Operating System

Lab Report

Lab 10

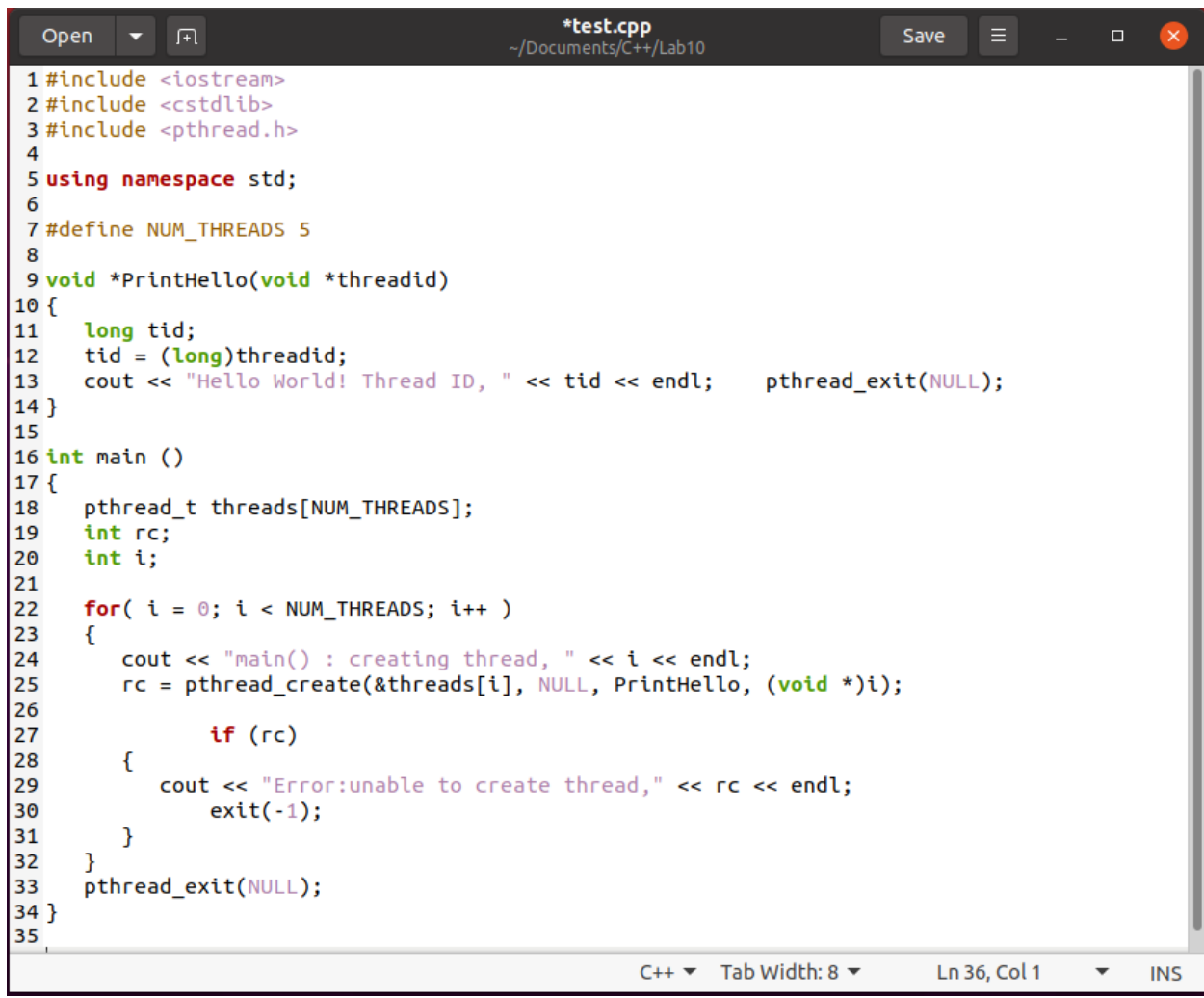|	
Group Members Name & Reg #:	**Muhammad Haris Irfan** **(FA18-BCE-090)**
Class	Operating System (**BCE-5B**)
Instructor's Name	Sir Wasif

In Lab Tasks

Question 1: Activity 1:

Write a program in C++ to create and terminate threads.

