Implementation of Integer Addition and Multiplication

1 Task Description

In this assignment, you have the option to choose C++, Python, or Java for your implementation. Your task is to implement:

- School Method for Integer Addition and Karatsuba Algorithm for Integer Multiplication
- Integer Division (postgraduate only)

If you are an undergraduate student, the maximum mark (in Gradescope) is 100. If you are a postgraduate student, your maximum mark is 200.

2 Submission Guideline

You must follow this guideline! Your submission will be marked automatically. Failure to follow this guideline will result in 0.

Your submission should contain exactly one file, which should be named according to the programming language you choose: `main.cpp` for C++, `main.py` for Python, or `main.java` for Java.

You do not need to submit a design.

Your program takes one line as input. The input line contains three integers separated by spaces. Let the three integers be "I1 I2 B". I1 and I2 are both nonnegative integers up to 100 digits long. B represents I1 and I2's base (B is from 2 to 10).

Your program should output the sum of I1 and I2, using the school method, then the product of I1 and I2, using the Karatsuba algorithm, and finally the ratio between I1 and I2 (rounded down). You are asked to come up with a way to perform this division. It is not covered in lectures. l2 will not be 0.

The results should still use base B. Please separate the results using one space.

Sample input 1: 101 5 10

Sample output 1: 106 505 20

Sample input 2: 10 111 2

Sample output 2: 1001 1110 0

Sample input 3: 111 10 2

Sample output 3: 1001 1110 11

If you are an undergraduate student, simply output 0 as the division result. For example, in sample 3, instead of 1001 1110 11, simply output 1001 1110 0.

3 Marking

Marking will be done automatically. I trust that you will indeed implement the school method for addition and the Karatsuba algorithm for multiplication. I will randomly pick some submissions to verify whether it is the case. If you use other methods in your submission, it will be considered cheating and you will receive 0. Feel free to use whatever method for division.

4 Submission Instructions

You are asked to submit via **Gradescope** `https://www.gradescope.com/` (by either direct upload or via a GitHub repository).

You are welcome to resubmit as many times as you wish before the deadline. We will compile and run your code using the specific commands for each language. The specific compilation commands used by the autograder are:

- For C++: `g++ -std=c++11 -o main.out -O2 -Wall main.cpp`
- For Python: `python3 main.py`
- For Java: `javac main.java` followed by `java -cp . main`

It is your responsibility to ensure that your code compiles and runs correctly on the Gradescope system, as compiler versions and environments may vary (e.g. g++ has too many versions, so being able to compile on your laptop does not guarantee that it compiles on the Gradescope system.)