

EE461 Microprocessor-based Digital Design

Macros

Assignment 11 Solutions

1. Write a macro with this header:

```
altb macro aaa, bbb, label1, label2
```

Symbol `aaa` represents the address of an 8-bit general purpose register containing a variable `a` and `bbb` represents the address of an 8-bit general purpose register containing a variable `b`.

Design the macro to compare the two variables. If $a < b$ then control will transfer to the statement with label `label1`; otherwise control will transfer to the statement labeled `label2`. The contents of `a` and `b` are integers in two's-complement format, so the comparison is between two signed numbers, not unsigned numbers. Note that the symbols `aaa`, `bbb`, `label1`, and `label2` are known only within the macro: they are *local* symbols that stand in the place of *external* symbols that exist in a program that uses the macro.

Usage of the macro would look something like this:

```
; If a < b do task1 , else do task2
    altb x,y,task1 ,task2
task 1
    ...
task2    goto    continue
continue    ...
```

SOLUTION

Listing 1: Implementation of the `altb` macro.

```
1 d      equ      H'20'      ; Temporary storage
2                                ; location for macro's use
3 N equ 7 ; Sign bit is the most significant
4
5 ; a < b is false if any one of three conditions is
6 ; a > 0 and d > 0
7 ; b < 0 and d > 0
8 ; a > 0 and b < 0
9 altb macro aaa, bbb, label1 , label2
10      local      FirstTest , SecondTest , ThirdTest
11      movf      bbb,W
12      subwf     aaa ,W
13      movwf     d
14 FirstTest      ; a > 0 and d > 0?
15      btfsc     aaa,N
16      goto     SecondTest
17      btfss     d,N
18      goto     label2
19 SecondTest ; b < 0 and d > 0?
20      btfss     bbb,N
21      goto     ThirdTest
22      btfss     d,N
23      goto     label2
24 ThirdTest ; a > 0 and b < 0?
25      btfsc     aaa,N
26      goto     label1
27      btfsc     bbb,N
28      goto     label2
29      goto     label1
30      endm
```