

**University of Puerto Rico – Mayagüez Campus**  
**School of Engineering**

**INEL 4206 – Microprocessors**

**Problem Set 3**

**Due: Friday November 15 (No extensions!)**

**Problem 1: Insertion Sort**

Using the instruction set discussed in class for the MIPS processor, you will implement an assembly language program that sorts an array of integers in ascending order (from the lowest to the highest number). To achieve this, you'll use the Insertion Sort algorithm. An example program in C++ is provided to you in the problem set files, so basically what you have to do is translate the HLL program (C++ program) into instructions from the MIPS Instruction Set (assembly language). You are given the first part of assembly program which creates the array of integers out of order, and stores the length of the array.

Does this sound familiar? Or seems like déjà vu? ☺. This is what you did for problem set 1, but now instead of using the MIPS assembly language you will use, the MIPS assembly language and Xspim.

**Problem 2: Quick Sort (Recursion)**

A recursive function is one which calls itself in a part of the function body. In this problem you will provide a program that sorts an array of integers in ascending order. This time you will use the Quick Sort Algorithm, as implemented on the C++ program given to you (file: qs.cc). This algorithm uses a strategy called “Divide and Conquer” which hands-off part of the problem to one instance of a function and the other part to another instance (or another function). The Quick Sort function will receive an array and the limits it will handle, its role is to determine a partition point, divide the array into two, and hand off the two parts, two to new instances of the quick sort function (here is the recursion!). Each call to the Quick Sort function will do a slice of the total work needed to sort the array.

## FILES

File you receive: *ps3pkg.tar.gz*

This is a compressed file, which you have to decompress using the command, “tar -xzf ps3pkg.tar.gz” on the console of the Linux workstation. This will create a folder named *ps3files* and inside you will find:

ps3.pdf → This file (or future versions)  
ps3a.asm → Base file for problem 1  
ps3b.asm → Base file for problem 2  
prog.cc → C++ File for Insertion Sort  
qs.cc → C++ File for Quick Sort  
submit → Answer Submission program  
answer files MUST have the filenames as follow  
ps3a.asm for problem 1  
ps3b.asm for problem 2

This files will be submitted using the submit script, by just running the command “./submit” inside the ps3files folder. You must use the account provided for this class to submit the files since they will be identified by the username (account name).

To run the MIPS emulator (Xspim) in the Linux console type ‘xspim’. If you get a message relating the trap file, go to my website (<http://micro.geekie.org>) and download the .trap file.

### Correction criteria:

Criteria	Weight(%)
Correctness	60%
Design	20%
Efficiency	10%
Style	10%

Remember the policy on late submission stated on the “Course Information Sheet”.