

CS 254 PROGRAMMING ASSIGNMENT #4

Memory Access

(rev. 02/24/2022)

Write a program to evaluate the arithmetic expression:

$$(13x - 4xy + 18)/7$$

Use symbolic addresses `x`, `y`, `answer`, and `remainder`. Put values for `x` and `y` in the `.data` section of your program followed by two locations for `answer` and `remainder`. Use two registers for `x` and `y` and load them from memory. At the end of the program, store the answer and remainder to memory. Assume that the values are small enough so that results fit into 32 bits. Since load delays are turned on in SPIM be careful what instructions are placed in the load delay slot.

Verify that the program works by using several initial values for `x` and `y`. Use `x=1`, `y=1` and `x=1`, `y=-1` to start since this will make debugging easy. Then try some other values. Don't assume that `x` and `y` are positive.



Remember that a value loaded from memory can only be used after a one instruction delay slot. Also, be sure to use the basic assembly two-operand instructions for multiply and divide and to retrieve the results of the operation from the `lo` and `hi` registers.

Use register `$10` as a base register and use register-offset addressing to load and store values. Set up the base register with a `lui` instruction. The program at the end of chapter 15 will be useful.

Set MIPS settings to the following:

ON	Bare Machine	ON	Enable Delayed Loads
ON	Enable Delayed Branches	OFF	Load Exception Handler
OFF	Enable Mapped IO	OFF	Accept Pseudo Instructions
OFF	Load Exception Handler		

Set these options as specified or QtSpim will start up with options you don't want. You *may* have to set the options, close QtSpim, and then restart it for the options to have an effect. Use only those instructions that have been discussed in the notes through chapter 15.

Execute the program statement at a time by using "Single Step (F10)" from the Simulator menu. The `answer` and `remainder` should be found in the `.data` section of the SPIM display following `x` and `y`.

Include a register use table in the documentation at the top of your source program. The source program should be nicely formatted. Labels (symbolic addresses) should start in column one. Nearly every line of the program will have a meaningful comment in terms of the algorithm. All comments should start in the same column, perhaps column 35. Make sure that the source file has no tab characters in it. Use the Blackboard assignment tool to turn in a source file for your program.