

*TMS320 DSP
DESIGNER'S NOTEBOOK*

Binary Search Algorithm on the TMS320C5x

APPLICATION BRIEF: SPRA238

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Contents

Abstract.....	7
Design Problem	8
Solution	8

Examples

Example 1. Code Listing	8
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Binary Search Algorithm on the TMS320C5x



Abstract

This document shows how to implement an efficient binary search algorithm on the TMS320C5x Family that will take advantage of the 'C5x's capability.



Design Problem

How do I implement an efficient binary search algorithm on the TMS320C5x Family that will take advantage of the 'C5x's capability?

Solution

There are many ways to implement the classical binary search algorithm but very few would take advantage of the 'C5x's advanced architecture and instruction set. The following is one of the many possible examples using the TMS320C5x executing the binary search algorithm.

The program takes advantage of the 'C5x's capability of performing bit-reversed addressing to half the search after each testing and therefore freeing the accumulator for other tasks. Also, instead of using conditional branching to perform the testing, the execute conditional (XC) instruction is used, thereby saving cycles and increasing performance.

This routine performs a binary search on an ordered table. It assumes that the table is ordered from low to high, where the largest number is located in the highest memory of the array. Modifications can be made to reverse the ordering, if necessary. This program also assumes that the size of the search table is some integer power of 2 (i.e., 2^N where $N=11$ in the following program). As a result, the search would never pass the last entry in the array. A maximum of N iterations is required to complete the search or determine that the search failed. Modifications can be made if the size of the array is not a power of 2. In order to do this, test conditions will have to be included to determine if the last entry has been passed.

This function returns the address of the found number and it is stored in the ACCUMULATOR. A 0x0000 address in the ACCUMULATOR signifies that the search was unsuccessful.

Example 1. Code Listing

```
.bss      NTABLE,800h      ;Sorted search table
                                ; from low to high
.bss      LOOK,1          ;Search value
.mmregs
.text
.
.
.
call      bsearch
.
.
.
bsearch  lar    AR0,#0800h  ;AR0 size of array
```



```
mar    *,AR0 ;
mar    *BR0+,AR3 ;Half the size of the array
lar    AR3,#NTABLE ;AR3 points to beginning of
                    ; array
lacl    #11 ;RPT N Times, Size of Array is 2^N
samm    BRCR ;Setup Repeat Block
ldp    #LOOK
lacc    LOOK ;Begin search
sub     * ;Compare data at AR3
bcnd    nothere,LT ;ERROR not found in this array
rptb    nothere-1
bcnd    found,EQ ;Check if found
xc      1,GT ;If too low on array
mar     *0+,AR0 ;Jump forward
xc      1,LT ;If too high on array
mar     *0-,AR0 ;Jump back
mar     *BR0+,AR3 ;Half the search space
lacc    LOOK
sub     *
nothere retd ;Did not find value in the table
zac ;return 0x0 for failed search
nop
found ldp    #0
apl    #Offfeh,PMST ;disable block repeat bit
retld
lamm    AR3 ;return address of search
nop
```