**CS 4532 – Concurrent Programming**

**Lab 1**

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**Step 1**

We have created three different types of programs, which dependent and independent on concurrency. We named the program as ‘Serial Program’, the ‘Parallel Program with one mutex for the entire linked list’, and the ‘Parallel Program with Read & Write Locks for the entire linked list’. These implemented using the C programming language along with the POSIX thread library - standard for Unix-like operating systems and an API for multi-threaded programming. The execution of these implementations was facilitated using a Python script, which was utilized to run various test cases.

A table of numbers and a number of threads

Description automatically generated with medium confidence**Step 3**

To achieve an accuracy of ±5% with a 95% confidence level for this assignment, it was determined that a sufficient sample size of 100 was necessary to calculate the prior standard deviation and mean of the distribution. The number of samples utilized in each instance is detailed below.

**Case 1:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Implementation | Number of Threads | | | |
| 1 | 2 | 3 | 4 |
| Serial |  |  |  |  |
| Mutex |  |  |  |  |
| R-WLock |  |  |  |  |

**Case 2:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Implementation | Number of Threads | | | |
| 1 | 2 | 3 | 4 |
| Serial |  |  |  |  |
| Mutex |  |  |  |  |
| R-WLock |  |  |  |  |

**Case 3:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Implementation | Number of Threads | | | |
| 1 | 2 | 3 | 4 |
| Serial |  |  |  |  |
| Mutex |  |  |  |  |
| R-WLock |  |  |  |  |

**Step 4**

A graph with lines and numbers

Description automatically generated***Case 1: n = 1000, m = 10000, mMember = 0.99, mInsert = 0.005, mDelete = 0.005***

A graph with a line

Description automatically generated***Case 2: n = 1000, m = 10000, mMember = 0.90, mInsert = 0.05, mDelete = 0.05***

***Case 3: n = 1000, m = 10000, mMember = 0.50, mInsert = 0.25, mDelete = 0.25***

A graph of a graph with numbers and a line

Description automatically generated

**Specifications of the Machine used.**

|  |  |
| --- | --- |
| Operating System | Mac OS 13.4.1 (22F82) |
| Architecture | M1 chip |
| Total Number of cores | 10 (8 performance and 2 efficiency) |
| Threads per core |  |
| Cores per socket Sockets |  |
| Sockets |  |
| Model |  |
| L1d |  |
| L2 |  |
| L3 |  |
| CPU MHz |  |
| Max MHz |  |
| Min MHz |  |
| Memory | 16 GB |

**Step 5**

**Observation and Conclusions**