Brandon Wade

CPE301 – SPRING 2016

Design Assignment 2

**DO NOT REMOVE THIS PAGE DURING SUBMISSION:**

The student understands that all required components should be submitted in complete for grading of this assignment.

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| --- | --- | --- | --- |
| **NO** | **SUBMISSION ITEM** | **COMPLETED (Y/N)** | **MARKS**  **(/MAX)** |
| 0. | COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS |  |  |
| 1. | INITIAL CODE OF TASK 1/A |  |  |
| 2. | INCREMENTAL / DIFFERENTIAL CODE OF TASK 2/B |  |  |
| 3. | INCREMENTAL / DIFFERENTIAL CODE OF TASK 3/C |  |  |
| 4. | INCREMENTAL / DIFFERENTIAL CODE OF TASK 4/D |  |  |
| 5. | INCREMENTAL / DIFFERENTIAL CODE OF TASK 5/E |  |  |
| 6. | SCHEMATICS |  |  |
| 7. | SCREENSHOTS OF EACH TASK OUTPUT |  |  |
| 8. | SCREENSHOT OF EACH DEMO |  |  |
| 9. | VIDEO LINKS OF EACH DEMO |  |  |
| 10. | GOOGLECODE LINK OF THE DA |  |  |
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| --- | --- | --- | --- |
| 0. | COMPONENTS LIST AND CONNECTION BLOCK DIAGRAM w/ PINS |  |  |

Atmel Studio 7.0

ATMega328P Chip

LED Bar

10x Resistors

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | INITIAL CODE OF TASK 1/A |  |  |

;

; DA2.asm

; Task 1 ASM

; Created: 3/6/2016 11:36:31 AM

; Author : Brandon

;

LDI R16, 0x01

OUT DDRC, R16 ; PortC configured for output

LDI R16, 0x00 ; will hold PortC signals

OUT PORTC, R16 ; initialize PortC to 0

LDI R18, 0x01 ; will be used to toggle PC0

BEGIN:

RCALL DELAY ; wait for .25 seconds

EOR R16, R18 ; toggle signal

OUT PORTC, R16 ; output

RJMP BEGIN ; loop forever

DELAY:

LDI R23, 0x85

STS TCNT1H, R23

LDI R23, 0xEE

STS TCNT1L, R23 ; set initial count of timer

LDI R23, 0x00

STS TCCR1A, R23 ; normal mode

LDI R23, 0x03

STS TCCR1B, R23 ; start timer with 1024 ps

AGAIN:

IN R23, TIFR1 ; check for overflow

SBRS R23, TOV1 ; if overflow, exit loop

RJMP AGAIN ; loop till overflow

LDI R23, 0x00

STS TCCR1B, R23 ; turn off timer

LDI R23, 0x01

OUT TIFR1, R23 ; clear overflow flag

RET

|  |  |  |  |
| --- | --- | --- | --- |
| 1. | INITIAL CODE OF TASK 1/B |  |  |

/\*

\* DA2T1C.c

\*

\* Created: 3/7/2016 10:47:19 AM

\* Author : Brandon

\*/

#define *F\_CPU* 8000000UL

#include <avr/io.h>

#include <util/delay.h>

int main(void)

{

DDRC |= 0x01; // PORTC configured to output mode

PORTC = 0x00; // PORTC initialized to 0

while (1)

{

TCNT1H = 0x85;

TCNT1L = 0xEE; // Set Count

TCCR1A = 0x00; // Normal Mode

TCCR1B = 0x03; // Set Pre Scalar

while((TIFR1 & 0x01) == 0); // Wait for flag

TCCR1A = 0x00;

TIFR1 |= 1<<TOV1; // Clear flag

PORTC ^= 0x01; // toggle PC0

}

}

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | INITIAL CODE OF TASK 2/A |  |  |

;

; DA2.asm

; Task 2 ASM

; Created: 3/6/2016 11:36:31 AM

; Author : Brandon

;

