Homework 11

1 **Find the memory and I/O (if available) addresses of the following timer/counter related registers from ATmega328P Register Summary (in the back of the booklet):**

Mem. Address I/O Address

TCNT0 0x46 0x26

TCCR0A 0x44 0x24

TCCR0B 0x45 0x25

OCR0A 0x47 0x27

OCR0B 0x48 0x28

TIMSK0 0x6E

TCNT1H 0x85

TCNT1L 0x84

TCCR1A 0x80

TCCR1B 0x81

TCCR1C 0x82

OCR1AH 0x89

OCR1AL 0x88

OCR1BH 0x8B

OCR1BL 0x8A

TIMSK1 0x6F

TCNT2 0xB2

TCCR2A 0xB0

TCCR2B 0xB1

OCR2A 0xB3

OCR2B 0xB4

TIMSK2 0x70

**2 Read Section 14 Interrupts and Timers of the booklet and answer the following questions.**

2.1 What are the benefits of the interrupts mechanism in a computer?

- An interrupt mechanism in a computer allows the system to respond instantly to stimuli

2.2 Explain what is an interrupt vector.

- An interrupt vector is the address that the program counter jumps to when a certain interrupt occurs

2.3 Why does an interrupt service routine (ISR) need to save all register it uses including SREG?

- Because an interrupt can occur between any two instructions. The ISR must preserve any registers it changes including SREG so that the interrupted program can be sure the values of everything remain the same between instructions.

2.4 Write an ISR for TIMER2\_COMPB event so that a two-byte integer at memory location 0x0200 (low byte) and 0x0201 (high byte) will be increased by one every time the ISR is invoked. Please give both C and assembly code.

- Assembly:

push r18

in r18, SREG

push r18

push r19

push r20

ldi r18, 1

lds r19, 0x0200

lds r29, 0x0201

add r19, r18

brcc no\_carry

add r20, r18

no\_carry:

pop r20

pop r19

pop r18

out SREG, r18

pop r18

C:

Int\* ptr = (int\*) 0x0200;

\*ptr += 1;