

PROGRAMMING ASSIGNMENT 2**Due date:** 31.05.2023 23:00

You are required to solve the **maximum consecutive sum problem: MCS**. The problem is defined as the following: Let $x[]$ be an array of integers. For a given x , we want to find a subarray $x[i..j]$ of x with maximum sum of integers. The problem is known as the [maximum sum subarray problem](#), where the task is to find a contiguous subarray with the largest sum, within a given one-dimensional array.

You are required to include the following steps in your parallel implementation:

- 1) Calculate s , as the **prefix-sums** of x .
- 2) Calculate m , as the **prefix-mins** of s .
- 3) Calculate s_m , where $s_m[j] = s[j] - m[j-1]$.
- 4) Calculate $indx$, where $indx[j] = \max\{i: 0 \leq i \leq j \text{ and } s[i]=m[j]\}$

The sum of numbers (MCS) will be $\max(s_m(j))$ and the indices will be $[\max(indx)+1, \text{minimum index of } s_m \text{ array with the element having the value MCS}]$.

You can see the example steps as follows:

	$x[0]$	$x[1]$	$x[2]$	$x[3]$	$x[4]$	$x[5]$	$x[6]$	$x[7]$	$x[8]$	$x[9]$
x :	-2	1	3	-7	11	-2	-6	12	-3	-1
s :	-2	-1	2	-5	6	4	-2	10	7	6
m :	-2	-2	-2	-5	-5	-5	-5	-5	-5	-5
s_m :	-2	1	4	-3	11	9	3	15	12	11
$indx$:	0	0	0	3	3	3	3	3	3	3

where the MCS value is $\max(s_m(j)) = 15$, the indices are $[4, 7]$.

For the original problem definition and the example, you can refer to the Section V.A of the [Peachy Parallel Assignments \(EduHPC 2019\)](#) document.

You are required to implement a parallel version of this problem on OpenMP (or any other parallel programming model that you will utilize in this course).

Notes:

- You are required to run your programs with large arrays (may be generated randomly) and various number of threads (1-16), and make a performance analysis by comparing different versions.
- You are required to write a report (2 pages at most), which includes

- Your computer's specification (i.e., the number of cores, the number of threads; typically that can be obtained by *lscpu* command in Linux platform),
- Instructions for compiling and executing your programs,
- Graphs, your observations about the performance of your implementation, how you interpret the results.

Submission: You are required to submit your **commented** source code and report to cloud-lms. Please create a compressed file including all source files and report; and name it as yourstudentnumber_ASS2.zip (e.g. If your student number is 202112345678, the file name must be 202112345678_ASS2.zip). You need to work individually, no group work is allowed. No late submission will be accepted.