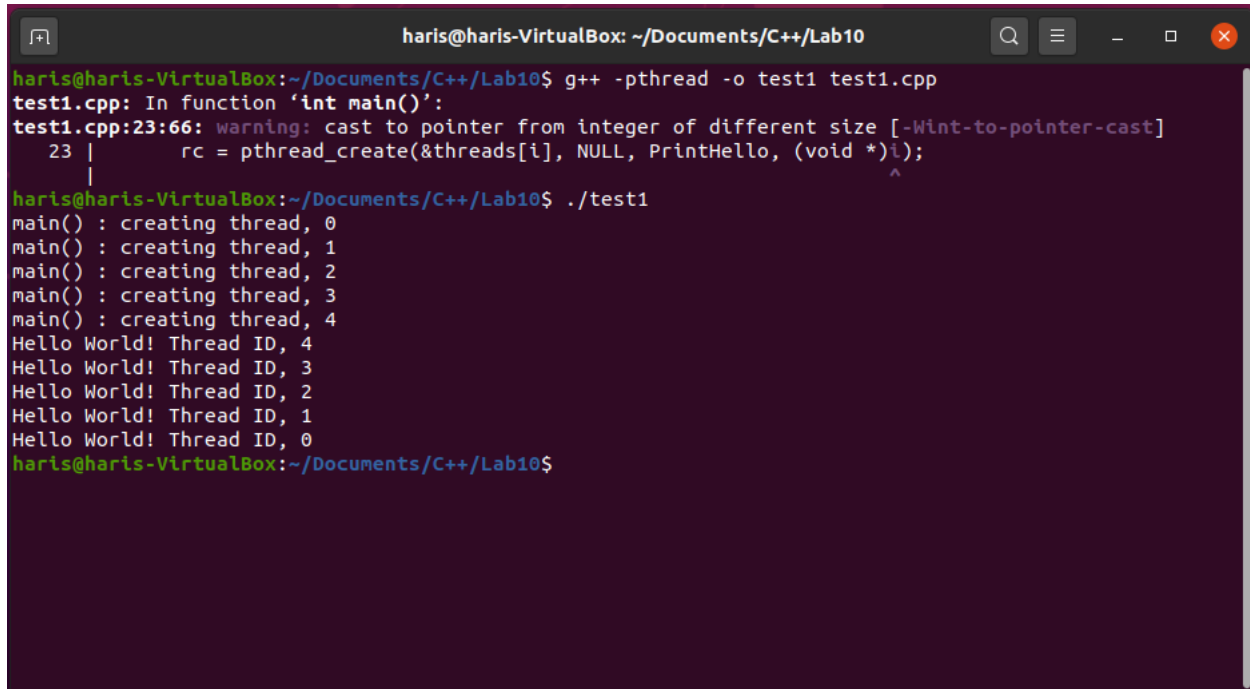## Solution:

> ➢ Code is given below:

```cpp
#include <iostream>
#include <cstdlib>
#include <pthread.h>

using namespace std;

#define NUM_THREADS 5

void *PrintHello(void *threadid)
{
   long tid;
   tid = (long)threadid;
   cout << "Hello World! Thread ID, " << tid << endl;    pthread_exit(NULL);
}

int main ()
{
   pthread_t threads[NUM_THREADS];
   int rc;
   int i;

   for( i = 0; i < NUM_THREADS; i++ )
   {
      cout << "main() : creating thread, " << i << endl;
      rc = pthread_create(&threads[i], NULL, PrintHello, (void *)i);

         if (rc)
      {
         cout << "Error:unable to create thread," << rc << endl;
            exit(-1);
      }
   }
   pthread_exit(NULL);
}
```
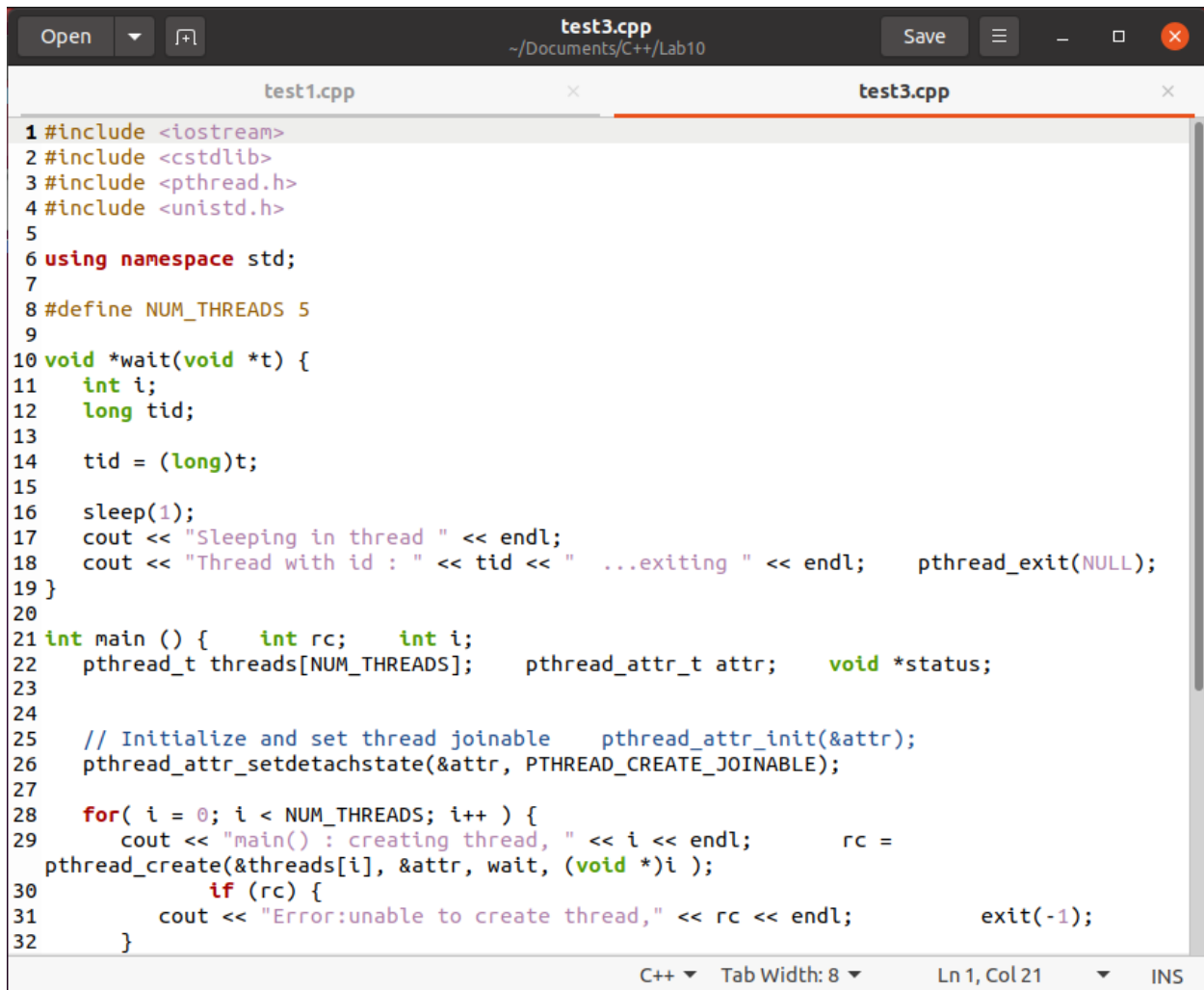
The Terminal Output is given below,

```
haris@haris-VirtualBox: ~/Documents/C++/Lab10

haris@haris-VirtualBox:~/Documents/C++/Lab10$ g++ -pthread -o test1 test1.cpp
test1.cpp: In function 'int main()':
test1.cpp:23:66: warning: cast to pointer from integer of different size [-Wint-to-pointer-cast]
   23 |          rc = pthread_create(&threads[i], NULL, PrintHello, (void *)i);
      |                                                                     ^
haris@haris-VirtualBox:~/Documents/C++/Lab10$ ./test1
main() : creating thread, 0
main() : creating thread, 1
main() : creating thread, 2
main() : creating thread, 3
main() : creating thread, 4
Hello World! Thread ID, 4
Hello World! Thread ID, 3
Hello World! Thread ID, 2
Hello World! Thread ID, 1
Hello World! Thread ID, 0
haris@haris-VirtualBox:~/Documents/C++/Lab10$
```

