ECE 265
Computer Problem #3

In this computer problem, you will add another feature to the programmable home thermostat (PHT). In particular, you will add a switch (INC/DEC) and a pushbutton (CHANGE_TEMP) which may be used to change the temperature setting.

When the (INC/DEC) switch is a “0”, and the CHANGE_TEMP pushbutton is depressed, then the temperature setting (TEMP_SET) should be decreased by one degree. When the (INC/DEC) switch is a “1”, and the CHANGE_TEMP pushbutton is depressed, then the temperature setting (TEMP_SET) should be increased by one degree.

<table>
<thead>
<tr>
<th>INC/DEC</th>
<th>CHANGE_TEMP</th>
<th>TEMP_SET</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>depressed</td>
<td>decrease 1°</td>
</tr>
<tr>
<td>1</td>
<td>depressed</td>
<td>increase 1°</td>
</tr>
</tbody>
</table>

The simple strobed input mode on Port C is used to interface the switch and pushbutton:

\[ \text{STRA} \quad \bullet \quad \text{CHANGE TEMP} \]

$1005 \quad \text{INC/DEC} \quad \text{Port CL}$

The CHANGE_TEMP pushbutton is connected to the STRA input line on the M68HC11. The INC/DEC switch is connected to Bit 7 of Port C and is strobed into the Port CL latch register on the rising edge of STRA (CHANGE_TEMP).
The following template may be used to develop your program:

* 
* Computer Problem #3, ECE 265 
* 
* Your Name 
* Your Partner’s Name 
* 

STACK EQU $00FF ; set up the stack and port 
PIOC EQU $1002 ; addresses 
PORTC EQU $1003 
PORTCL EQU $1005 
LCDDATA EQU $1040 
LCDCTRL EQU $1041 

ORG 0 
TEMP_DEF FCB $72 ; set the default temperature 
TEMP_SET RMB 1 ; desired temperature setting 
TMP1 RMB 1 

ORG $E000 
MAIN: LDS #STACK ; initialize the stack pointer 
LDAA PORTC ; read Port C 
JSR INIT_TEMP ; initialize TEMP_SET 

LOOP: JSR UP_DOWN ; increment/decrement TEMP_SET 
JSR PRINT ; print TEMP_SET to LCD 
; display 
BRA LOOP 

UP_DOWN: LDAA PIOC ; change temperature? 
BPL RETURN ; no, then return 
LDAA PORTCL ; yes, then process 

RETURN: RTS
After reading Port C and computing the initial temperature setting (subroutine INIT_TEMP), the program continually checks to see if the temperature setting (TEMP_SET) should be increased or decreased (subroutine UP_DOWN) and prints the temperature setting to the LCD display (subroutine PRINT). Your task is to write the UP_DOWN subroutine and integrate it with your results from Computer Problem #2. Note from the template, that the main loop (LOOP) has been changed slightly.

Be sure that the UP_DOWN subroutine works for any temperature setting in the range of 0-99. It should also hold the temperature setting when attempting to increment the temperature at 99 or to decrement the temperature at 0.

After you have successfully written and tested the program to produce the desired results, then upload the assembly language program (pht3.asm) to the Computer Problem #3 dropbox on Carmen. Also, print copies of the following two pages and turn them in during class on the due date:

1. pht3.LST

2. THRSim11 IO Box Window

The THRSim11 IO Box Window should show some typical results. Only one hardcopy of the program and results needs to be turned in for each group, but each person should upload pht3.asm through their Carmen account.