National Textile University

Department of Computer Science

Subject:
Operating System

Submitted to:
Sir Nasir

Submitted by:
Hafsa Amjad

Reg number:
23-NTU-CS-1162

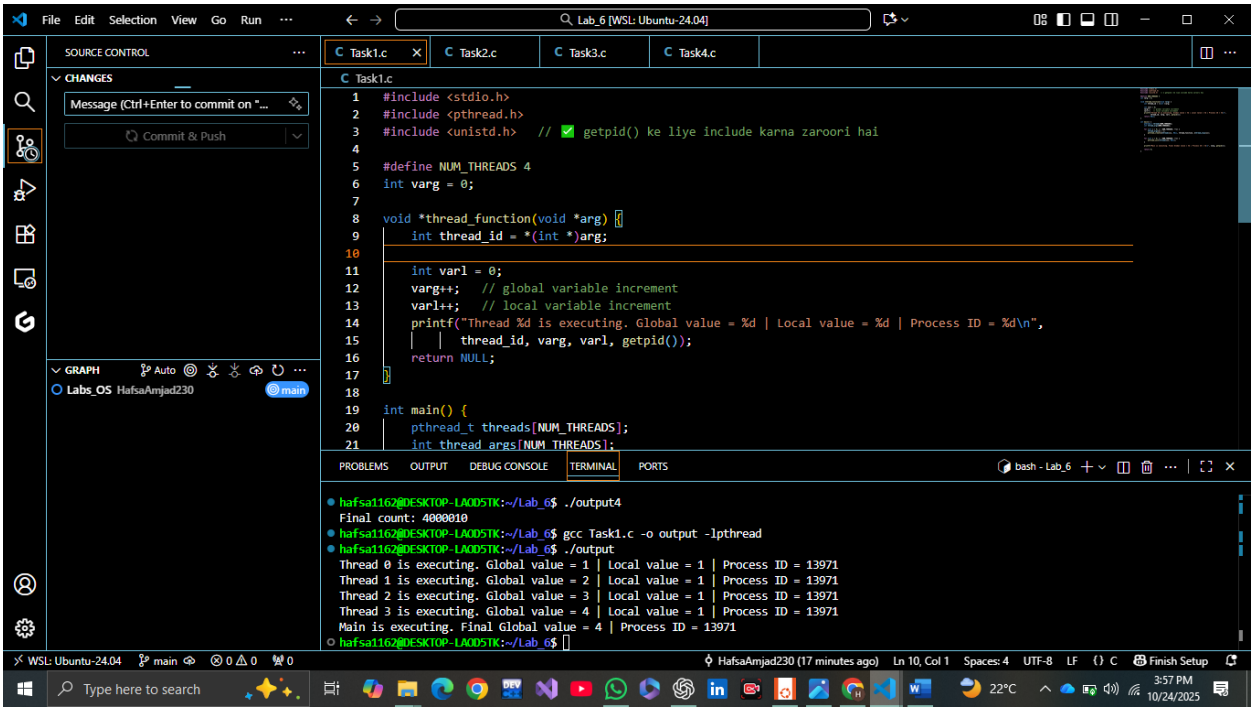
Lab no:
6

Semester:
5th

Task 1:

```
#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++;   // global variable increment
   varl++;   // local variable increment
   printf("Thread %d is executing. Global value = %d | Local value = %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. Final Global value = %d | Process ID = %d\n", varg, getpid());

  return 0;
}
```



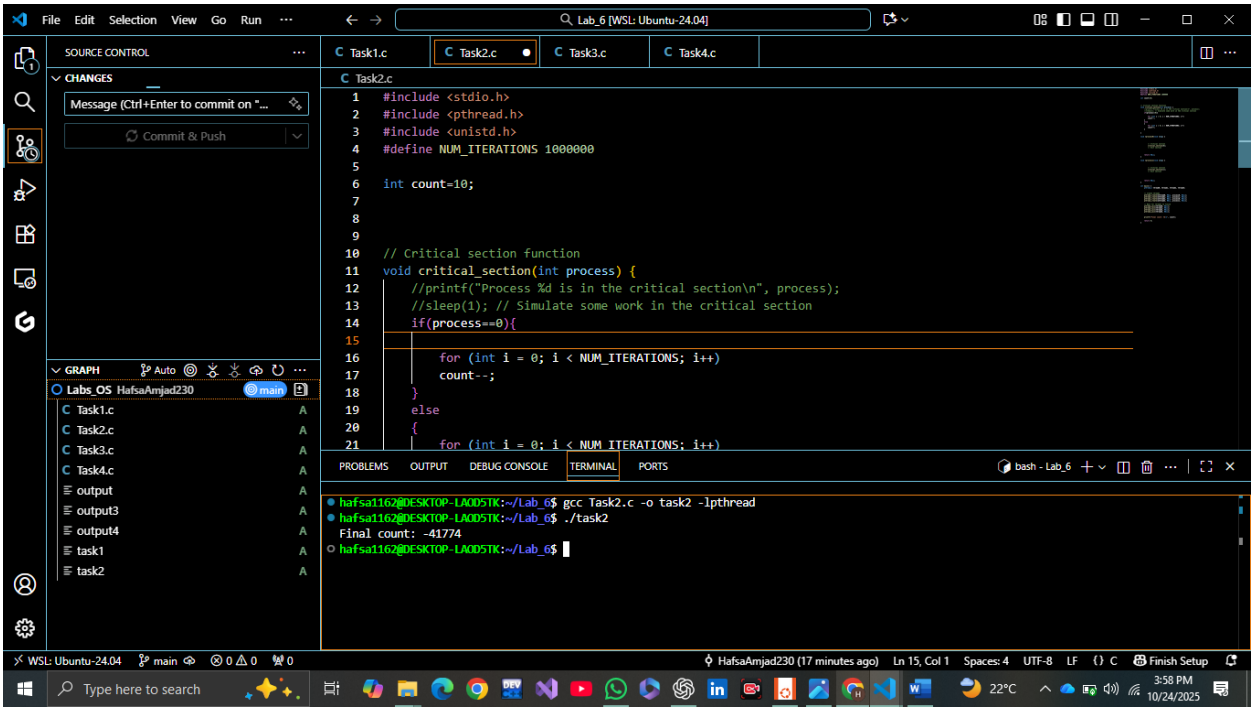
Task 2:

```
#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;
}

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;
}
```