LDI R16, 0xFF

OUT DDRB, R16 ; PortB configured for output

LDI R16, 0x01

OUT DDRC, R16 ; PortC configured for output

LDI R16, 0x00 ; will hold PortC signals

OUT PORTB, R16 ; initialize PortB to 0

OUT PORTC, R16 ; initizlize PortC to 0

LDI R17, 0x00 ; holds current count

LDI R18, 0x01 ; will be used to toggle PC0

BEGIN:

RCALL DELAY ; wait for .25 seconds

EOR R16, R18 ; toggle signal

OUT PORTC, R16 ; output

SBRS R16, 0

RJMP SKIP\_INC ; only increment on rising edge

INC R17 ; increment count

OUT PORTB, R17 ; output

SKIP\_INC:

RJMP BEGIN ; loop forever

DELAY:

LDI R23, 0x85

STS TCNT1H, R23

LDI R23, 0xEE

STS TCNT1L, R23 ; set initial count of timer

LDI R23, 0x00

STS TCCR1A, R23 ; normal mode

LDI R23, 0x03

STS TCCR1B, R23 ; start timer with 1024 ps

AGAIN:

IN R23, TIFR1 ; check for overflow

SBRS R23, TOV1 ; if overflow, exit loop

RJMP AGAIN ; loop till overflow

LDI R23, 0x00

STS TCCR1B, R23 ; turn off timer

LDI R23, 0x01

OUT TIFR1, R23 ; clear overflow flag

RET

|  |  |  |  |
| --- | --- | --- | --- |
| 2. | INITIAL CODE OF TASK 2/B |  |  |

/\*

\* DA2T1C.c

\*

\* Created: 3/7/2016 10:47:19 AM

\* Author : Brandon

\*/

#define *F\_CPU* 8000000UL

#include <avr/io.h>

#include <util/delay.h>

int main(void)

{

DDRC |= 0x01; // PORTC configured to output mode

DDRB |= 0xFF;

PORTC = 0x00; // PORTC initialized to 0

PORTB = 0x00; // PORTB initialized to 0

while (1)

{

TCNT1H = 0x85;

TCNT1L = 0xEE; // set count

TCCR1A = 0x00; // normal mode

TCCR1B = 0x03; // set pre scalar

while((TIFR1 & 0x01) == 0); // wait for flag

TCCR1A = 0x00;

TIFR1 |= 1<<TOV1; // reset flag

PORTC ^= 0x01; // toggle PC0

if(PORTC & 0x01)

PORTB++; // increment count

}

}

|  |  |  |  |
| --- | --- | --- | --- |
| 3. | INITIAL CODE OF TASK 3/A |  |  |

;

; DA2.asm

; Task 3 ASM

; Created: 3/6/2016 11:36:31 AM

; Author : Brandon

;

LDI R16, 0xFF

OUT DDRB, R16 ; PortB configured for output

LDI R16, 0x61

OUT DDRC, R16 ; PortC configured for output

LDI R16, 0x00 ; will hold PortC signals

OUT PORTB, R16 ; initialize PortB to 0

OUT PORTC, R16 ; initizlize PortC to 0

LDI R17, 0x00 ; holds current count

LDI R18, 0x01 ; will be used to toggle PC0

LDI R19, 0x20 ; will be used to toggle PC5

LDI R20, 0x40 ; will be used to toggle PC6

LDI R21, 0x00 ; holds modulo 5

LDI R22, 0x00 ; holds modulo 10

BEGIN:

