2022 Fall Computer Architecture

Homework 1

Due date: 10/4 23:59

Description

In this homework, you are going to use Jupiter RISC-V simulator to develop a simple calculator which supports seven operators, addition, subtraction, multiplication, division, minimum, power and factorial.

After finishing this homework, you will be familiar with the usage of Jupiter RISC-V simulator, register definition, and some basic operations in RV32I Base Integer Instruction Set.

Requirement

The calculator should support the following operations:

$+,\ -,\ \times,\ /,\ \min, \wedge,\ !$

Input format:	Output format:
A	[Result]
operator	
B	

$0 \leq A, B \leq 1024, \text{o}p \in \{0, 1, 2, 3, 4, 5, 6\}$

If $op = 0$, calculate $A + B$ and output the result.

If $op = 1$, calculate $A - B$ and output the result.

If $op = 2$, calculate $A \times B$ and output the result.

If $op = 3$, calculate $A \ / \ B$ and output the result. (Quotient)

If $op = 4$, calculate minimum (A, B) and output the result.

If $op = 5$, calculate A^B and output the result.

If $op = 6$, calculate $A!$ and output the result. (In this case, $B = 0$)

If division by zero occurs, the program should print "$division\ by\ zero$".

Don't worry about overflow or underflow.

No need to handle 0^0.

Input

Every input file has three lines. The first line contains a non-negative integer A, the second line contains a non-negative integer op, the third line contains a non-negative integer B, corresponding to the first operand, the operator, and the second operand.

Output

The output should contain only one integer that is the result of the input equation.

Sample Input 1

```
7
0
4
```

Sample Output 1

```
11
```

Sample Input 2

```
7
3
4
```

Sample Output 2

```
1
```

Sample Input 3

```
7
3
0
```

Sample Output 3

```
division by zero
```

Sample Input 5

```
10
4
1024
```

Sample Output 5

```
10
```

Sample Input 6

```
3
6
0
```

Sample Output 4

```
6
```

Grading policy

For operations `+`, `-`, `×`, `/`, min, each operation has 4 testcases, 3 points per testcase. For operations `^` and `!`, each operation has 5 testcases, 4 points per testcase.

We will judge the correctness of your program by running the following command:

```
$ jupiter [student_id]_hw1.s < input_file
```

10 points off per day for late submission.

You will get zero points for plagiarism.

Submission

Due date: 10/4 23:59

Please name your program file **[student_id]_hw1.s** and upload it to NTUCOOL.

For example, if your student id is **b12345678**, your program file name should be **b12345678_hw1.s**.

Reference

- Jupiter RISC-V simulator
  https://github.com/andrescv/Jupiter
- Jupiter RISC-V simulator docs
  https://github.com/JupiterSim/Docs
- RISC-V Instruction Set Manual
  https://github.com/riscv/riscv-isa-manual
  https://riscv.org/technical/specifications