

Use ARM assembly with ARMSim# to implement the following Labs:

## Project 2:

### Part-1:

Write an ARM assembly code to implement a loop for calculating factorial of an integer N. For example if the input N from the standard input is equal to 5, it should return 120 (i.e, 5! ); the result (i.e, 120) should be printed on the standard output.

### Part-2:

1. Repeat part-1 for N factorial, by adding code to measure program execution time in milliseconds. This can be achieved by reading system time and storing it into a General Purpose Register (GPR), or preferably in memory location, and before the program exits read system time again the difference is the time elapsed for execution. Write the elapsed time in the output file on the same line as the factorial number in tabular form. Example:

Number	Factorial	Time elapsed (ms)
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5	120	351

Once you have your program working and creating the proper out file as shown in the example above, move to next step.

2. Repeat step 1 using by having the following numbers in your input file to calculate their factorial and the output file must have one entry for each number as shown in the example table in previous step. The numbers to use in your input file are:

0, 1, 3, 5, 5, 7, 8, 9, 10, 11, 12

### Part-3:

1. Open another input file e.g summation-input that contains list of integers, do summation for each integer (use loops as you did in Project 1). For each summation measure program execution time, also measure the whole list integers summation time in milliseconds. This can be achieved by reading system time and storing it into two different General Purpose Registers (GPRs), or preferably in memory locations, and after each integer summation read system time again the difference is the time elapsed for executing that summation. Write the elapsed time in the summation-output file on the same line as the summation number in tabular form. Example:

Number	Summation	Time elapsed (ms)
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5	15	201

Do step three for all of the following numbers in your summation-input file to calculate their summation and the summation output file must have one entry for each number as shown in the example table above, also the last line in the table must have the total elapsed time for doing all integer summation using system time. The numbers to use in your summation input file are:

0, 1, 2000, 4000, 6000, 8000, 10000, 12000, 14000, 16000, 18000, 20000

Note: add appropriate comments to your assembly code explaining what each instruction does in the context of your program.

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Project submission:

Submit the whole project (individual lab submission will not be accepted).

Use Windows zip to zip both assembly files, and both input and output files as well, basically your zip file will include all four files.

The format for zip file name must be as follows:

<section number-lastname-firstname-course name-proj#-weekdays-period>.zip

Example for MW student's submission:

15725-Doe-John-COMP122L-Proj1-MW-2PM.zip

Example for TR student's submission:

15648-Doe-John-COMP122L-Proj1-TR-2PM.zip

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