11 gets to the first instruction in the interrupt service routine (before it actually executes that instruction). You only have to fill in blanks where registers or memory was changed.

Reg	-	-		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	S X H I N Z V C		2070																
CCR			2080																
A:B			2090																
X			20A0																
Y			FFD0																
SP			FFE0																
PC			FFF0																

3. A 68HC11 is used to count the number of people entering a room. Every time some one enters the room, a pulse will be generated. You are asked to connect this pulse to one of your input capture pins. Write a program which will generate an interrupt when someone enters the room, and display the number of people in the room on LEDs connected to Port C. When the program is started the room is empty. (Don't worry about decrementing Port C when someone leaves – maybe this is a prison, and when someone goes in, they can't get out again).

   (a) Which input capture pin are you going to use? What pin on the HC11 should you connect the pulse to? _____

   (b) List at least six things you need to do in software to use interrupts on the HC11.

   (c) Here is the start of your program. Finish writing the program. Be sure to include all the steps you listed above.

```
#include <hc11.h>

main()
{
   while (1)
   {
   }
}
```