Question 2: Activity 2:

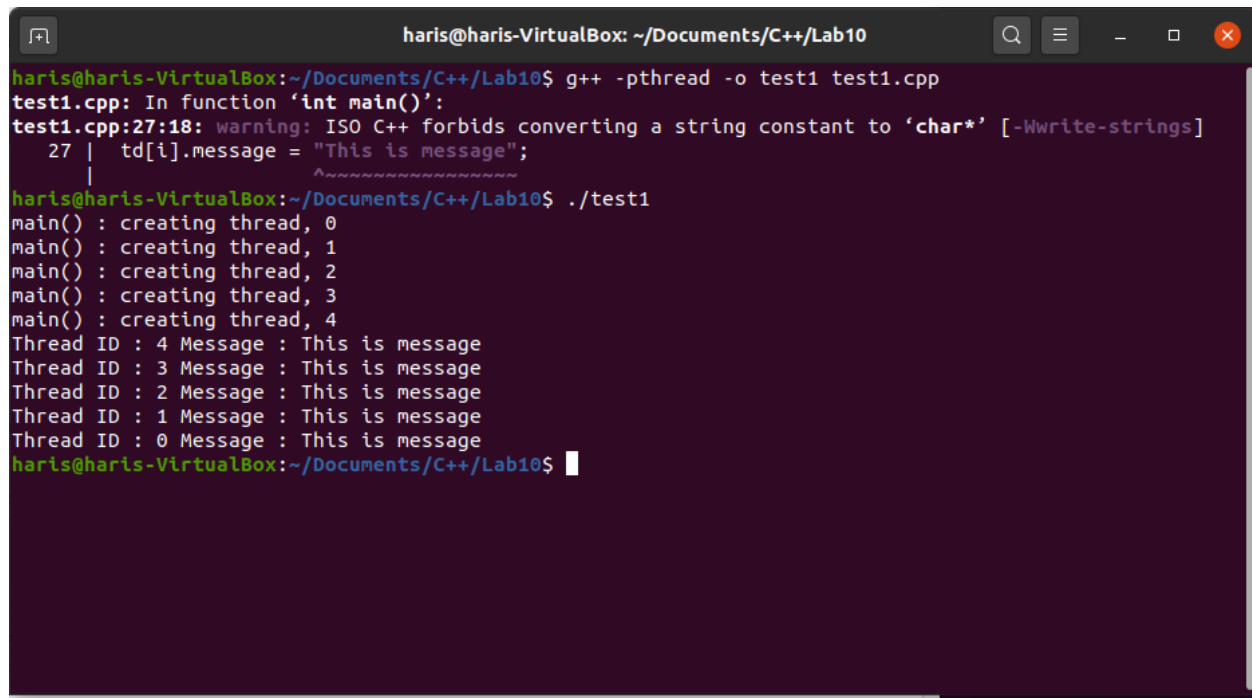**Passing Arguments to Threads**

Solution:

