

ECE 265

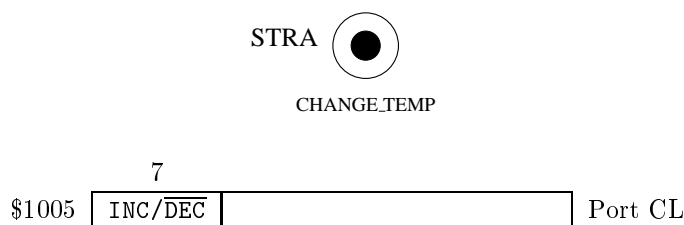
Computer Problem #3

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

When the ($\text{INC}/\overline{\text{DEC}}$) 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 ($\text{INC}/\overline{\text{DEC}}$) switch is a “1”, and the CHANGE_TEMP pushbutton is depressed, then the temperature setting (TEMP_SET) should be increased by one degree.

$\text{INC}/\overline{\text{DEC}}$	CHANGE_TEMP	TEMP_SET
0	depressed	decrease 1°
1	depressed	increase 1°

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



The CHANGE_TEMP pushbutton is connected to the STRA input line on the M68HC11. The $\text{INC}/\overline{\text{DEC}}$ 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.