

# [MP2 Specs] x86-to-C interface programming project specifications

Started: Nov 22 at 11:41pm

## Quiz Instructions

### Instructions

- This assignment will provide only your MP2 specification/problem, and will not be graded.
- Submit your MP2 solution using the assignment titled "[MP2 Submission] x86-C Interface Programming Project."
- Accomplish the peer evaluation using the assignment titled "Peer Evaluation [for MP2]."
- Though MP2 is assigned by group/pair, students should treat this requirement as an individual assignment by independently working on their solution. Then, the opportunity to collaborate later on with your partner will hopefully provide a helpful advantage to both members. Groupings/pairings are automatically assigned in alphabetical order.
- Since groupmates may receive two different MP2 specs or problems, partners may discuss and decide which of the two specs to take.

⋮

Write the kernel in (1) C program and (2) an x86-64 assembly language. The kernel is to perform DAXPY ( $A \cdot X + Y$ ) function.

**Input:** Scalar variable  $n$  (integer) contains the length of the vector; Scalar variable  $A$  is a double-precision float. Vectors  $X$ ,  $Y$  and  $Z$  are **double-precision float**.

\*Required to use functional scalar SIMD registers

\*Required to use functional scalar SIMD floating-point instructions

**Process:**  $Z[i] = A \cdot X[i] + Y[i]$

**Example:**

$A \rightarrow 2.0$

$x \rightarrow 1.0, 2.0, 3.0$

y -> 11.0, 12.0, 13.0  
y -> 11.0, 12.0, 13.0, support

(answer) z--> 13.0, 16.0, 19.0

**Output:** store result in vector Z. Display the result of 1st ten elements of vector Z for all versions of kernel (i.e., C and x86-64).

Note:

- 1.) Write a C main program to call the kernels of the C version and x86-64 assembly language.
- 2.) Time the kernel portion only.
- 3.) For each kernel version, time the process for vector size  $n = \{2^{20}, 2^{24}, \text{ and } 2^{30}\}$ . If  $2^{30}$  is impossible, you may reduce it to the point your machine can support (i.e.,  $2^{28}$  or  $2^{29}$ ).
- 4.) You must run at least 30 times for each version to get the average execution time.
- 5.) For the data, you may initialize each vector and scalar variable with the same or different random value.
- 6.) You will need to check the correctness of your output. Thus, if the C version is your "sanity check answer key," then the output of the x86-64 version has to be checked with the C version and output correspondingly (i.e., the x86-64 kernel output is correct, etc.).
- 7.) Output in GitHub (make sure that I can access your Github):
  - a.) Github readme containing the following (debug and release mode; C and x86-64):
    - i.) comparative execution time and short analysis of the performance of the kernels
    - ii.) Take a screenshot of the program output with the correctness check (C).
    - iii.) Take a screenshot of the program output, including the correctness check (x86-64).
    - iv.) short videos (5-10mins) showing your source code, compilation, and execution of the C and x86-64 program
  - b.) Visual Studio project folder containing **complete** files (source code: C, x86-64, and all other required files) for others to load and execute your program.

Rubric:

C main program with initialization and correct call/passing parameters to C and x86-64	10
Correct output (C version)	10
Correct output (x86-64)	40
Comparative result	20
Analysis of result	10
Short video	10
not following instructions	-10 / instruction
Note: No usage of functional scalar SIMD registers and scalar SIMD instructions	grade = 0

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Quiz saved at 11:42pm

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