➢ Code is given below:

```cpp
#include <iostream>
#include <cstdlib>
#include <pthread.h>
#include <unistd.h>

using namespace std;

#define NUM_THREADS 5

void *wait(void *t) {
    int i;
    long tid;

    tid = (long)t;

    sleep(1);
    cout << "Sleeping in thread " << endl;
    cout << "Thread with id : " << tid << "   ...exiting " << endl;    pthread_exit(NULL);
}

int main () {    int rc;    int i;
    pthread_t threads[NUM_THREADS];    pthread_attr_t attr;    void *status;


    // Initialize and set thread joinable    pthread_attr_init(&attr);
    pthread_attr_setdetachstate(&attr, PTHREAD_CREATE_JOINABLE);

    for( i = 0; i < NUM_THREADS; i++ ) {
        cout << "main() : creating thread, " << i << endl;        rc =
    pthread_create(&threads[i], &attr, wait, (void *)i );
            if (rc) {
            cout << "Error:unable to create thread," << rc << endl;        exit(-1);
        }
```

The Terminal Output is given below,
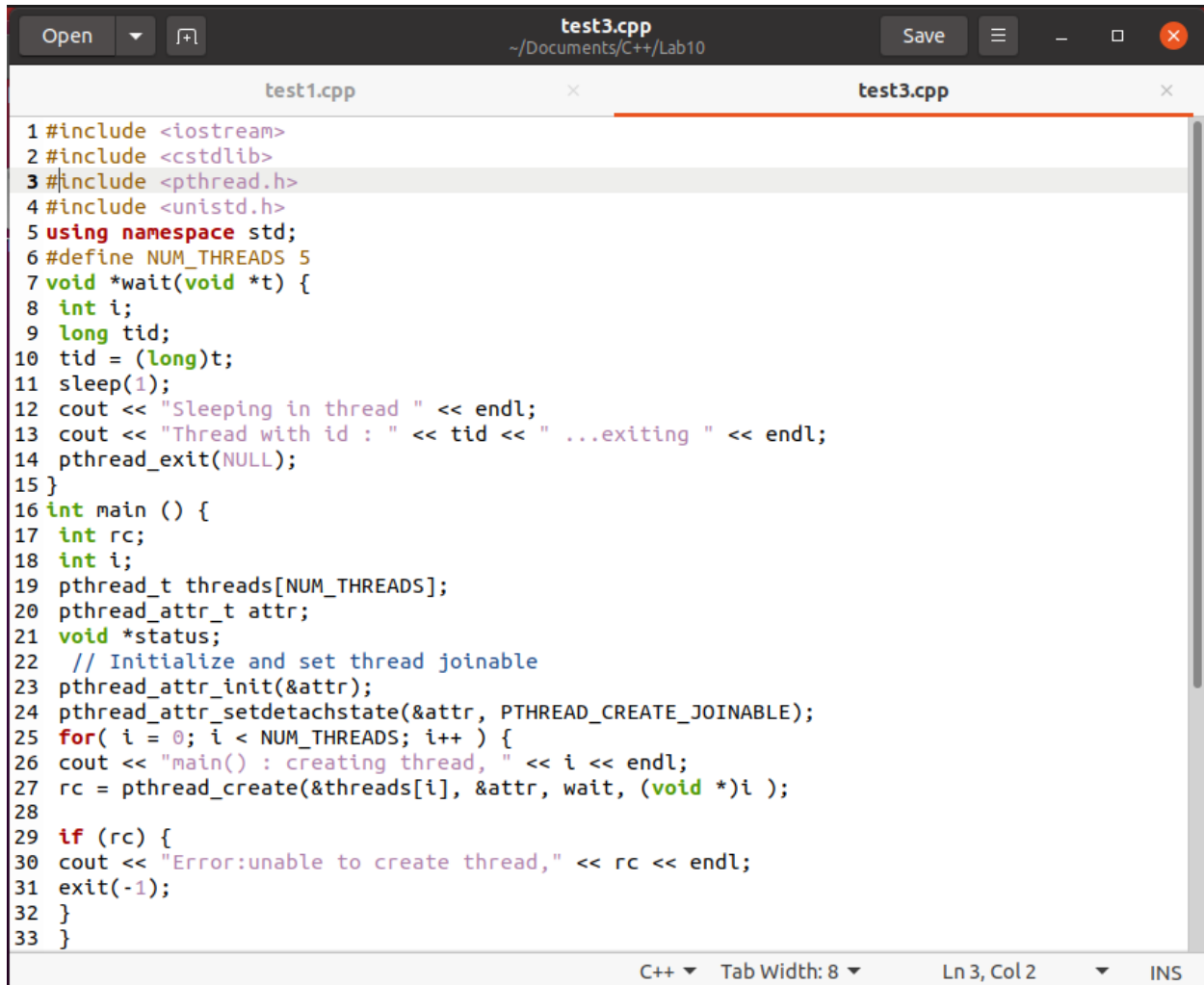
```
haris@haris-VirtualBox: ~/Documents/C++/Lab10

haris@haris-VirtualBox:~/Documents/C++/Lab10$ g++ -pthread -o test1 test1.cpp
test1.cpp: In function 'int main()':
test1.cpp:27:18: warning: ISO C++ forbids converting a string constant to 'char*' [-Wwrite-strings]
   27 |   td[i].message = "This is message";
      |                   ^~~~~~~~~~~~~~~~~~
haris@haris-VirtualBox:~/Documents/C++/Lab10$ ./test1
main() : creating thread, 0
main() : creating thread, 1
main() : creating thread, 2
main() : creating thread, 3
main() : creating thread, 4
Thread ID : 4 Message : This is message
Thread ID : 3 Message : This is message
Thread ID : 2 Message : This is message
Thread ID : 1 Message : This is message
Thread ID : 0 Message : This is message
haris@haris-VirtualBox:~/Documents/C++/Lab10$
```

