New York University
Tandon School of Engineering
Department of Electrical & Computer Engineering

Introduction to Operating Systems (CS-GY6233)
Spring 2021

Assignment 6
(10 points)

1. (5 points)
   a. Write a program that accepts a single parameter (`n`) that is passed to your program from the command line/shell. Your program's main thread shall instantiate a shared integer variable (you may name it `counter`) and then create a child thread using the pthreads library. The parent process thread shall have a loop that increments the `counter n` times, whereas the child thread shall implement a loop that decrements the `counter n` times and then exits. **Your program shall protect access to the shared variable using a mutex lock**.
   After the parent thread has incremented the `counter n` times, it shall wait for the child thread to exit, and then print the value of `counter` to the screen.

   You shall run your program multiple times (let's say 10) for different value of `n` (which you pass from the command-line), and `n` should perhaps change from 10 to 100,000,000 in a logarithmic manner (i.e. multiply by 10 after each experiment).

   b. Tabulate your results by recording the values of `n` and `counter` in each experiment, and then answer the following questions:
   c. Does the final printed value of the counter change from one experiment to the other, or is it constant? If it is constant, what is the value? Explain why if not constant.

2. (5 points)
   a. Repeat assignment 4 part 2, except that now you shall use semaphores to avoid the spinlocks (i.e. the while loops).

Submission file structure:

Please submit a **single .zip file** named **[Your Netid]_lab#.zip**. It shall have the following structure (replace # with the actual assignment number):

```
└── [Your Netid] hw# (Single folder includes all your submissions)
    ├── lab#_1.c (Source code for problem 1)
    ├── lab#_2a.c (Source code for problem 2a, and so on)
    ├── lab#_1.h (Source code header file, if any)
    ├── Makefile (makefile used to build your program, if any)
```

├── lab#.pdf (images + Report/answers to short-answer questions)

What to hand in (using NYU Classes):

- Source file(s) named as described above.
- A .pdf file named **"lab#.pdf"**, containing:
    - Screen shot(**s**) of your terminal window showing the current directory, the command used to compile your program, the command used to run your program and the output of your program.
    - Answers to H/W questions

RULES:

- You shall **use kernel version 4.x.x or above**. You shall not use kernel version 3.x.x.
- You may consult with other students about GENERAL concepts or methods but copying code (or code fragments) or algorithms is NOT ALLOWED and is considered cheating (whether copied form other students, the internet or any other source).
- If you are having trouble, please ask your teaching assistant for help.
- You must submit your assignment prior to the deadline.