

Homework #1

TA in charge: Haejin Nam
E-mail: haejinnam@kaist.ac.kr

I. Goal of this assignment

- ✓ Comprehensive understanding on MIPS instruction set architecture.
- ✓ **Write an assembly language program that implements an algorithm written in a high-level language.**

II. What to implement

- ✓ You need to implement a merge sort algorithm below:

```
void merge(int A[], int left, int mid, int right) {
    int i, left_i, right_i, buf[20];

    for(i = left; i <= right; ++i)
        buf[i] = A[i];

    i = left;
    left_i = left;
    right_i = mid + 1;

    while(left_i <= mid && right_i <= right)
        A[i++] = (buf[left_i] < buf[right_i])? buf[left_i++] : buf[right_i++];

    while(left_i <= mid)
        A[i++] = buf[left_i++];
    while(right_i <= right)
        A[i++] = buf[right_i++];
}

void mergesort(int A[], int left, int right) {
    int mid;
    if(left < right) {
        mid = (left + right)/2;
        mergesort(A, left, mid);
        mergesort(A, mid + 1, right);
        merge(A, left, mid, right);
    }
}
```

- ✓ *The execution flow of your implementation should match to the given specific algorithm.* (Should not modify the algorithm itself)
- ✓ The initial data set for the input of the algorithm:
{13,43,16,23,9, 2,15,19,8,28, 30,4,48,24,10, 18,29,35,6,35}

III. Simulator: SPIM

- ✓ We will use a simulator to check out whether the implemented assembly program runs properly on a MIPS machine.
- ✓ SPIM is a simulator for MIPS32, a modern 32-bit architecture of MIPS. You can simulate a MIPS32 machine with your assembly programs run on it.
- ✓ In this assignment we will use the latest version of SPIM, **QtSpim**. You can use it on various environments: MS Windows, Mac OS X, and Linux.
- ✓ Download and install the version corresponding to your environment from here:
<https://sourceforge.net/projects/spimsimulator/files/>
- ✓ See **Appendix document** for basic operation of the simulator. You would not need specific details about the simulator within this assignment.

IV. Submission and grading

- ✓ Your submission should include: **(Total 100 pts)**
 - A. Source code file of the assembly program [**SourceCode_StudentID_NAME.s**]:
The source code should contain:
 - i. Implementation of the given algorithm in assembly language **(30 pts)**
 - ii. Comments to explain the details of your implementation **(30 pts)**
 - iii. Code load the given initial data set to memory **(5 pts)**
 - iv. Code to print out the sorted array to the simulator console **(5 pts)**

*Your program **must be executable on the simulator**. Otherwise, there will be no points. Please check your program before submission.*
 - B. Brief report [**Report_StudentID_NAME.pdf**]:
The report should contain:
 - i. Register mapping table for each function **(10 pts)**
 - ii. Brief explanation on your implementation **(20 pts)**

There is no specific format for the report. You can use either English or Korean as you want

- ✓ *Compress all these files into a .zip file and upload it on KLMS.*
- ✓ The name of the file should be [HW1_StudentID_NAME.zip].
e.g. Project1_20170123_JoneSmith.zip

V. Due date

- ✓ **Sep. 28th (Fri.), 23:59**
- ✓ Late submission due date: Sep. 29th (Sat.), 23:59
- ✓ For late submissions, there will be **50% penalty on your total score.**
- ✓ After the late submission due date, you will get **0 point.**

VI. Cheating

- ✓ If there are any cheatings in your submission, you will get **0 point.**
- ✓ *Followings will be regarded as cheating:*
 - A. Copying other students' simulation results or reports
 - B. Modifying other students' results and using them as if they were your own
 - C. Using other sources without any references excluding your own simulation results
 - D. All other sorts of inappropriate behaviors

VII. Tips

- ✓ Refer the appendix and the uploaded sample codes to see how to load initial data and print out some texts in the simulator.
- ✓ You need to know how to implement recursive calls with assembly language..
- ✓ If you have some questions, please contact to the TA in charge. You can use e-mail (haejinnam@kaist.ac.kr) or KLMS QnA board. Both English and Korean are okay for questions.
- ✓ From Sept. 22nd to 26th, there will be a long holiday. TA could be hard to reply quickly during this period. TA will try to reply on time, but please understand that there could be some delays.