Question 3: Activity 3:

Joining and Detaching Threads

Solution:

➤ Code is given below:

```
test3.cpp
~/Documents/C++/Lab10

test1.cpp                                    test3.cpp

1 #include <iostream>
2 #include <cstdlib>
3 #include <pthread.h>
4 #include <unistd.h>
5 using namespace std;
6 #define NUM_THREADS 5
7 void *wait(void *t) {
8  int i;
9  long tid;
10  tid = (long)t;
11  sleep(1);
12  cout << "Sleeping in thread " << endl;
13  cout << "Thread with id : " << tid << " ...exiting " << endl;
14  pthread_exit(NULL);
15 }
16 int main () {
17  int rc;
18  int i;
19  pthread_t threads[NUM_THREADS];
20  pthread_attr_t attr;
21  void *status;
22   // Initialize and set thread joinable
23  pthread_attr_init(&attr);
24  pthread_attr_setdetachstate(&attr, PTHREAD_CREATE_JOINABLE);
25  for( i = 0; i < NUM_THREADS; i++ ) {
26  cout << "main() : creating thread, " << i << endl;
27  rc = pthread_create(&threads[i], &attr, wait, (void *)i );
28
29  if (rc) {
30  cout << "Error:unable to create thread," << rc << endl;
31  exit(-1);
32  }
33  }

                    C++ ▼   Tab Width: 8 ▼      Ln 3, Col 2      ▼    INS
