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## CS344: Operating Systems Lab

Lab # 11 (1 Questions, 50 Points)

Held on 14-Nov-2023

Lab Timings: 09:00 to 12:00 Hours    Pages: 2

Submission: 12:00 Hrs, 14-Nov-2023

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- This assignment is based on chapter 4, Threads in the book Operating System Principles, Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne.
- In order to perform this assignment, understanding of system calls `pthread_create`, `pthread_attr_init`, `pthread_join`, `pthread_exit`, `pthread_mutex_init`, `pthread_mutex_destroy`, `pthread_mutexattr_init`, `pthread_mutexattr_destroy`, `pthread_mutex_lock`, `pthread_mutex_trylock` and `pthread_mutex_unlock` are essential.
- Carefully read the manual pages for the above library functions
- For details along with examples go through the link: <https://hpc-tutorials.llnl.gov/posix/>

**Question 1:** (50 points)

**Matrix multiplication:** Write one C program which performs the following:

**Problem Description:** Perform the following:

- Create two matrices each of size  $400 \times 400$ .
- Randomly initialize the matrices.
- Create 4 threads.
- Assign data to each thread as shown for matrix 1

row #	1	...	100	101	...	200	201	...	300	301	...	400
1	$T_1$	...	$T_1$	$T_2$	...	$T_2$	$T_3$	...	$T_3$	$T_4$	...	$T_4$
2	$T_1$	...	$T_1$	$T_2$	...	$T_2$	$T_3$	...	$T_3$	$T_4$	...	$T_4$
3	$T_1$	...	$T_1$	$T_2$	...	$T_2$	$T_3$	...	$T_3$	$T_4$	...	$T_4$
	$\vdots$			$\vdots$			$\vdots$	$T_3$	$T_4$	...	$T_4$	
400	$T_1$	...	$T_1$	$T_2$	...	$T_2$	$T_3$	...	$T_3$	$T_4$	...	$T_4$

- Assign data to each thread as shown for matrix 2

row #	1	2	3	4	...	400
1	$T_1$	...	$T_1$	$T_1$	...	$T_1$
$\vdots$		$\vdots$			$\vdots$	$\vdots$
100	$T_1$	...	$T_1$	$T_1$	...	$T_1$
101	$T_2$	...	$T_2$	$T_2$	...	$T_2$
$\vdots$		$\vdots$			$\vdots$	$\vdots$
200	$T_2$	...	$T_2$	$T_2$	...	$T_2$
201	$T_3$	...	$T_3$	$T_3$	...	$T_3$
$\vdots$		$\vdots$			$\vdots$	$\vdots$
300	$T_3$	...	$T_3$	$T_3$	...	$T_3$
301	$T_4$	...	$T_4$	$T_4$	...	$T_4$
$\vdots$		$\vdots$			$\vdots$	$\vdots$
400	$T_4$	...	$T_4$	$T_4$	...	$T_4$

- In each thread, compute matrix multiplication on relevant data
- In each thread, write the relevant result in third matrix
- In the main program, print the third matrix in a file
- Use thread synchronization as appropriate

### Marks distribution

- Matrix 1 creation: 2
- Matrix 2 creation: 2
- Matrix 1 initialization: 2
- Matrix 2 initialization: 2
- Each thread creation: 2 (8)
- Data distribution for matrix 1: 7
- Data distribution for matrix 2: 7
- Thread synchronization: 20