**University of Management and Technology Lahore**

**School of Science and Technology**

**Department of Computer Science**

**Complex Computing Problem (CCP)**

Semester: Fall 2024

Course: Operating Systems (CC3011)

Maximum Marks: 15

Submission Date: 25th January, 2025

**TABLE I: Blooms Taxonomy Domain Levels**

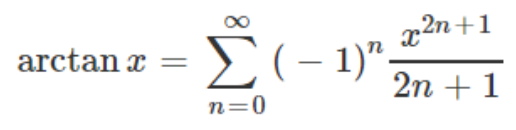
|  |  |  |  |
| --- | --- | --- | --- |
| **CCP Attribute.** | **Domain** | **Description** | **Bloom’s**  **Taxonomy**  **Level** |
| **1** | Cognitive | **Understanding**: Grasp the meaning of materials | C2 |
| **2** | Cognitive | **Applying**: Use the information in a new situation. | C3 |
| **3** | Cognitive | **Analyzing**: Analyze different solutions (single flow, multiple flows using fork and multithreading) | C4 |

**TABLE II: ASSESSMENT RUBRIC AND DELIVERABLES (MAX. MARKS:15)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Assessment Criteria** | **CCP Attribute** | **Outstanding** | **Effective** | **Inadequate** |
| Problem analysis resulting in constraints to be imposed on solution. | Range of conflicting requirements | 3 | 2 | 1 |
| Show  execution of submodules and their communication | Interdependence | 2 | 1 | 1 |
| Show synchronization | Accurate locks placement | 3 | 2 | 1 |
| Code originality |  | 2 | 1 | 0.5 |
| Viva. | Depth of knowledge required, Interdependence | 5 | 3 | 1 |

# Complex Computing Problem Statement

**Design and implementation**: **Estimate Pi using the Maclaurin series for arc tan(x):**



**Since arctan(1) = pi/4, we can compute pi = 4\*[1 - 1/3 + 1/5 - 1/7 + 1/9 - . . . ] Run your program as**:

**pi\_mutex <number of threads><n>**

1. pi\_mutex is the executable of your code.
2. n is the number of terms of the Maclaurin series to use

**The solution provided must satisfy the following constraints**

# Range of conflicting requirements

1. n should be greater than 100,000
2. The final result should be global and all submodules update it accordingly.
3. The program should correctly handle the number of terms evenly divisible by the number of threads, ensuring load balancing.

# Depth of knowledge required

The student should research the various programming techniques, algorithms, hardware configurations, and configurations of the system they will use to develop and deploy their solution. Students should formulate a suitable abstract model. They should consider factors such as workload balance, data dependencies, and communication overhead to devise an effective abstract model for the given problem. They should creatively analyze and fine-tune their implementation to ensure efficient resource utilization and minimize idle time.

# Interdependence

The solution provided must be based on a distributed architecture. The sub modules must work independently and may react on the interrupts/messages generated by the other sub modules. There must be redundancy in the decision paths to avoid complete failure of the system.

**Report submission tasks: PDF- No other format will be accepted.**

1. Report must be written in double column, 10-point font, Times New Romans
2. Report must contain details of implementation used, with proper captions of locks used, Flowchart for implementation method. Make your own figures in any software

The following should be added in the technical report.

* 1. Title
  2. Sequential code, single flow Implementation detail
  3. Multiprocessor implementation detail
  4. Implementation code files for the Multithreading based solution
  5. Discussion on results and Performance analysis
  6. Make a video (.mp4) file with your group member explaining how you have attempted to solve the given problem using parallel techniques and upload a video link on LMS.
  7. Plagiarism must be less than 10%. Your report will be uploaded on Turnitin.com for plagiarism check. Write in your own words.