

ECE 376 - Test #1: Name _____

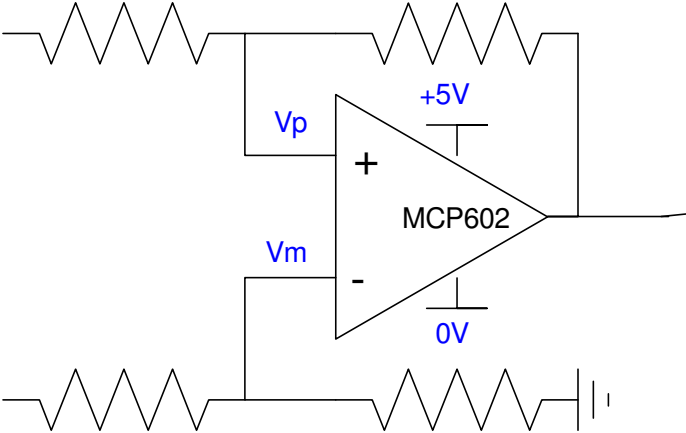
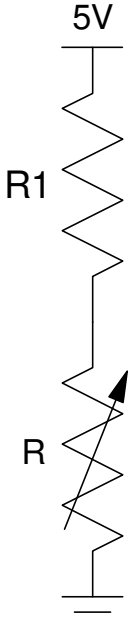
1) **Digital Inputs.** A thermistor has the following resistance vs temperature:

$$R = 1000 \cdot \exp\left(\frac{3905}{T+273} - \frac{3905}{298}\right) \Omega$$

where T is the temperature in degrees Celsius. Design a circuit which outputs:

- +5V when T > 60C
- 0V when T < 58C
- No change for 58C < T < 60C

<p style="text-align: center;">R1</p> <p>1000 + 10(Birth Month) + Birth Date</p> <p>ex: May 14 = 1514 Ohms</p>	<p>R1 = _____</p>
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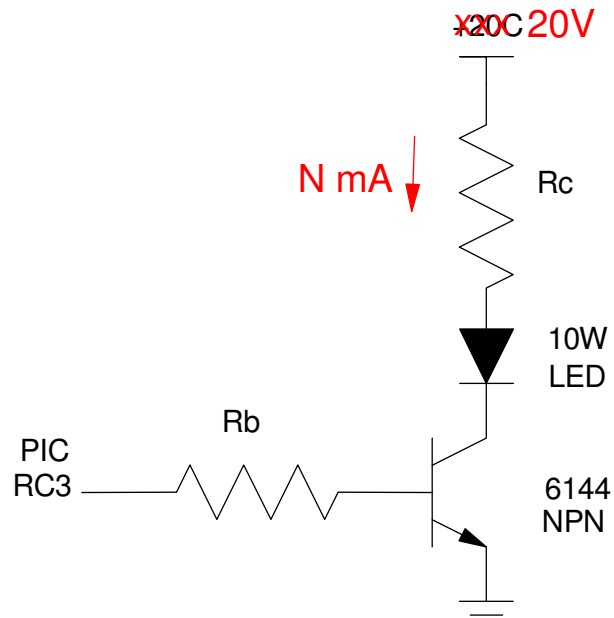
2) Digital Outputs: Determine R_b and R_c so that your PIC can drive a white 10W LED at N mA where N is related to your birthday

- $V_f = 10.0V @ 1A$
- 650 Lumens @ 1A
- $N = 1000 + 10*(\text{birth month}) + (\text{birth date})$.

Assume a 6144 NPN transistor

- $V_{be} = 700mV$
- $V_{ce(sat)} = 360mV$
- Current gain = $\beta = 200$

N mA $1000 + 10*(\text{Birth Month}) + \text{Birth Date}$ ex: May 14th = 1514mA	R_b	R_c



3) **Assembler:** Determine the contents of the W, PORTB, and PORTC registers after each operation.

Assume

- PORTB and PORTC are output.
- Default is decimal

	W	PORTB	PORTC
Start:	0	Birth Month (1..12)	Birth Date (1..31)
movf PORTC,W			
addwf PORTB,W			
addwfc PORTC,F			
andlw 0x05			
movff PORTB,PORTC			
bsf PORTB,4			
btg PORTC,1			

4) Assembler & Timing: Determine the number of clocks the following assembler subroutine takes to execute. Assume MONTH and DAY be your birth month and day.

MONTH (birth month: 1..12)	DAY (birth day: 1..31)	N Number of clocks Wait routine takes

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Wait:
    movlw    150
    movwf   CNT2
W2:
    movlw   MONTH
    movwf  CNT1
    nop
W1:
    movlw   DAY
    movwf  CNT0
    nop
    nop
W0:
    nop
    nop
    nop
    decfsz CNT0,F
    goto   W0

    decfsz CNT1,F
    goto   W1

    decfsz CNT2,F
    goto W2
return
    
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Modify this routine so that it takes 20,000,000 clocks (2 seconds) to execute (+/- 100,000 clocks)