RCALL DELAY ; wait for .25 seconds

EOR R16, R18 ; toggle signal

OUT PORTC, R16 ; output

SBRS R16, 0

RJMP SKIP\_INC ; only increment on rising edge

INC R17 ; increment count

OUT PORTB, R17 ; output

INC R21 ; increment modulo 5

CPI R21, 5

BRNE SKIP\_INC ; only toggle on 5th rising edge

CLR R21 ; clear modulo 5

EOR R16, R19 ; toggle on 5th rising edge

OUT PORTC, R16 ; output

INC R22 ; increment modulo 10

CPI R22, 2

BRNE SKIP\_INC ; only toggle on 10th rising edge

CLR R22 ; clear modulo 10

EOR R16, R20 ; toggle on 10th rising edge

OUT PORTC, R16 ; output

SKIP\_INC:

RJMP BEGIN ; loop forever

DELAY:

LDI R23, 0x85

STS TCNT1H, R23

LDI R23, 0xEE

STS TCNT1L, R23 ; set initial count of timer

LDI R23, 0x00

STS TCCR1A, R23 ; normal mode

LDI R23, 0x03

STS TCCR1B, R23 ; start timer with 1024 ps

AGAIN:

IN R23, TIFR1 ; check for overflow

SBRS R23, TOV1 ; if overflow, exit loop

RJMP AGAIN ; loop till overflow

LDI R23, 0x00

STS TCCR1B, R23 ; turn off timer

LDI R23, 0x01

OUT TIFR1, R23 ; clear overflow flag

RET

|  |  |  |  |
| --- | --- | --- | --- |
| 3. | INITIAL CODE OF TASK 3/B |  |  |

/\*

\* DA2T1C.c

\*

\* Created: 3/7/2016 10:47:19 AM

\* Author : Brandon

\*/

#define *F\_CPU* 8000000UL

#include <avr/io.h>

#include <util/delay.h>

int main(void)

{

DDRC |= 0x61; // PORTC configured to output mode

DDRB |= 0xFF;

PORTC = 0x00; // PORTC initialized to 0

PORTB = 0x00; // PORTB intiialized to 0

int i = 0;

int j = 0; // helpers to keep track of every 5th and 10th pulse

while (1)

{

TCNT1H = 0x85;

TCNT1L = 0xEE; // set count

TCCR1A = 0x00; // normal mode

TCCR1B = 0x03; // set prescalar

while((TIFR1 & 0x01) == 0); // wait for flag

TCCR1A = 0x00;

TIFR1 |= 1<<TOV1; // reset flag

PORTC ^= 0x01; // toggle PC0

if(PORTC & 0x01)

{

PORTB++; // increment count

if(++i == 5)

{

PORTC ^= 0x20; // toggle on 5th

i = 0;

if(++j == 2)

{

PORTC ^= 0x40; // toggle on 10th

j = 0;

}

}

}

}

}

|  |  |  |  |
| --- | --- | --- | --- |
| 4. | INITIAL CODE OF TASK 4/A |  |  |

;

; DA2.asm

; Task 3 ASM

; Created: 3/6/2016 11:36:31 AM

; Author : Brandon

;

.org 0x00

RJMP INIT

.org 0x20

RJMP TCNT1\_overflow ; interrupt

INIT:

LDI R16, 0xFF

OUT DDRB, R16 ; PortB configured for output

LDI R16, 0x61

OUT DDRC, R16 ; PortC configured for output

LDI R16, 0x00 ; will hold PortC signals

OUT PORTB, R16 ; initialize PortB to 0

OUT PORTC, R16 ; initizlize PortC to 0

LDI R17, 0x00 ; holds current count

LDI R18, 0x01 ; will be used to toggle PC0

LDI R19, 0x20 ; will be used to toggle PC5

LDI R20, 0x40 ; will be used to toggle PC6

LDI R21, 0x00 ; holds modulo 5

LDI R22, 0x00 ; holds modulo 10

BEGIN:

LDI R23, 0x85

STS TCNT1H, R23

LDI R23, 0xEE

STS TCNT1L, R23 ; set initial count of timer

LDI R23, 0x00

STS TCCR1A, R23 ; normal mode

LDI R23, 0x03

STS TCCR1B, R23 ; start timer with 1024 ps

LDI R23, 0x01

STS TIMSK1, R23 ; enable timer interrupt

SEI ; enable interrupts

AGAIN:

