

# CSE 378 10wi Homework 2: Recursive functions with MIPS

Due: Friday, Feb. 5, 2010 at 5pm

**Note:** No late assignments will be accepted after Mon Feb. 8 at 5 pm, even if you have late days remaining, so we can hand out a solution and discuss it in sections before the midterm.

The objective of this assignment is to review your understanding of the MIPS function calling conventions and to practice assembly language programming. You will write 2 functions  $max()$  and  $maxaux()$  in the MIPS assembly language.  $max(A[], n)$  finds the largest value in  $A[0..n - 1]$ .  $maxaux(A[], k, n)$  returns the largest value in  $A[k..n - 1]$ . The pseudocode is as follows.

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**Algorithm 1**  $int\ max(int\ A[],\ int\ n)$

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return  $maxaux(A, 0, n)$

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**Algorithm 2**  $int\ maxaux(int\ A[],\ int\ k,\ int\ n)$

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**if**  $k == n - 1$  **then**

return  $A[k]$

**else**

$temp = maxaux(A, k + 1, n)$

**if**  $temp > A[k]$  **then**

return  $temp$

**else**

return  $A[k]$

**end if**

**end if**

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In the code,

- $A[ ]$  is an array of signed 32-bit 2's complement integers.
- $n$  is the size of the array  $A[ ]$ .
- $k$  identifies the beginning of the array section where you should search for the largest value. In other words, find the maximum value in  $A[k..n - 1]$ . You can assume that  $k \leq n - 1$  always.
- Your assembly language code must implement the algorithms exactly as shown above, including using the same interfaces (number of parameters, types, and order), and using recursion in *maxaux* to find the largest value in the rest of the array.
- You should use the standard MIPS calling conventions, including use of registers and the stack, for function calls.

## Interface

Function *max* will be provided with the memory address of  $A[ ]$  in register a0, and  $n$  in register a1. Return the answer in register v0.

Function *maxaux* will be provided with the memory address of  $A[ ]$  in register a0,  $k$  in register a1 and  $n$  in register a2. Return the answer in register v0.

## What you should do:

1. Start by using the template SPIM file on the MIPS resources page:  
<http://www.cs.washington.edu/education/courses/cse378/CurrentQtr/template.spim>
2. Write the functions observing the given interfaces.
3. Load your program into SPIM and execute it. Use this main function and make several function calls to your max function using proper calling conventions.
4. Turn in two assembler (.s) files. One file should include the main function and the 2 functions you write. Turn in one more .s file which only contains the max and maxaux functions (you can simply delete the main part). This will make it easier for us to test your code. Please include your name at the top of the .s files in a comment.
5. Submit your assignment via the Catalyst WebTools using the link on the course web.