NATIONAL TEXTILE

UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

Subject

Operating System

SUBMITTED BY:

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SECTION SE: 5th (A)

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Lab 6

Task1:

Code:

```
#include <stdio.h>
#include <pthread.h>
#include <unistd.h>
#define NUM_THREADS 4
int varg=0;

void *thread_function(void *arg) {
    int thread_id = *(int *)arg;

    int varl=0;
    varg++;
    varl++;
    printf("Thread %d is executing the global value is %d:
local vale is %d:   process id %d:  \n",
thread_id,varg,varl,getpid());
    return NULL;
}

int main() {
    pthread_t threads[NUM_THREADS];
    int thread_args[NUM_THREADS];


    for (int i = 0; i < NUM_THREADS; ++i) {
        thread_args[i] = i;
        pthread_create(&threads[i], NULL, thread_function,
&thread_args[i]);
    }

    for (int i = 0; i < NUM_THREADS; ++i) {
```

```
        pthread_join(threads[i], NULL);
    }
    printf("Main is executing the global value is
%d::    Process ID %d:  \n",varg,getpid());

    return 0;
}
```

Output:

```
fatima@DESKTOP-3BA3T21:~/23-NTU-CS-1155 Lab6$ ./task1.out
Thread 0 is executing the global value is 1: local vale is 1:   process id 23655:
Thread 1 is executing the global value is 2: local vale is 1:   process id 23655:
Thread 2 is executing the global value is 3: local vale is 1:   process id 23655:
Thread 3 is executing the global value is 4: local vale is 1:   process id 23655:
Main is executing the global value is 4::    Process ID 23655:
fatima@DESKTOP-3BA3T21:~/23-NTU-CS-1155 Lab6$
```

Task2 Problem:

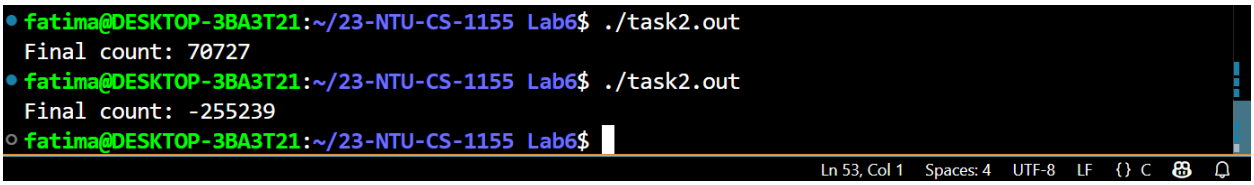
Code:

```
#include <stdio.h>
#include <pthread.h>
#include <unistd.h>
#define NUM_ITERATIONS 1000000

int count=10;



// Critical section function
void critical_section(int process) {
    //printf("Process %d is in the critical section\n",
process);
    //sleep(1); // Simulate some work in the critical section
    if(process==0){

        for (int i = 0; i < NUM_ITERATIONS; i++)
        count--;
```

```
    }
    else
    {
        for (int i = 0; i < NUM_ITERATIONS; i++)
        count++;
    }

}

void *process0(void *arg) {



        // Critical section
        critical_section(0);
        // Exit section



    return NULL;
}

void *process1(void *arg) {



        // Critical section
        critical_section(1);
        // Exit section




    return NULL;
}
```

```c
int main() {
    pthread_t thread0, thread1, thread2, thread3;


    // Create threads
    pthread_create(&thread0, NULL, process0, NULL);
    pthread_create(&thread1, NULL, process1, NULL);
    pthread_create(&thread2, NULL, process0, NULL);
    pthread_create(&thread3, NULL, process1, NULL);

    // Wait for threads to finish
    pthread_join(thread0, NULL);
    pthread_join(thread1, NULL);
    pthread_join(thread2, NULL);
    pthread_join(thread3, NULL);


    printf("Final count: %d\n", count);

    return 0;
}
```

Output:



Task2 solution:

Code:

```c
#include <stdio.h>
#include <pthread.h>
#include <unistd.h>
#define NUM_ITERATIONS 100000
// Shared variables
```

```c
int turn;
int flag[2];
int count=0;

// Critical section function
void critical_section(int process) {
    //printf("Process %d is in the critical section\n",
process);
    //sleep(1); // Simulate some work in the critical section
    if(process==0){

        for (int i = 0; i < NUM_ITERATIONS; i++)
            count--;
    }
    else
    {
        for (int i = 0; i < NUM_ITERATIONS; i++)
            count++;

    }
   // printf("Process %d has updated count to %d\n", process,
count);
    //printf("Process %d is leaving the critical section\n",
process);
}

// Peterson's Algorithm function for process 0
void *process0(void *arg) {

        flag[0] = 1;
        turn = 1;
        while (flag[1]==1 && turn == 1) {
            // Busy wait
        }
        // Critical section
        critical_section(0);
```

```
        // Exit section
        flag[0] = 0;
        //sleep(1);


    pthread_exit(NULL);

}

// Peterson's Algorithm function for process 1
void *process1(void *arg) {

        flag[1] = 1;
        turn = 0;
        while (flag[0] ==1 && turn == 0) {
            // Busy wait
        }
        // Critical section
        critical_section(1);
        // Exit section
        flag[1] = 0;
        //sleep(1);

    pthread_exit(NULL);
}

int main() {
    pthread_t thread0, thread1;

    // Initialize shared variables
    flag[0] = 0;
    flag[1] = 0;
    turn = 0;


    // Create threads
```

```
    pthread_create(&thread0, NULL, process0, NULL);
    pthread_create(&thread1, NULL, process1, NULL);

    // Wait for threads to finish
    pthread_join(thread0, NULL);
    pthread_join(thread1, NULL);

    printf("Final count: %d\n", count);

    return 0;
}
```

Output:

```
fatima@DESKTOP-3BA3T21:~/23-NTU-CS-1155 Lab6$ ./sol.out
Final count: 0
fatima@DESKTOP-3BA3T21:~/23-NTU-CS-1155 Lab6$
```

TaskMutex:

Code:

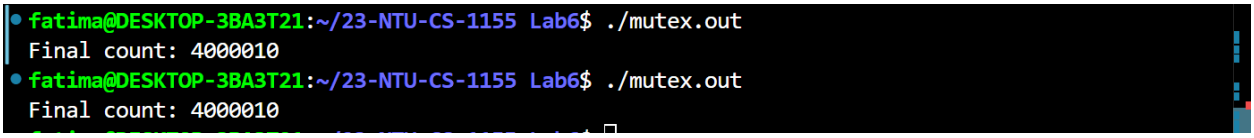
```
    #include <stdio.h>
#include <pthread.h>
#include <unistd.h>
#define NUM_ITERATIONS 1000000

int count=10;

pthread_mutex_t mutex; // mutex object

// Critical section function
void critical_section(int process) {
    //printf("Process %d is in the critical section\n",
process);
    //sleep(1); // Simulate some work in the critical section
    if(process==0){
```

```
        for (int i = 0; i < NUM_ITERATIONS; i++)
        count--;
    }
    else if(process == 1)
    {
        for (int i = 0; i < NUM_ITERATIONS; i++)
        count++;
    }
    else{
        for (int i = 0; i < NUM_ITERATIONS; i++)
        count+=2;
    }
    //printf("Process %d has updated count to %d\n", process,
count);
    //printf("Process %d is leaving the critical section\n",
process);
}

// Peterson's Algorithm function for process 0
void *process0(void *arg) {

        pthread_mutex_lock(&mutex); // lock

        // Critical section
        critical_section(0);
        // Exit section

        pthread_mutex_unlock(&mutex); // unlock

    return NULL;
}

// Peterson's Algorithm function for process 1
void *process1(void *arg) {
```

```
        pthread_mutex_lock(&mutex); // lock

        // Critical section
        critical_section(1);
        // Exit section

        pthread_mutex_unlock(&mutex); // unlock


    return NULL;
}

void *process2(void *arg){
    pthread_mutex_lock(&mutex); // lock

        // Critical section
        critical_section(2);
        // Exit section

        pthread_mutex_unlock(&mutex); // unlock


    return NULL;
}

int main() {
    pthread_t thread0, thread1, thread2, thread3,thread4,
thread5;

    pthread_mutex_init(&mutex,NULL); // initialize mutex

    // Create threads
    pthread_create(&thread0, NULL, process0, NULL);
    pthread_create(&thread1, NULL, process1, NULL);
    pthread_create(&thread2, NULL, process2, NULL);
    pthread_create(&thread3, NULL, process0, NULL);
```

```
    pthread_create(&thread4, NULL, process1, NULL);
    pthread_create(&thread5, NULL, process2, NULL);

    // Wait for threads to finish
    pthread_join(thread0, NULL);
    pthread_join(thread1, NULL);
    pthread_join(thread2, NULL);
    pthread_join(thread3, NULL);
    pthread_join(thread4, NULL);
    pthread_join(thread5, NULL);

    pthread_mutex_destroy(&mutex); // destroy mutex

    printf("Final count: %d\n", count);

    return 0;
}
```

Output:



Comparison of Peterson and mutex algorithm:

Peterson	**Mutex**
Use shared memory variable **flag** and **turn** to coordinate entry into critical section	Use a **lock** object which is controlled by Operating system.
Programmers are **manually** enforcing **mutual exclusion**.	The **OS kernel** and **pthread** library handle it automatically.
Only **2** processes work in it.	**Any number** of processes work in it.
Low-Efficiency wastes CPU cycles.	**High-Efficiency** OS handles its scheduling.