Lab 07: POSIX Threads – Passing Data to/from threads

Objective of this lab is to practice POSIX thread API and multi-threaded application implementation.

$man pthread_create
$man pthread_join
$man pthread_exit
$man pthread_cancel

Basic APIs

Int **pthread_create**(pthread_t *threadid,constpthread_attr_t *attr,void *(*start_routine)(void*), void *arg)
Int **pthread_join**(pthread_tthreadid, void **value_ptr)

How to compile

1. Include required header file
   #Include<pthread.h>
2. Linking pthread library is also needed
   gcc progname.c –o progname –lpthread
   OR
   gcc progname.c –o progname -pthread

Task

You are to multiply two matrices together. Both of these matrices must have exactly 1024 rows and 1024 columns each. You will use the following algorithm to produce the product MatrixC:
Note: You can input matrix using rand() function for all of its indices but If you want to take user input and implement lower order matrix i.e 16*16 matrix and then want to extend it, you can proceed with it as well.

$$c_{i,j} = \sum_{k=1}^{n} a_{i,k} b_{k,j}$$

Specifically, on each iteration, a row of A multiplies a column of B, such that:

$$c_{p,k} = c_{p,k} + a_{p,p-1} b_{p-1,k}$$

For this lab, you are to produce the below mentioned three solutions:

1. A single threaded version of your algorithm (one main thread) that multiplies Matrix A with Matrix B and derives Matrix C.
2. A multithreaded version of your algoritm that does the same thing, but creates separate thread for computing single multiplication value of the resultant matrix (i.e., MatrixC[i][j] is computed in a thread).
3. A multithreaded version of your algoritm that does the same thing, but creates overall threads equal to the number of cores in your computer system.

    a. To check the CPU cores info, type lscpu or nproc

You are to time all the versions of these programs(i.e anonymous@anonymous:~$ time ./matrix

./matrix is the executable file generated after compiling the program.

There are several sources on the web (via google search) to find out how to basically code the matrix multiplcation portion of this lab. Here is some sample code that multiples two 3x3 matrices (A & B) into a product matrix C (we are assuming of course that A and B actually have data):

```
int i,j,k;
 for (i=1; i<=3; i++)
 {
   for (j=1; j<=3; j++)
     {
       sum = 0;
       for (k=1; k<=3; k++)
         sum = sum + A[i][k]*B[k][j];
     }
     C[i][j] = sum;
 }
```

Submission& Evaluation

1. This is an individual assignment.
2. All the working against every task should be shown to the instructor within lab.