```
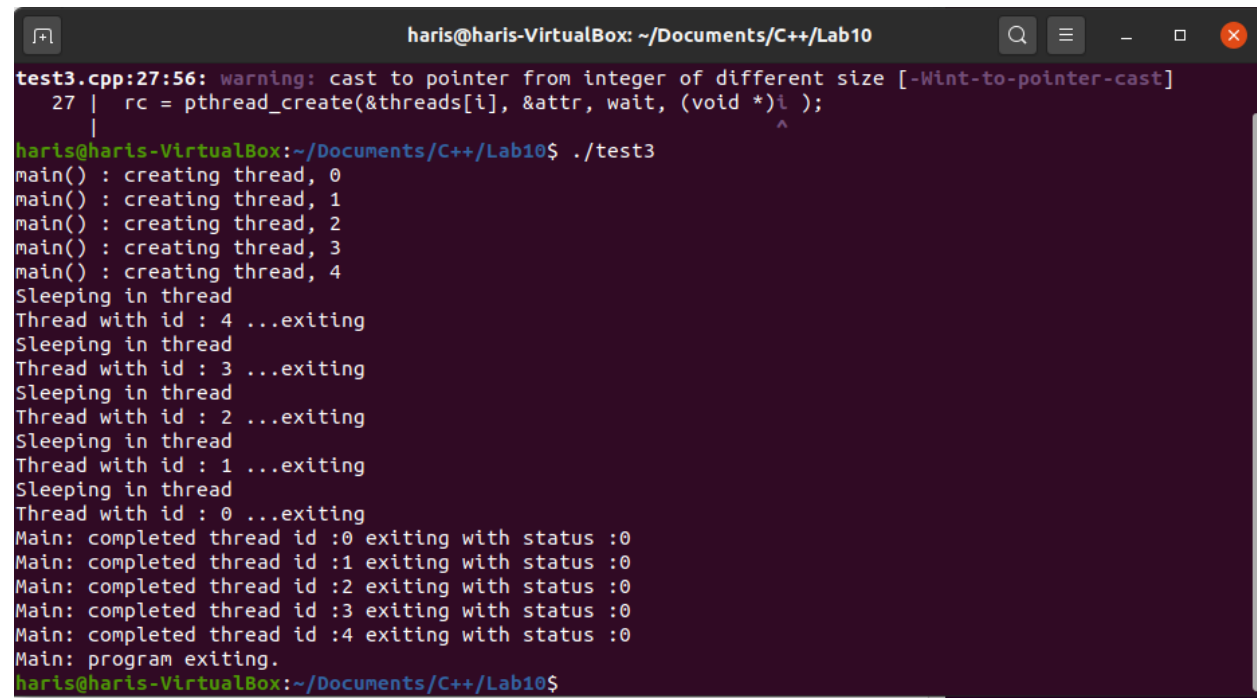
The Terminal Output is given below,
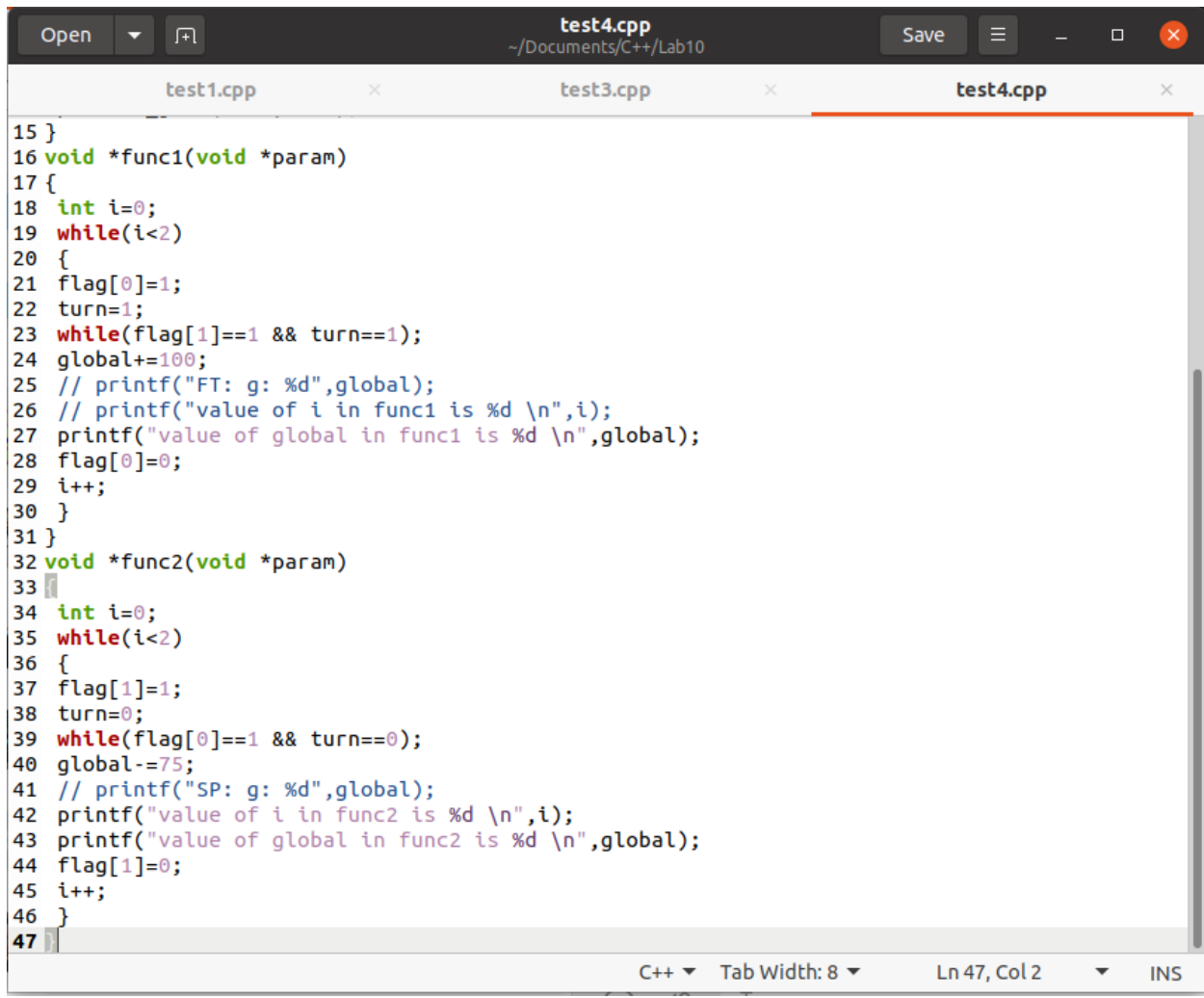
```
test3.cpp:27:56: warning: cast to pointer from integer of different size [-Wint-to-pointer-cast]
   27 |   rc = pthread_create(&threads[i], &attr, wait, (void *)i );
      |                                                          ^
haris@haris-VirtualBox:~/Documents/C++/Lab10$ ./test3
main() : creating thread, 0
main() : creating thread, 1
main() : creating thread, 2
main() : creating thread, 3
main() : creating thread, 4
Sleeping in thread
Thread with id : 4 ...exiting
Sleeping in thread
Thread with id : 3 ...exiting
Sleeping in thread
Thread with id : 2 ...exiting
Sleeping in thread
Thread with id : 1 ...exiting
Sleeping in thread
Thread with id : 0 ...exiting
Main: completed thread id :0 exiting with status :0
Main: completed thread id :1 exiting with status :0
Main: completed thread id :2 exiting with status :0
Main: completed thread id :3 exiting with status :0
Main: completed thread id :4 exiting with status :0
Main: program exiting.
haris@haris-VirtualBox:~/Documents/C++/Lab10$
```

