CS 4175 Fall 2023
Shirley Moore, Instructor
Programming Assignment 2
50 points

Producer-Consumer Bounded Buffer Problem using Pthreads

For this assignment, you will implement a solution to the producer-consumer bounded buffer problem. In this problem, producer threads add items to and consumer threads removes items from a shared, fixed-capacity buffer as follows:

- Some number of Producer threads, each in a loop:
  1. produce the next item
  2. add it to the shared buffer (to one end of a circular queue)
- Some number of Consumer threads, each in a loop:
  1. remove the next item from the front of the buffer
  2. consume it

Please modify the attached prodcons.c code to implement your solution. The program takes the following positional input arguments: 1) the number of producers (which is equal to the number of consumers), 2) the number of items each producer will producer and each consumer will consume, 3) the buffer size. For example,

smoore@csadmins-MacBook-Pro CS4175-fall2023 % ./prodcons 8 100 10

8 Producers & 8 Consumers, each producing 100 items, buff size 10

Routines to add and remove items from the circular buffer are provided. These functions have no synchronization, nor do they check if there is space on an add or something to remove on a remove. They just add or remove to buff in a circular fashion and update other state variables as a result of their actions. A debug print_buffer function is also provided (call `fflush(stdout)` after any debug output to force it to the terminal window).

Your tasks are the following:

Task 1. (10 pts) Implement code in `main` to create producer and consumer threads.

Task 2. (15 pts) Implement the producer and consumer thread functions.

Task 3. (15 pts) Add all synchronization necessary to synchronize the actions of concurrent producer and consumer threads.

Task 4. (10 pts) Thoroughly test your code with a set of test cases. Show and explain the results.

You should turn in your completed code and your results and explanation for Task 4.