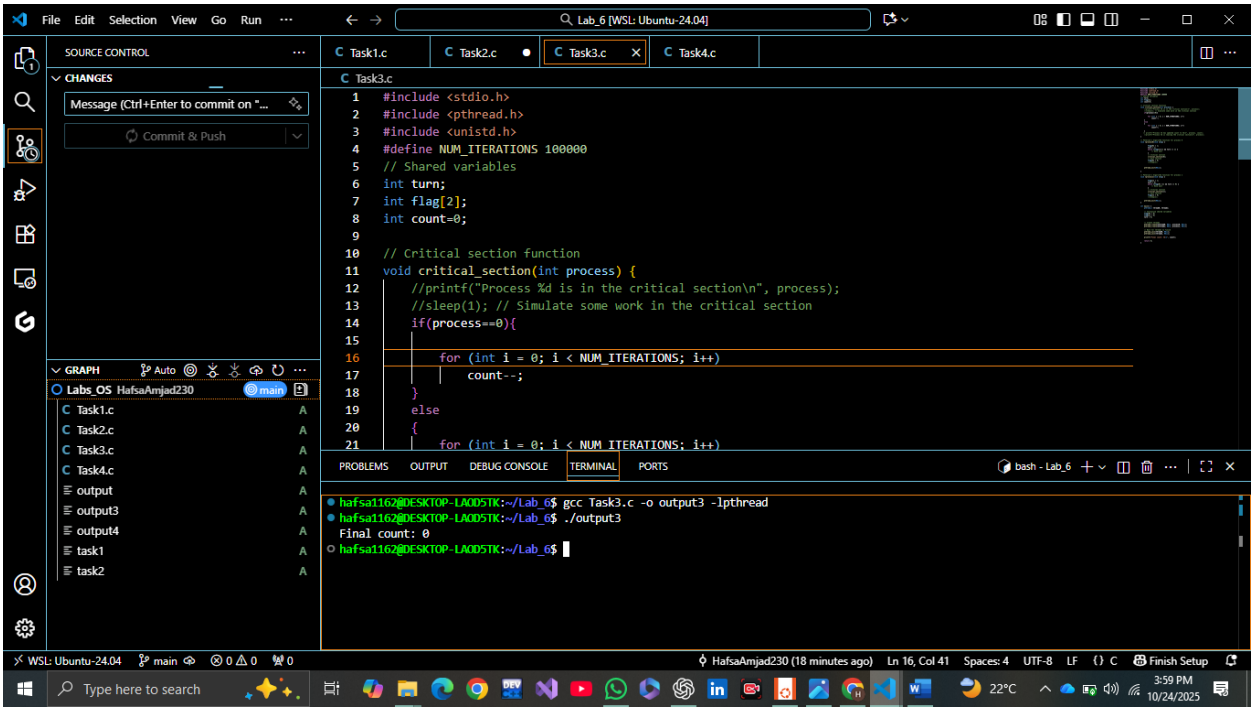
Task 3:

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



Task 4:

```
#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) {

   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 if (process == 2) {
        for (int i = 0; i < NUM_ITERATIONS; i++)
            count += 2;  // third process modifies differently
    }
}

// Process 0
void *process0(void *arg) {
    pthread_mutex_lock(&mutex);   // lock
    critical_section(0);
    pthread_mutex_unlock(&mutex); // unlock
    return NULL;
}

// Process 1
void *process1(void *arg) {
    pthread_mutex_lock(&mutex);
    critical_section(1);
    pthread_mutex_unlock(&mutex);
    return NULL;
}

// ✅ Process 2 (newly added)
void *process2(void *arg) {
```

```
    pthread_mutex_lock(&mutex);
    critical_section(2);
    pthread_mutex_unlock(&mutex);
    return NULL;
}

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

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

    // Create threads for all processes
    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 all threads to complete
    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;

}
```