Producer consumer!!!!!!!!!!!!!!!!!!!!!!

```
#include <stdio.h>
#include <stdlib.h>
#include <pthread.h>
#include <semaphore.h>
#include<unistd.h>

#define BUFFER_SIZE 5
#define NUM_PRODUCERS 2
#define NUM_CONSUMERS 2



int buffer[BUFFER_SIZE];
int in = 0;
int out = 0;

sem_t emptySlots;    // Semaphore to track empty slots in the buffer
sem_t filledSlots;   // Semaphore to track filled slots in the buffer
sem_t bufferMutex;   // Semaphore for mutual exclusion access to the buffer

void *producer(void *producerId) {
    int id = *(int *)producerId;
    int item = 0;

    while (1) {
        // Produce item
        item++;
        sem_wait(&emptySlots); // Wait for an empty slot in the buffer
        sem_wait(&bufferMutex); // Obtain exclusive access to the buffer

        // Add item to the buffer
        buffer[in] = item;
        printf("Producer %d produced item %d\n", id, item);
        in = (in + 1) % BUFFER_SIZE;

        sem_post(&bufferMutex); // Release exclusive access to the buffer
        sem_post(&filledSlots); // Signal that a slot in the buffer is filled

        // Sleep for a random period
        usleep(rand() % 10000000);
    }
}

void *consumer(void *consumerId) {
    int id = *(int *)consumerId;
    int item;

    while (1) {
        sem_wait(&filledSlots); // Wait for a filled slot in the buffer
        sem_wait(&bufferMutex); // Obtain exclusive access to the buffer

        // Consume item from the buffer
        item = buffer[out];
        printf("Consumer %d consumed item %d\n", id, item);
        out = (out + 1) % BUFFER_SIZE;

        sem_post(&bufferMutex); // Release exclusive access to the buffer
        sem_post(&emptySlots); // Signal that a slot in the buffer is empty
        // Sleep for a random period
        usleep(rand() % 10000000);
    }
}




int main() {
    // Producer-Consumer Problem
    sem_init(&emptySlots, 0, BUFFER_SIZE); // Initialize emptySlots semaphore with buffer size
    sem_init(&filledSlots, 0, 0); // Initialize filledSlots semaphore with 0
    sem_init(&bufferMutex, 0, 1); // Initialize bufferMutex semaphore with 1

    pthread_t producers[NUM_PRODUCERS];
    pthread_t consumers[NUM_CONSUMERS];

    int producerIds[NUM_PRODUCERS];
    int consumerIds[NUM_CONSUMERS];

    for (int i = 0; i < NUM_PRODUCERS; i++) {
        producerIds[i] = i + 1;
        pthread_create(&producers[i], NULL, producer, (void *)&producerIds[i]);
    }

    for (int i = 0; i < NUM_CONSUMERS; i++) {
        consumerIds[i] = i + 1;
        pthread_create(&consumers[i], NULL, consumer, (void *)&consumerIds[i]);
    }

    for (int i = 0; i < NUM_PRODUCERS; i++) {
        pthread_join(producers[i], NULL);
    }

    for (int i = 0; i < NUM_CONSUMERS; i++) {
        pthread_join(consumers[i], NULL);
    }
   // Cleanup semaphores
    sem_destroy(&emptySlots);
    sem_destroy(&filledSlots);
    sem_destroy(&bufferMutex);

    return 0;
}
```

Output

```
Producer 1 produced item 1
Consumer 2 consumed item 1
Producer 2 produced item 1
Consumer 1 consumed item 1
Producer 2 produced item 2
Producer 1 produced item 2
Consumer 1 consumed item 2
Consumer 2 consumed item 2
Producer 1 produced item 3
Producer 2 produced item 3
Consumer 1 consumed item 3
Producer 1 produced item 4
Producer 1 produced item 5
Consumer 2 consumed item 3
Producer 1 produced item 6
Producer 2 produced item 4
Consumer 2 consumed item 4
Consumer 1 consumed item 5
Consumer 1 consumed item 6
Producer 1 produced item 7
Consumer 1 consumed item 4
Consumer 2 consumed item 7
Producer 2 produced item 5
Consumer 2 consumed item 5
Producer 1 produced item 8
Consumer 1 consumed item 8
Producer 2 produced item 6
Consumer 1 consumed item 6
Producer 1 produced item 9
Consumer 2 consumed item 9
Producer 1 produced item 10
Consumer 1 consumed item 10
Producer 2 produced item 7
Producer 1 produced item 11
Consumer 1 consumed item 7
Consumer 2 consumed item 11
Producer 2 produced item 8
Producer 1 produced item 12
Consumer 2 consumed item 8
Consumer 1 consumed item 12
Producer 1 produced item 13
Producer 2 produced item 9
Producer 1 produced item 14
Consumer 1 consumed item 13
Consumer 2 consumed item 9
Producer 2 produced item 10
```

```
Consumer 1 consumed item 14
Consumer 2 consumed item 10
Producer 1 produced item 15
Consumer 1 consumed item 15
Producer 2 produced item 11
Consumer 2 consumed item 11
Producer 2 produced item 12
Consumer 2 consumed item 12
Producer 1 produced item 16
Consumer 1 consumed item 16
Producer 1 produced item 17
Producer 2 produced item 13
Consumer 2 consumed item 17
Producer 2 produced item 14
Consumer 2 consumed item 13
Consumer 2 consumed item 14
Producer 1 produced item 18
Consumer 1 consumed item 18
Producer 2 produced item 15
Consumer 2 consumed item 15
Producer 2 produced item 16
Consumer 1 consumed item 16
Producer 1 produced item 19
Producer 1 produced item 20
Consumer 1 consumed item 19
Producer 2 produced item 17
Consumer 1 consumed item 20
Producer 1 produced item 21
Consumer 2 consumed item 17
Producer 1 produced item 22
Producer 2 produced item 18
Producer 2 produced item 19
Producer 2 produced item 20
Consumer 1 consumed item 21
Producer 1 produced item 23
Consumer 2 consumed item 22
Consumer 1 consumed item 18
Producer 2 produced item 21
Consumer 1 consumed item 19
Consumer 1 consumed item 20
Consumer 2 consumed item 23
Producer 1 produced item 24
Consumer 2 consumed item 21
Consumer 2 consumed item 24
Producer 2 produced item 22
Consumer 2 consumed item 22
Producer 1 produced item 25
Consumer 1 consumed item 25
Producer 1 produced item 26
Producer 2 produced item 23
Consumer 2 consumed item 26
Consumer 1 consumed item 23
Producer 1 produced item 27
Producer 2 produced item 24
Consumer 2 consumed item 27
Producer 2 produced item 25
Consumer 1 consumed item 24
Consumer 1 consumed item 25
Producer 1 produced item 28
Consumer 2 consumed item 28
Producer 2 produced item 26
Consumer 2 consumed item 26
```

```
Producer 1 produced item 29

Consumer 1 consumed item 29

Producer 1 produced item 30

Producer 2 produced item 27

Producer 2 produced item 28

Consumer 2 consumed item 30

Consumer 1 consumed item 27

Consumer 1 consumed item 28

Producer 1 produced item 31

Consumer 2 consumed item 31

Producer 2 produced item 29

Consumer 1 consumed item 29

Producer 1 produced item 32

Consumer 2 consumed item 32
```