



National Textile University

Department of Computer Science

Subject: Operating System

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Lab no.: lab5

Semester:5th

3. C Programs with Threads

Program 1: Creating a Simple Thread

Objective: Create a thread and print messages from both main thread and new thread.

```
#include <stdio.h>

#include <pthread.h>

#include <unistd.h>

// Thread function - this will run in the new thread
void* thread_function(void* arg) {

    printf("Hello from the new thread!\n");

    printf("Thread ID: %lu\n", pthread_self());

    return NULL;

}

int main() {

    pthread_t thread_id;

    printf("Main thread starting...\n");

    printf("Main Thread ID: %lu\n", pthread_self());

    // Create a new thread

    pthread_create(&thread_id, NULL, thread_function, NULL);

    // Wait for the thread to finish

    pthread_join(thread_id, NULL);

    printf("Main thread exiting...\n");

    return 0;

}
```

```
● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ gcc Task1.c -o task1 -lpthread
● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ ./task1
Main thread starting...
Main Thread ID: 123646009440064
Hello from the new thread!
Thread ID: 123646005737152
Main thread exiting...
❖ amina@DESKTOP-SEP18NK:~/OSLabs/lab5$
```

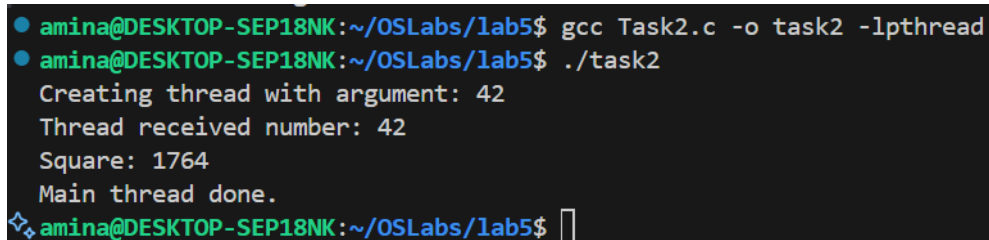
Program 2: Passing Arguments to Threads

Objective: Pass data to a thread function.

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

void* print_number(void* arg) {
    // We know that we've passed an integer pointer
    int num = *(int*)arg; // Cast void* back to int*
    printf("Thread received number: %d\n", num);
    printf("Square: %d\n", num * num);
    return NULL;
}

int main() {
    pthread_t thread_id;
    int number = 42;
    printf("Creating thread with argument: %d\n", number);
    // Pass address of 'number' to thread
    pthread_create(&thread_id, NULL, print_number, &number);
    pthread_join(thread_id, NULL);
    printf("Main thread done.\n");
    return 0;
}
```



```
● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ gcc Task2.c -o task2 -lpthread
● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ ./task2
Creating thread with argument: 42
Thread received number: 42
Square: 1764
Main thread done.
❖ amina@DESKTOP-SEP18NK:~/OSLabs/lab5$
```

Task2CGPA:

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

```

#include <pthread.h>

void* print_number(void* arg)
{
    float num = *(float*)arg; // Cast void* back to float*
    printf("Thread received number: %f\n", num);
    printf("Square: %f\n", num * num);
    return NULL;
}

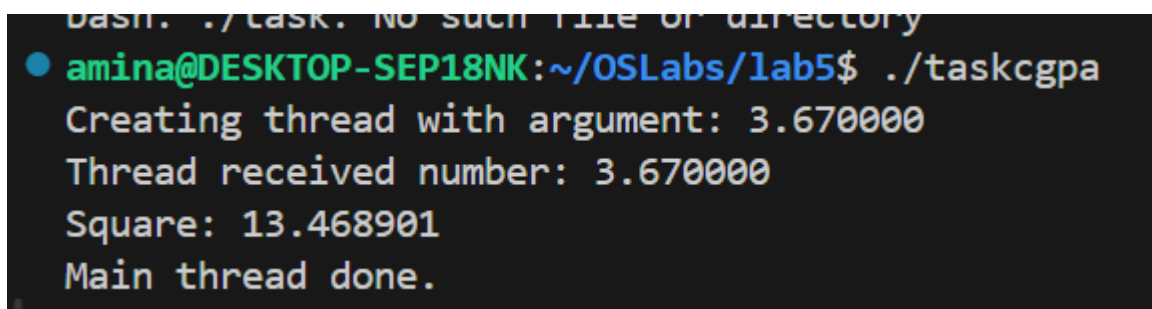
int main()
{
    pthread_t thread_id;
    float cgpa = 3.67;

    printf("Creating thread with argument: %f\n", cgpa);

    // Pass address of 'cgpa' to thread
    pthread_create(&thread_id, NULL, print_number, &cgpa);
    pthread_join(thread_id, NULL);

    printf("Main thread done.\n");
    return 0;
}

```



A terminal window with a dark background. The prompt is 'amina@DESKTOP-SEP18NK:~/OSLabs/lab5\$'. The command './taskcgpa' has been executed. The output shows the thread creation message, followed by the thread's output (number and square), and finally the main thread completion message.