Question 4: Activity part 1:

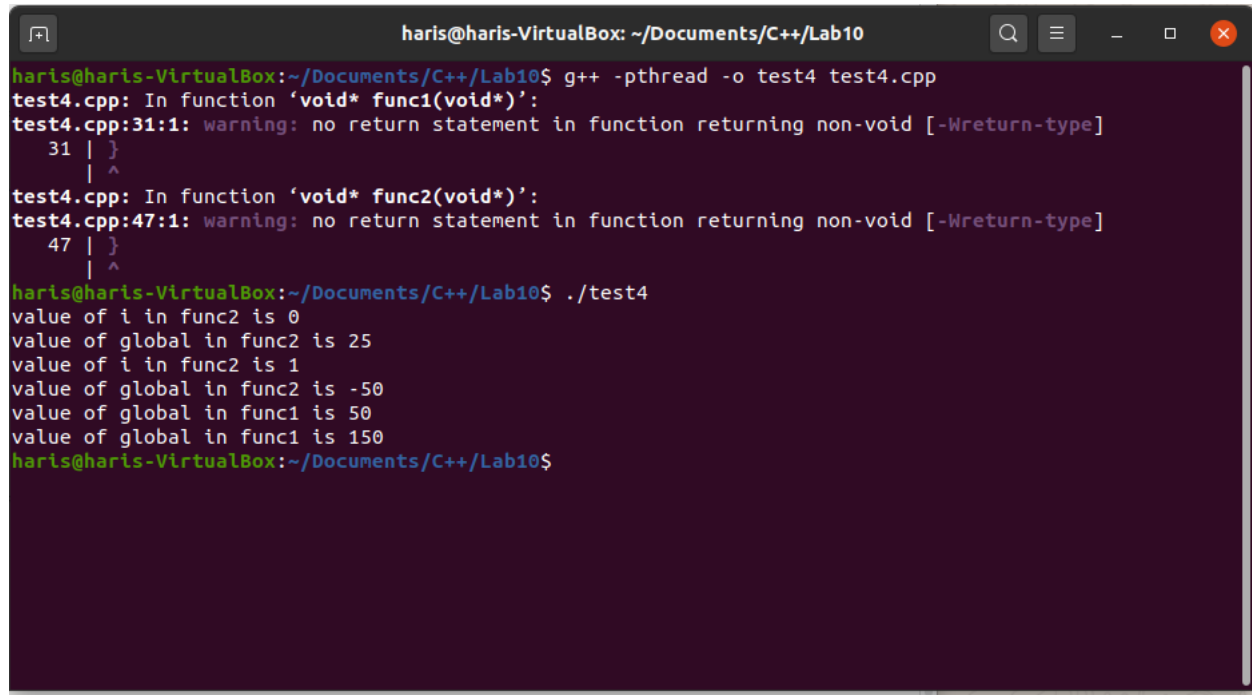**Peterson solution for 2 processes critical section problem**

Solution:

➤ Code is given below:

```cpp
15 }
16 void *func1(void *param)
17 {
18  int i=0;
19  while(i<2)
20  {
21  flag[0]=1;
22  turn=1;
23  while(flag[1]==1 && turn==1);
24  global+=100;
25  // printf("FT: g: %d",global);
26  // printf("value of i in func1 is %d \n",i);
27  printf("value of global in func1 is %d \n",global);
28  flag[0]=0;
29  i++;
30  }
31 }
32 void *func2(void *param)
33 {
34  int i=0;
35  while(i<2)
36  {
37  flag[1]=1;
38  turn=0;
39  while(flag[0]==1 && turn==0);
40  global-=75;
41  // printf("SP: g: %d",global);
42  printf("value of i in func2 is %d \n",i);
43  printf("value of global in func2 is %d \n",global);
44  flag[1]=0;
45  i++;
46  }
```

C++ ▼   Tab Width: 8 ▼   Ln 47, Col 2   ▼   INS

The Terminal Output is given below,

```
haris@haris-VirtualBox:~/Documents/C++/Lab10$ g++ -pthread -o test4 test4.cpp
test4.cpp: In function 'void* func1(void*)':
test4.cpp:31:1: warning: no return statement in function returning non-void [-Wreturn-type]
   31 | }
      | ^
test4.cpp: In function 'void* func2(void*)':
test4.cpp:47:1: warning: no return statement in function returning non-void [-Wreturn-type]
   47 | }
      | ^
haris@haris-VirtualBox:~/Documents/C++/Lab10$ ./test4
value of i in func2 is 0
value of global in func2 is 25
value of i in func2 is 1
value of global in func2 is -50
value of global in func1 is 50
value of global in func1 is 150
haris@haris-VirtualBox:~/Documents/C++/Lab10$
```

