

## 2023-Batch-I-Set-2

### Lab 3 - CSS 311 – Parallel and Distributed Computing

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#### OpenMP – Synchronization Controls and Scheduling Loops

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1. Write an OpenMP program with C/C++ that estimates the **value of pi ( $\pi$ )** using following numerical integration formula called **rectangle rule**.

$$Area = \int_0^1 \frac{4}{1+x^2} dx = \pi$$

The following components are to be shown.

- (a) Write the **serial version** program to estimate the value of pi ( $\pi$ ). Test the result with classical integration value.
  - (b) Write the **parallel version** program to estimate the same. Test the result with classical integration value and by (a). It includes number of threads involved and the area calculated by which thread number.
  - (c) Identify the line of statement which leads the **race condition**. Race condition occurs when the multiple threads accessing a shared variable. If it exists how will you handle this problem? Use appropriate OpenMP clause and find the solution. Test the result with classical integration value and by (a) and (b).
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2. Write an OpenMP program with C/C++ that illustrates the following OpenMP clause with its various types.

**schedule** clause: It allows to specify how the iterations of the loop should be scheduled, i.e., allocated to threads. The various types of schedule are as follows.

- (a) Write an OpenMP program with C++ that calculate the *sum of the of the squares* of first  $N$  natural numbers using *for* loop. (**Serial Version**)

Try the following on parallel version of the code.

- (b) **schedule** (static), **schedule** (static, C) where C – number of chunks to tasks. Each chunk contains C contiguous iterations.
  - (c) **schedule** (dynamic), **schedule** (dynamic, C)
  - (d) **schedule** (guided), **schedule** (guided, C)
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