Arithmetic Operations in MIPS

I. Problem Statement

Write a MIPS Assembly language program to read two integers, A and B, from the console. Subsequently, produce the sum (A+B) plus both differences (A-B and B-A). Output the result of these computations to the console. The computation must use the appropriate instructions. The output must clearly identify each output.

Bonus points:
(5 points) Produce and output the product (A*B).
(5 points) Produce and output the quotient and remainder for (A/B).
(5 points) Produce and output the quotient and remainder for (B/A).

II. Approach

As part of the Course 5330 Computer Architecture, the Professor Dr. Richard Goodrum decided to test the skills of the students taking the course. In this Assignment basic arithmetic operations needed to be coded in Mips assembly language. An open source simulator/IDE for MIPS assembly language called MARS (version 4.5) was used to develop the assignment. Mars needed a Java 8+ JRE to be installed. I have used Java 11.0.12.

III. Limitations

Given that the Mips processor uses 32 bit architecture, the computations A+B, A-B, B-A & A*B can all output values that may exceed the maximum range of signed 32 bit size of –2,147,483,648 to 2,147,483,647. When such situation occurs, there is no handling for overflow and thus wrong answers may be encountered. There could either be explicit errors like "arithmetic overflow” or the value displayed on the console may be outright wrong.

IV. Solution

The program starts with a Descriptive prompt for the user’s edification on how to interact with the program. We obtain two integers from the user and perform arithmetic operations which are then displayed back as output on the user’s console. The program can be broken down into the following aspects:

- Receiving two integers as input from the console.
- Summating and displaying the output.
- Subtracting the integers (A-B & B-A) and displaying the output.
- Multiplying the integers and displaying the output.
- Dividing the integers (A/B & B/A) and displaying the output.

V. Program Screenshots

Figure 1: Assembler output of the program is provided in this image. As seen it has successfully compiled else we can see errors at this position. At this point can run the program. In the next image, we'll discuss the output of the program.

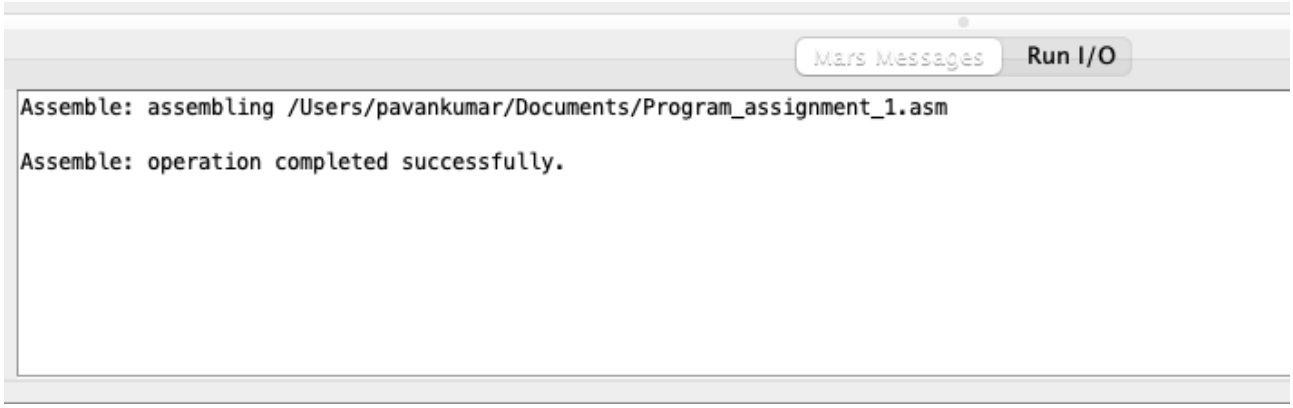

Figure 1: Mars Assembler Output

Figure 2: This is the console output as obtained from running the program in the MARS IDE. It shows the initial descriptive prompt to the user so that proper inputs can be provided. In this trial run, the value of A or first input is 489 and the value of B or second input is 372. The program then runs computing the arithmetic operations that are outputted on the console as shown in the image.

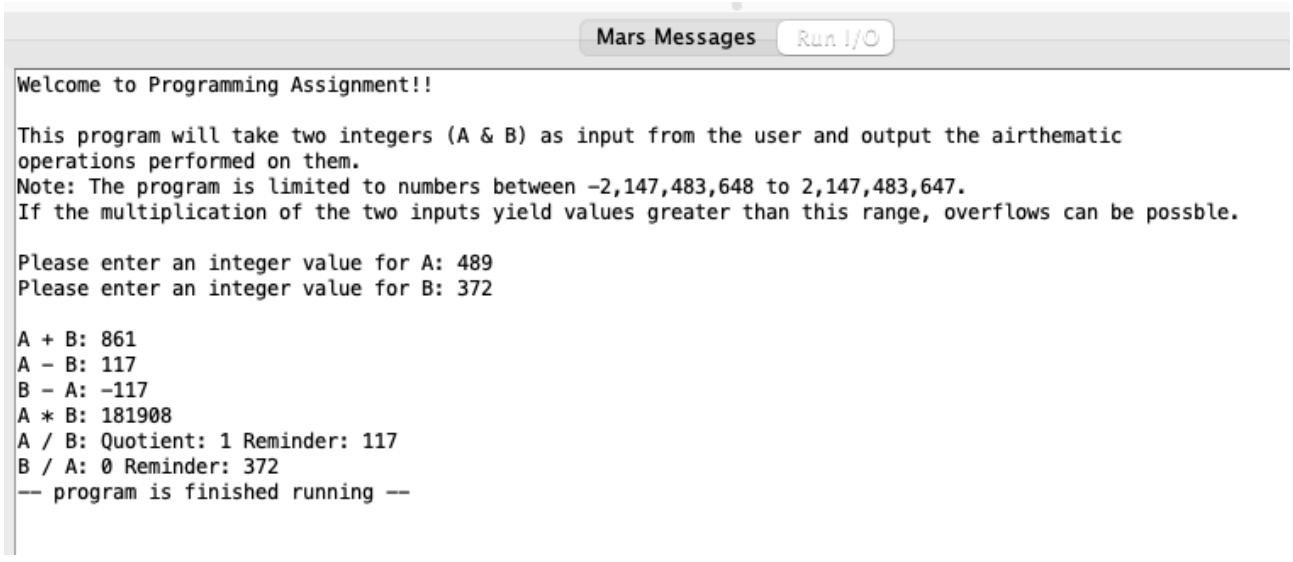

Figure 2: Program Trial run and Output