Question 4: Activity part 2:

Modified Code

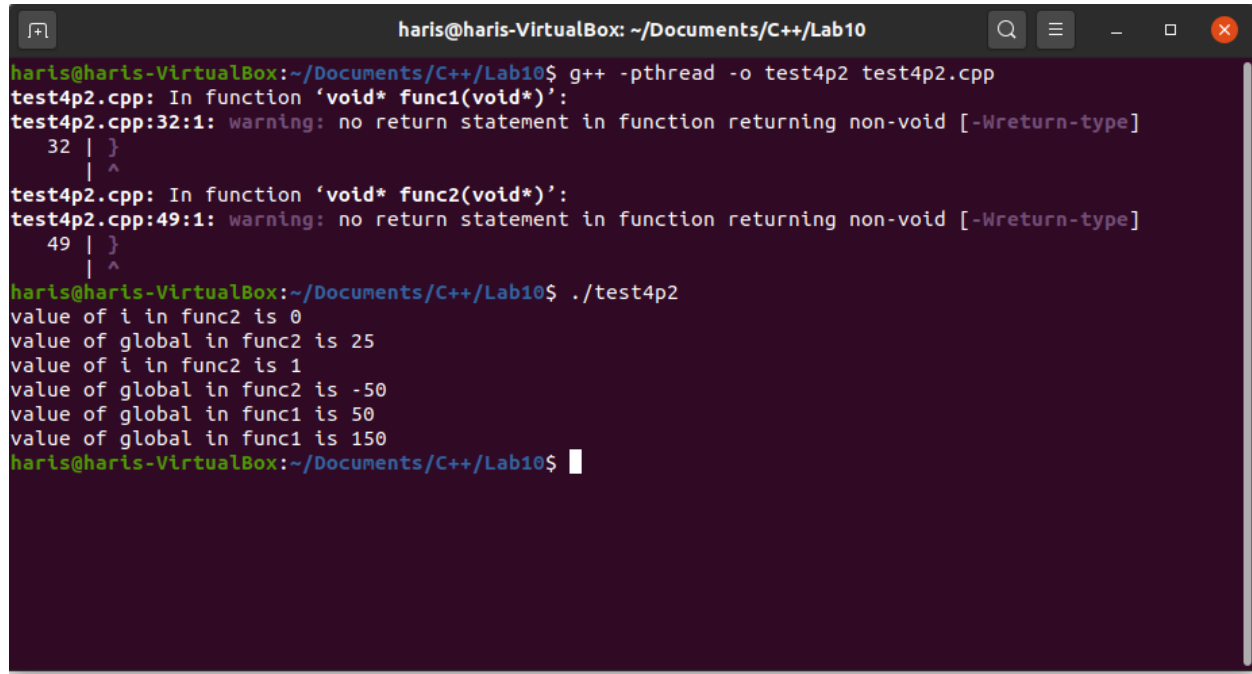# Solution:

➢ Code is given below:

```cpp
test4p2.cpp
~/Documents/C++/Lab10

1 #include<pthread.h>
2 #include<stdio.h>
3 void *func1(void *);
4 void *func2(void *);
5 int flag[2];
6 int turn=0;
7 int global=100;
8 int main()
9 {
10  pthread_t tid1,tid2;
11  pthread_create(&tid1,NULL,func1,NULL);
12  pthread_create(&tid2,NULL,func2,NULL);
13  pthread_join(tid1,NULL);
14  pthread_join(tid2,NULL);
15 }
16 void *func1(void *param)
17 {
18  int i=0;
19  while(i<2)
20  {
21  flag[0]=1;
22  turn=1;
23  __sync_synchronize();
24  while(flag[1]==1 && turn==1) sched_yield();
25  global+=100;
26  // printf("FT: g: %d",global);
27  // printf("value of i in func1 is %d \n",i);
28  printf("value of global in func1 is %d \n",global);
29  flag[0]=0;
30  i++;
31  }
32 }
33 void *func2(void *param)
34 {
35  int i=0;
36  while(i<2)
```

C++ ▾   Tab Width: 8 ▾   Ln 17, Col 2   ▾   INS

The Terminal Output is given below,

```
haris@haris-VirtualBox:~/Documents/C++/Lab10$ g++ -pthread -o test4p2 test4p2.cpp
test4p2.cpp: In function 'void* func1(void*)':
test4p2.cpp:32:1: warning: no return statement in function returning non-void [-Wreturn-type]
   32 | }
      | ^
test4p2.cpp: In function 'void* func2(void*)':
test4p2.cpp:49:1: warning: no return statement in function returning non-void [-Wreturn-type]
   49 | }
      | ^
haris@haris-VirtualBox:~/Documents/C++/Lab10$ ./test4p2
value of i in func2 is 0
value of global in func2 is 25
value of i in func2 is 1
value of global in func2 is -50
value of global in func1 is 50
value of global in func1 is 150
haris@haris-VirtualBox:~/Documents/C++/Lab10$
```

_____THE END_____