EE3450 2021 Fall Computer Architecture Program Assignment 1

Assignment Description

- For this assignment, you have to write an assembly code in RISC-V to implement QuickSort.

- After the code is completed, you will learn how to use a toolchain to compile codes, and how to use an ISA simulator to debug.

Environment Setup

- In the beginning, we have to setup the environment with RISC-V toolchains and ISA simulator (spike).
- TA has provided an VM image with tools listed above.
- Please refer to “*environment_setup.pptx*” for detailed descriptions.

RISC-V tools and ISA simulator

- We use RISC-V tools (including compiler, linker, etc.) to build the project and generate executable binaries.

- The ISA simulator runs the compiled binaries. We can use it to check the execution result and debug.

- Please refer to "*run_tutorial.pptx*" for detailed descriptions.

Program Assignment 1: QuickSort

- QuickSort is a widely-used sorting algorithm with a time complexity of $O(n \log_2 n)$.

- Please understand QuickSort first.
  - Wikipedia – QuickSort

- The example code in C is provided in the template.

Program Assignment 1: QuickSort

- In this assignment, you have to finish your code in “*.S” file for the following 3 parts:
  - Part1: Swap
  - Part2: Partition
  - Part3: QuickSort

- Template code with print helper function are provided by TA. Please do not modify the print function part in the code.

Part 1 : Swap

- Finish the code “ee3450_pa1/part1/main.S”.
- For a given array, the program changes the value of two elements in the array.
- Run and check the correctness of your program.

Part 2 : Partition

- Finish the code “ee3450_pa1/part2/main.S”.
- In this part, you have to implement the partition function in the QuickSort algorithm. We select the last element of an array as pivot.
- Run and check the correctness of your program.
- Hint: You can reuse your code in part 1.

Part 3 : QuickSort

- Finish the code “ee3450_pa1/part3/main.S”.
- In this part, you have to implement the QuickSort algorithm.
- Run and check the correctness of your program.
- Hint: You can reuse your code in part 1 & 2.

Delivery

- Rename your main.S in three parts as
  - PA1_<student_ID>_part1.S
  - PA1_<student_ID>_part2.S
  - PA1_<student_ID>_part3.S

  For example: PA1_109061585_part1.S

- Send your code through eeclass

Note

- Supported input value range for print function: [0, 99]
- Hint: Properly comment your code could make debugging easier.
- Hint: You can refer to the provided C code first.
- Plagiarism is strictly prohibited, including looking at other's work or copying code from the net. TAs will check the plagiarism by programs.