P20-0107
BCS - 4A

—

MUHAMMAD AWAIS

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

void *thread1()
{
  for (int c = 0; c < 10; c++)
    printf("Hello\n");
}

void *thread2()
{
  for (int c = 0; c < 10; c++)
    printf("World\n");
}

int main()
{
  int status;
  pthread_t tid1, tid2;

  pthread_create(&tid1, NULL, thread1, NULL);
  pthread_create(&tid2, NULL, thread2, NULL);

  pthread_join(tid1, NULL);
  pthread_join(tid2, NULL);
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question1
World
World
World
World
World
World
World
World
World
World
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question1
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
World
World
World
World
World
World
World
World
World
World
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question1
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
World
World
World
World
World
World
World
World
World
World
Hello
Hello
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question1
Hello
Hello
Hello
World
World
World
World
World
World
World
World
World
World
World
Hello
Hello
Hello
Hello
Hello
Hello
Hello
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$
```
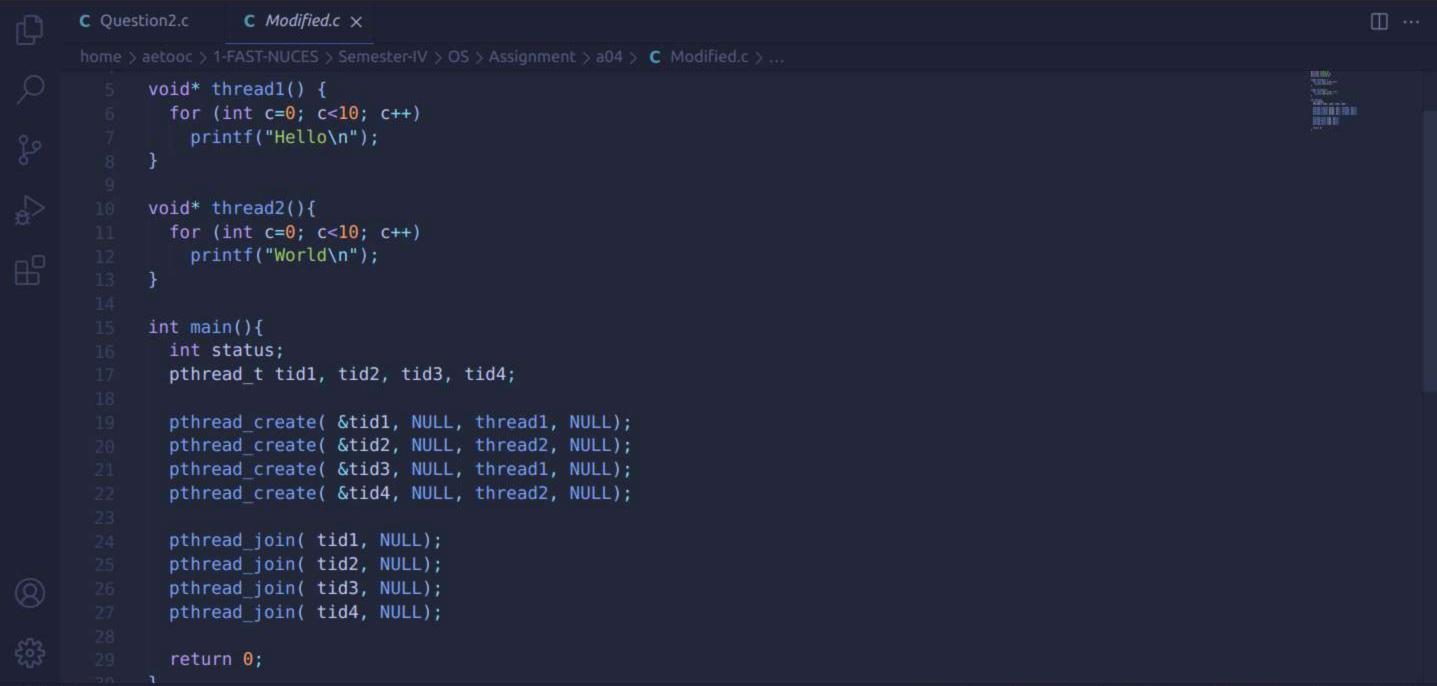
Answer:

"World" is printed first for ten times, and sometimes "Hello" is printed first for ten times which indicates that sometimes Thread 2 is executed first without the race condition and sometimes Thread 1.

After running this code multiple times, I observed that sometimes Thread 1 executes for less than ten times and is preempted. Thread 2 is given a turn and starts executing. Thread 2 completes its execution, and Thread 1 resumes its execution from where it left and vice versa. Preemption can happen at any time irrespective of what iteration of loop is running.

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-- INSERT --   17,1   All

home > aetooc > 1-FAST-NUCES > Semester-IV > OS > Assignment > a04 > C Modified.c > ...