```

bash: ./task: No such file or directory
● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ ./taskcgpa
Creating thread with argument: 3.670000
Thread received number: 3.670000
Square: 13.468901
Main thread done.

```

Program 3: Passing Multiple Data

```
//Multiple Threads (CGPA +NAME)

#include <stdio.h>

#include <pthread.h>

typedef struct {

float id;

char* message;

} ThreadData;

void* printData(void* arg) {

ThreadData* data = (ThreadData*)arg;

printf("Thread %f says: %s\n", data->id, data->message);

return NULL;

}

int main() {

pthread_t t1;

ThreadData data1 = {1, "My name is Amina and cpga is 3.67"};

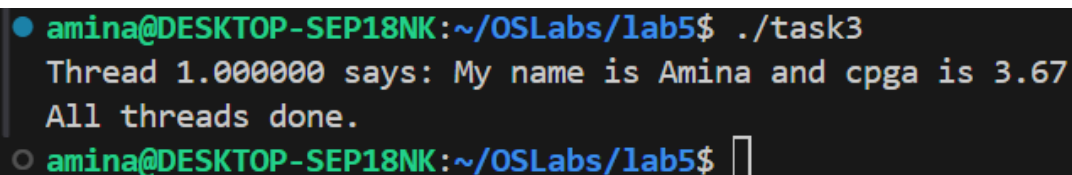
pthread_create(&t1, NULL, printData, &data1);

pthread_join(t1, NULL);

printf("All threads done.\n");

return 0;

}
```



```
● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ ./task3
Thread 1.000000 says: My name is Amina and cpga is 3.67
All threads done.
○ amina@DESKTOP-SEP18NK:~/OSLabs/lab5$
```

Program 4: Thread Return Values

Objective: Get return values from threads.

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

```

#include <pthread.h>
#include <stdlib.h>
void* calculate_sum(void* arg) {
    int n = *(int*)arg;
    int* result = malloc(sizeof(int)); // Allocate memory for result
    *result = 0;
    for (int i = 1; i <= n; i++) {
        *result += i;
    }
    printf("Thread calculated sum of 1 to %d = %d\n", n, *result);
    return (void*)result; // Return the result
}
int main() {
    pthread_t thread_id;
    int n = 100;
    void* sum;
    pthread_create(&thread_id, NULL, calculate_sum, &n);
    // Get the return value from thread
    pthread_join(thread_id, &sum);
    printf("Main received result: %d\n", *(int*)sum);
    free(sum); // Don't forget to free allocated memory
    return 0;
}

```

```

● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ gcc Task5.c -o task5 -lpthread
● amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ ./task5
Thread 1: Starting task...
Thread 3: Starting task...
Thread 2: Starting task...
Thread 3: Task completed!
Thread 2: Task completed!
Thread 1: Task completed!
Main thread: All threads have finished.
○ amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ █

```

Program 2: Demonstrating a Race Condition

Objective: What happens when multiple threads modify a shared variable **without** synchronization.

```

#include <pthread.h>
int counter = 0; // Shared variable
void* increment(void* arg) {
    for (int i = 0; i < 100000; i++) {
        counter++; // Not thread-safe
    }
}

```

```
}  
return NULL;  
}  
int main() {  
    pthread_t t1, t2;  
    pthread_create(&t1, NULL, increment, NULL);  
    pthread_create(&t2, NULL, increment, NULL);  
    pthread_join(t1, NULL);  
    pthread_join(t2, NULL);  
    printf("Expected counter value: 200000\n");  
    printf("Actual counter value: %d\n", counter);  
    return 0;  
}
```

```
amina@DESKTOP-SEP18NK:~/OSLabs/lab5$ ./task6  
Expected counter value: 200000  
Actual counter value: 151887  
amina@DESKTOP-SEP18NK:~/OSLabs/lab5$
```