RJMP AGAIN ; loop forever

TCNT1\_overflow:

LDI R23, 0x01

OUT TIFR1, R23

EOR R16, R18 ; toggle signal

OUT PORTC, R16 ; output

SBRS R16, 0

RJMP SKIP\_INC ; only increment on rising edge

INC R17 ; increment count

OUT PORTB, R17 ; output

INC R21 ; increment modulo 5

CPI R21, 5

BRNE SKIP\_INC ; only toggle on 5th rising edge

CLR R21 ; clear modulo 5

EOR R16, R19 ; toggle on 5th rising edge

OUT PORTC, R16 ; output

INC R22 ; increment modulo 10

CPI R22, 2

BRNE SKIP\_INC ; only toggle on 10th rising edge

CLR R22 ; clear modulo 10

EOR R16, R20 ; toggle on 10th rising edge

OUT PORTC, R16 ; output

SKIP\_INC:

LDI R23, 0x85

STS TCNT1H, R23

LDI R23, 0xEE

STS TCNT1L, R23 ; set initial count of timer

RETI

|  |  |  |  |
| --- | --- | --- | --- |
| 4. | INITIAL CODE OF TASK 4/B |  |  |

/\*

\* DA2T1C.c

\*

\* Created: 3/7/2016 10:47:19 AM

\* Author : Brandon

\*/

#define *F\_CPU* 8000000UL

#include <avr/io.h>

#include <util/delay.h>

#include <avr/interrupt.h>

int i = 0;

int j = 0; // helpers to keep track of 5th and 10th pulses

ISR(TIMER1\_OVF\_vect)

{

TIFR1 |= 1<<TOV1; // reset flag

PORTC ^= 0x01; // toggle PC0

if(PORTC & 0x01)

{

PORTB++; // inc count

if(++i == 5)

{

PORTC ^= 0x20; // toggle on 5th

i = 0;

if(++j == 2)

{

PORTC ^= 0x40; // toggle on 10th

j = 0;

}

}

}

TCNT1H = 0x85;

TCNT1L = 0xEE; // set count

}

int main(void)

{

DDRC |= 0x61; // PORTC configured to output mode

DDRB |= 0xFF;

PORTC = 0x00; // PORTC initialized to 0

PORTB = 0x00; // PORTB initialized to 0

TCNT1H = 0x85;

TCNT1L = 0xEE; // set count

TCCR1A = 0x00; // normal mode

TCCR1B = 0x03; // set pre scalar

TIMSK1 = 0x01; // enable timer interrupt

sei(); // enable global interrupts

while (1) // wait for interrupts, loop forever

{

}

}

|  |  |  |  |
| --- | --- | --- | --- |
| 6. | SCHEMATICS |  |  |

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| --- | --- | --- | --- |
| 7. | SCREENSHOTS OF EACH TASK OUTPUT |  |  |

TASK 1/A:

|  |  |  |  |
| --- | --- | --- | --- |
| 8. | SCREENSHOT OF EACH DEMO |  |  |

TASK 1/A:

Video below

|  |  |  |  |
| --- | --- | --- | --- |
| 9. | VIDEO LINKS OF EACH DEMO |  |  |
| Demo ASM - <https://www.youtube.com/playlist?list=PLp82ERNjD3ZY7RiQE7akGRd7dOT7NSAHC>  Demo C - <https://www.youtube.com/playlist?list=PLp82ERNjD3ZZF0pcgVJH0VDHRdgkJ1ooZ> | | | |
| 10. | GOOGLECODE LINK OF THE DA |  |  |
| https://github.com/wadeb1/KF3HF6ZFMP.git | | | |

**Student Academic Misconduct Policy**

<http://studentconduct.unlv.edu/misconduct/policy.html>

“This assignment submission is my own, original work”.

Brandon Wade