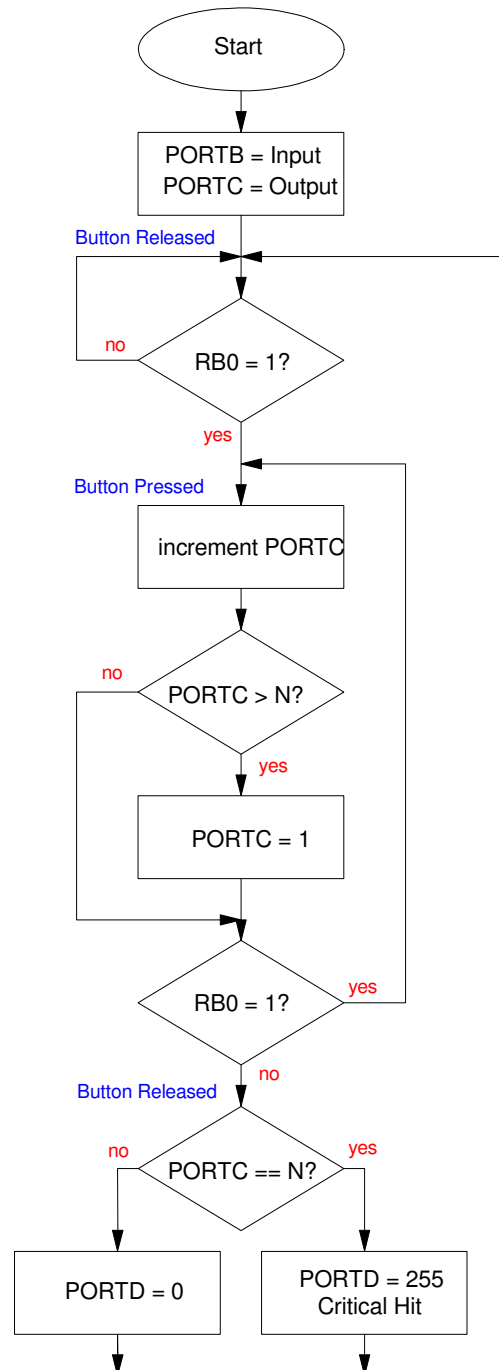
5) Assembler & Flow Charts. Write an assembler program for an electronic N sided die

- Let N be Your Birth Date plus one (1..31 + 1). For example, if you were born on May 14th, N=15
- PORTC outputs a random number from 1..N when you press and release PortB button 0 (RB0)
- PORTD lights turn on if you rolled the maximum number, N (critical hit)

N Birth Date + 1 ex: May 14 = 15 (15 sided die)	N =
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#include <pic18f4620.inc>
TOTAL EQU 0

org 0x800
movlw 0x0F
movwf ADCON1
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Memory Read & Write			
MOVWF	PORTA	memory write	w → PORTA
MOVFF	PORTA PORTB	copy	PORTA → PORTB
MOVF	PORTA,W	memory read	PORTA → W
MOVLW	234	Move Literal to WREG	123 → W
Memory Clear, Negation			
CLRF	PORTA	clear memory	0x00 → PORTA
COMF	PORTA, W	toggle bits	!PORTA → W (bit toggle)
NEGF	PORTA, W	negate	-PORTA → W (2's compliment)
Addition & Subtraction			
INCF	PORTA,F	increment	PORTA + 1 → PORTA
ADDWF	PORTA, F	add	PORTA + W → PORTA
ADDWFC	PORTA, W	add with carry	PORTA + W + carry → W
ADDLW		Add Literal and WREG	
DECF	PORTA,F	decrement	PORTA - 1 → PORTA
SUBFWB	PORTA,F	subtract with borrow	PORTA - W - c → PORTA
SUBWF	PORTA,F	subtract no borrow	PORTA - W → PORTA
SUBWFB	PORTA,F	subtract with borrow	PORTA - W - c → PORTA
SUBLW	223	Subtract WREG from #	223 - W → W
Shift left (*2), shift right (/2)			
RLCF	PORTA,F	rotate left through carry (9-bit rotate)	
RLNCF	PORTA,F	rotate left no carry	
RRCF	PORTA,F	rotate right through carry	
RRNCF	PORTA,F	rotate right no carry	
Bit Operations			
BCF	PORTA, 3	Bit Clear f	clear bit 3 of PORTA
BSF	PORTA, 4	Bit Set f	set bit 4 of PORTA
BTG	PORTA, 2	Bit Toggle f	toggle bit 2 of PORTA
Logical Operations			
ANDWF	PORTA, F	logical and	PORTA = PORTA and W
ANDLW	0x23	AND Literal with WREG	W = W and 0x23
IORWF	PORTA,F	logical or	PORTA = PORTA or W
IORLW	0x23	Inclusive OR Literal	W = W or 0x23
XORWF	PORTA,F	logical exclusive or	PORTA = PORTA xor W
XORLW	0x23	Exclusive OR Literal	W = W xor 0x23
Tests (skip the next instruction if...)			
CPFSEQ	PORTA	Compare PORTA to W, skip if PORTA = W	
CPFSGT	PORTA	Compare PORTA to W, Skip if PORTA > W	
CPFSLT	PORTA	Compare PORTA to W, Skip if PORTA < W	
DECFSZ	PORTA,F	decrement, skip if zero	
DCFSNZ	PORTA,F	decrement, skip if not zero	
INCFSZ	PORTA,F	increment, skip if zero	
INFSNZ	PORTA,F	increment, skip if not zero	
BTFS	PORTA, 5	Bit Test f, Skip if Clear	
BTFS	PORTA, 1	Bit Test f, Skip if Set	
Flow Control			
GOTO	Label	Go to Address 1st word	
CALL	Label	Call Subroutine 1st word	
RETURN		Return from Subroutine	
RETLW	0x23	Return with 0x23 in WREG	