```c
void* thread1() {
  for (int c=0; c<10; c++)
    printf("Hello\n");
}

void* thread2(){
  for (int c=0; c<10; c++)
    printf("World\n");
}

int main(){
  int status;
  pthread_t tid1, tid2, tid3, tid4;

  pthread_create( &tid1, NULL, thread1, NULL);
  pthread_create( &tid2, NULL, thread2, NULL);
  pthread_create( &tid3, NULL, thread1, NULL);
  pthread_create( &tid4, NULL, thread2, NULL);

  pthread_join( tid1, NULL);
  pthread_join( tid2, NULL);
  pthread_join( tid3, NULL);
  pthread_join( tid4, NULL);

  return 0;
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Modified
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
World
World
Hello
Hello
Hello
Hello
Hello
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Hello
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```

```
Hello
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Hello
Hello
Hello
Hello
World
World
World
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Modified
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
Hello
World
World
World
World
World
World
World
World
World
World
World
World
World
World
World
World
World
World
World
World
World
Hello
Hello
```

Question2.c - Visual Studio Code

File   Edit   Selection   View   Go   Run   Terminal   Help

C Question2.c ✕   C *Modified.c*

home > aetooc > 1-FAST-NUCES > Semester-IV > OS > Assignment > a04 > C Question2.c > ⊕ handler(void *)

```c
11    void handler(void *ptr);
12
13    int counter;
14
15    int main()
16    {
17      int i[2];
18      pthread_t thread_a;
19      pthread_t thread_b;
20
21      i[0] = 0;
22      i[1] = 1;
23
24      pthread_create(&thread_a, NULL, (void *)&handler, (void *)&i[0]);
25      pthread_create(&thread_b, NULL, (void *)&handler, (void *)&i[1]);
26
27      pthread_join(thread_a, NULL);
28      pthread_join(thread_b, NULL);
29
30      printf("----------------------------------------\n");
31      printf("Final counter value: %d\n", counter);
32      printf("Error:               %d\n", (NUM_RUNS * 2 - counter));
33
34      exit(0);
35    }
```

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```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 1
Starting thread: 0
Thread 1, counter = 9032008
Thread 0, counter = 15921710
-----------------------------------
Final counter value: 15921710
Error:               4078290
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 0
Starting thread: 1
Thread 0, counter = 8267463
Thread 1, counter = 11255047
-----------------------------------
Final counter value: 11255047
Error:               8744953
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 0
Starting thread: 1
Thread 0, counter = 8835340
Thread 1, counter = 11674881
-----------------------------------
Final counter value: 11674881
Error:               8325119
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 0
Starting thread: 1
Thread 0, counter = 5951689
Thread 1, counter = 10742412
-----------------------------------
Final counter value: 10742412
Error:               9257588
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 0
Starting thread: 1
Thread 0, counter = 9318167
Thread 1, counter = 10435857
------------------------------------
Final counter value: 10435857
Error:              9564143
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 0
Starting thread: 1
Thread 0, counter = 9204324
Thread 1, counter = 10863885
------------------------------------
Final counter value: 10863885
Error:              9136115
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 0
Starting thread: 1
Thread 0, counter = 7547635
Thread 1, counter = 13156408
------------------------------------
Final counter value: 13156408
Error:              6843592
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
Starting thread: 0
Starting thread: 1
Thread 0, counter = 8595174
Thread 1, counter = 16107683
------------------------------------
Final counter value: 16107683
Error:              3892317
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ ./Question2
```

```
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ time ./Question2 > /dev/null

real    0m0.054s
user    0m0.106s
sys     0m0.000s
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ time ./Question2 > /dev/null

real    0m0.051s
user    0m0.100s
sys     0m0.000s
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ time ./Question2 > /dev/null

real    0m0.042s
user    0m0.072s
sys     0m0.000s
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ time ./Question2 > /dev/null

real    0m0.057s
user    0m0.113s
sys     0m0.000s
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$ time ./Question2 > /dev/null

real    0m0.051s
user    0m0.077s
sys     0m0.000s
(anaconda3)aetooc@neo:~/1-FAST-NUCES/Semester-IV/OS/Assignment/a04$
```

QUESTION 2

1. 20,000,000

2. 15921710

3. 4078290. On different runs, it's value varies
   between (3892317 to 8736995)

4. Roughly 0.094s (from above readings)

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