Programming Assignment 2: Raiding on Aincrad

Deadline: 6/9(Sun) 23:59:59 (No late submission)

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1. Introduction

Aincrad (アインクラッド) is the first «Realized World» shown in the Sword Art Online (ソードアート・オンライン) series and the stage for the first VRMMORPG, «Sword Art Online». Aincrad is an iron-and-stone made floating castle that has about ten kilometers floor base diameter and consists of a hundred floors stacking straight upwards, meaning that each floor's diameter is a bit smaller than the previous one. On each floor, there are a couple of large cities along with countless small scale towns and villages, forests, plains, and even lakes. Only one stairway links each floor to another, and the stairways exist beyond the boss room of each Labyrinth. You have to subvert the boss, and then you can go up one floor.

You, your lover, Asuna, and other players are now trapped in Aincrad. The only way out tis to reach the 100th floor. You are now a leader of raiders group, and you are expected to be the one who can save the world.

Assume you are now at x^{th} floor. The way to subvert the boss at x^{th} floor is to calculate the HP number of the boss as follows:

$$F(x)=\begin{cases} 2*x+F(x/5), \text{when } x>20 \\ F(x-2)+F(x-3), \text{when } 10<x\le 20 \\ F(x-1)+F(x-2), \text{when } 1<x\le 10 \\ 1, \text{when } x=0 \\ 5, \text{when } x=1 \\ -1, \text{otherwise} \end{cases}$$

Here we assume x is an integer. You are now asked to write a Recursive RISC-V Assembly Programming to calculate the HP number. The program **must use recursion** as described above. It should only print the final value of F(x). The basic range of x is set $x \leqq 99$ (total 100 floors). However, I encourage you to handle large x if you can (as bonus).

2. Example

   Assume x is 3. By the equation shown above, the condition $1 < x \leq 10$ holds for F(3) and the program has to calculate F(x-1) + F(x-2) = F(2) + F(1). Then the program will recursively calculate F(2) and F(1), respectively. F(2) also satisfy the condition $1 < x \leq 10$ and will be calculated as F(2) = F(1) + F(0) = 5 + 1 = 6. We then obtain F(1) = 5. Finally, the recursive program will give the final result F(3) = F(2) + F(1) = 6 + 5 = 11.

3. Input Format

   The input file consists of 1 line which gives the value of x. The input of the above example is:

   ```
   3
   ```

4. Output Format

   The program will only print the F(x) (HP) you calculated.

   The output of the above example is:

   ```
   11
   ```

5. Evaluation

   Your assignment will be scored according to (1) the correctness of your output, (2) the readability of your source code, and (3) the demo session. You have to implement the RISC-V assembly program by yourself. Using existing tools to generate RISC-V assembly code from C/C++ code is prohibited and doing so will lead to 0 score for this assignment. The program **must use recursion**, otherwise you will get 0 points. You are encouraged to add extra functions which will be considered as bonuses. The demo session will be held after the deadline and you have to explain your code to TAs. Absence from the demo session will lead to a huge penalty of your PA2 score.

6. RISC-V Simulator

   Please refer to https://github.com/riscv/riscv-isa-sim

7. Submission

   Please submit your source code to Portal system. The deadline is 6/9(Sun) 23:59:59 and no late submissions would be accepted. Please name your file as “PA2_your_student_ID”.

If you have any question, please E-mail to TA or me. Good luck!