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Course	Operating System
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Assignment #03

1. The following code deals with basic thread creation.

(a) Write the following program and observe and *explain* the output.

```
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ gcc -o thread-ex thread-ex.c -lpthread
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex
Hello
Hello
Hello
Hello
World
World
World
World
World
World
World
World
World
World
World
World
World
Hello
Hello
Hello
Hello
Hello
```

Observation And Explanation:-

The sequence of output depends on the execution of threads in the program .So every time output depends on the threads execution. This is because if we run program once again and more .output is not same in all time this is because sequence of output depends on the execution of threads.

```

tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ gcc -o thread-ex thread-ex.c -lpthread
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
World
World
World
World
World
World
World
World
World
World
World
Hello
Hello

```

(b) Modify the program to create four threads using the same two functions (thread1 and thread2)

```

D:\University Lectures\Semester 6\Operating System\Assignments\assignment # 3\thread-ex.c • (Bootstrap Crash Course) - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help

FOLD thread-ex.c
1 #include <stdio.h>
2 #include <pthread.h>
3 #include <stdlib.h>
4
5 void* thread1(){
6
7     for (int c = 0; c < 10; c++)
8     {
9         printf("Hello\n");
10    }
11 }
12
13 void* thread2(){
14     for (int c = 0; c < 10; c++)
15     {
16         printf("World\n");
17     }
18 }
19
20 int main()
21 {
22     int status;
23     pthread_t tid1,tid2 , tid3 , tid4;
24
25     pthread_create(&tid1 , NULL , thread1 , NULL);
26     pthread_create(&tid2 , NULL , thread2 , NULL);
27     pthread_create(&tid3 , NULL , thread1 , NULL);
28     pthread_create(&tid4 , NULL , thread2 , NULL);
29     pthread_join(tid1 , NULL);
30     pthread_join(tid2 , NULL);
31     pthread_join(tid3 , NULL);
32     pthread_join(tid4 , NULL);
33     return 0;
34 }

```

(c) Run both versions and include screenshots of the output.

Two Thread Execution:-

```
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3  
$ ./thread-ex  
Hello  
Hello  
Hello  
Hello  
Hello  
Hello  
Hello  
Hello  
Hello  
Hello  
World  
World  
World  
World  
World  
World  
World  
World  
World  
World
```

Four Thread Execution:-

[illegible]

2. Take a look at the following code:

(a) Compile and execute the program.

```
tashfeen222@hp: /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
File Edit View Search Terminal Help
Thread 0 , counter = 10122813
-----
Final counter value: 10122813
Error: 9877187
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ gcc -o thread-ex2 thread-ex2.c -lpthread
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex2
Starting thread: 0
Starting thread: 1
Thread 1 , counter = 8724067
Thread 0 , counter = 10976655
-----
Final counter value: 10976655
Error: 9023345
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ gcc -o thread-ex2 thread-ex2.c -lpthread
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex2
Starting thread: 0
Starting thread: 1
Thread 1 , counter = 7674449
Thread 0 , counter = 11218960
-----
Final counter value: 11218960
Error: 8781040
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ gcc -o thread-ex2 thread-ex2.c -lpthread
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex2
Starting thread: 0
Starting thread: 1
Thread 0 , counter = 8801567
Thread 1 , counter = 10622565
-----
Final counter value: 10622565
Error: 9377435
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
```

(b) Answer the following questions:

i. What should be the value of the counter variable at the end?

Final counter variable value is the same value of last thread execution counter.

Its mean

if thread1 execution end at last final counter value is same as the value of thread1

if thread0 execution end at last final counter value is same as the value of thread0

ii. What is the value you get?

I get the value same as

if thread1 execution end at last final counter value is same as the value of thread1

if thread0 execution end at last final counter value is same as the value of thread0

```
tashfeen222@hp: /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
File Edit View Search Terminal Help
Starting thread: 0
Starting thread: 1
Thread 1 , counter = 10870851
Thread 0 , counter = 11624213
-----
Final counter value: 11624213
Error: 8375787
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex2
Starting thread: 0
Starting thread: 1
Thread 1 , counter = 9012986
Thread 0 , counter = 11255050
-----
Final counter value: 11255050
Error: 8744950
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ gcc -o thread-ex2 thread-ex2.c -lpthread
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex2
Starting thread: 0
Starting thread: 1
Thread 1 , counter = 10728702
Thread 0 , counter = 11226156
-----
Final counter value: 11226156
Error: 8773844
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ gcc -o thread-ex2 thread-ex2.c -lpthread
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ ./thread-ex2
Starting thread: 0
Starting thread: 1
Thread 1 , counter = 7666717
Thread 0 , counter = 11261503
-----
Final counter value: 11261503
Error: 8738497
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$
```

iii. How large is the error and how much does it vary on different runs?

Error is so large in every time program running. And it actually vary in each time running the program .And its range approximately 7700000 to 10700000 on my system approximately

iv. How much *user time* (roughly) does the program take to run on your system?

Approximately 0.35s

```
tashfeen222@hp: /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
File Edit View Search Terminal Help
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.36s user 0.00s system 190% cpu 0.191 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.35s user 0.00s system 192% cpu 0.184 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.38s user 0.00s system 196% cpu 0.196 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.38s user 0.00s system 195% cpu 0.195 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.33s user 0.00s system 191% cpu 0.173 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.32s user 0.00s system 190% cpu 0.170 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.39s user 0.00s system 196% cpu 0.199 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.33s user 0.00s system 192% cpu 0.173 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.37s user 0.00s system 193% cpu 0.192 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.35s user 0.00s system 189% cpu 0.185 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.31s user 0.00s system 188% cpu 0.165 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$ time ./thread-ex2 >/dev/null
./thread-ex2 > /dev/null 0.33s user 0.00s system 191% cpu 0.172 total
tashfeen222@hp /media/tashfeen222/4A902C1F902C144B/University Lectures/Semester 6/Operating System/Assignments/assignment3
$
```

←-----THE END-----→

