CS2518 - P5 - MUTEX

In this practical it is the task to fix the multi-threaded program given below.

Compile the program and observe the output. Obviously, the output is not as expected and the code requires some modification. Specifically, a *mutex* should be used to fix existing issues.

(This task should not take you the entire practical time; use the remaining time to work on any open points from your previous labs!).

```
#include <stdio.h>
#include <stdlib.h>
#include <pthread.h>

#define NUM_THREADS 5
#define INCREMENTS 100000

int counter = 0; // Shared global counter

void *increment_counter(void *arg) {
    for (int i = 0; i < INCREMENTS; i++) {
        counter++;
    }
    return NULL;
}

int main() {
    pthread_t threads[NUM_THREADS];

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

    for (int i = 0; i < NUM_THREADS; i++) {
        pthread_join(threads[i], NULL);
    }

    printf("Final counter value: %d (Expected: %d)\n", counter,
        NUM_THREADS * INCREMENTS);
    return 0;
}
```

CS2518 Continuous Assessment - PART 5

Please submit your completed and commented program.

In addition, answer the following question in detail: *Why did the program output an unexpected counter value without the use of a mutex? Explain in detail why this situation occurs and why a mutex can fix this issue.*

The program and your answer has to be submitted at the end of the semester together with questions from the other practicals (You do not have to complete all tasks/answers within the practical slot).