U18CO018
Shubham Shekhaliya
Assignment – 9 (OS)

1. Implement Producer Consumer Problem solution using Semaphore.
Description

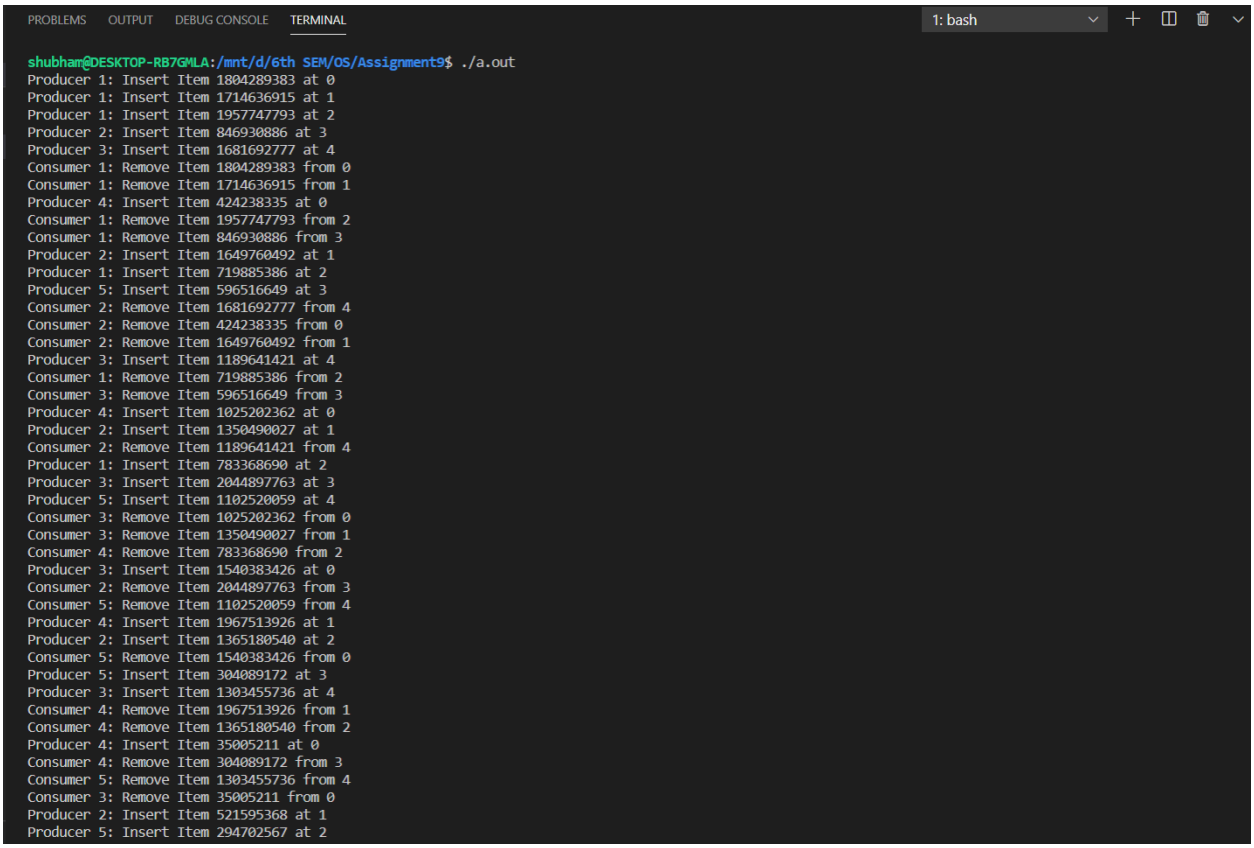
The producer and consumer share a fixed-size buffer used as a queue. The producer's job is to generate data and put this in the buffer. The consumer's job is to consume the data from this buffer, one at a time. The producer should go to sleep when buffer is full. Next time when consumer removes data it notifies the producer and producer starts producing data again. The consumer should go to sleep when buffer is empty. Next time when producer add data it notifies the consumer and consumer starts consuming data. This solution can be achieved using semaphores.

Code :-

```
#include <pthread.h>
#include <semaphore.h>
#include <stdlib.h>
#include <stdio.h>
#define MaxItems 5   // Maximum items a producer can produce or a consumer can co
nsume
#define BufferSize 5 // Size of the buffer
sem_t empty;
sem_t full;
int in = 0;
int out = 0;
int buffer[BufferSize];
pthread_mutex_t mutex;

void *producer(void *pno) {
    int item;
    for (int i = 0; i < MaxItems; i++) {
        item = rand(); // Produce an random item
        sem_wait(&empty);
        pthread_mutex_lock(&mutex);
        buffer[in] = item;
        printf("Producer %d: Insert Item %d at %d\n", *((int *)pno), buffer[in],
in);
```

```
        in = (in + 1) % BufferSize;
        pthread_mutex_unlock(&mutex);
        sem_post(&full);
    }
}
void *consumer(void *cno) {
    for (int i = 0; i < MaxItems; i++) {
        sem_wait(&full);
        pthread_mutex_lock(&mutex);
        int item = buffer[out];
        printf("Consumer %d: Remove Item %d from %d\n", *((int *)cno), item, out)
;
        out = (out + 1) % BufferSize;
        pthread_mutex_unlock(&mutex);
        sem_post(&empty);
    }
}
int main() {
    pthread_t pro[5], con[5];
    pthread_mutex_init(&mutex, NULL);
    sem_init(&empty, 0, BufferSize);
    sem_init(&full, 0, 0);

    int a[5] = {1, 2, 3, 4, 5}; //Just used for numbering the producer and consum
er

    for (int i = 0; i < 5; i++)
        pthread_create(&pro[i], NULL, producer, (void *)&a[i]);

    for (int i = 0; i < 5; i++)
        pthread_create(&con[i], NULL, consumer, (void *)&a[i]);

    for (int i = 0; i < 5; i++)
        pthread_join(pro[i], NULL);

    for (int i = 0; i < 5; i++)
        pthread_join(con[i], NULL);

    pthread_mutex_destroy(&mutex);
    sem_destroy(&empty);
    sem_destroy(&full);
    return 0;
}
```

Output:-


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
1: bash
shubham@DESKTOP-RB7GMLA:/mnt/d/6th SEM/OS/Assignment9$ ./a.out
Producer 1: Insert Item 1804289383 at 0
Producer 1: Insert Item 1714636915 at 1
Producer 1: Insert Item 1957747793 at 2
Producer 2: Insert Item 846930886 at 3
Producer 3: Insert Item 1681692777 at 4
Consumer 1: Remove Item 1804289383 from 0
Consumer 1: Remove Item 1714636915 from 1
Producer 4: Insert Item 424238335 at 0
Consumer 1: Remove Item 1957747793 from 2
Consumer 1: Remove Item 846930886 from 3
Producer 2: Insert Item 1649760492 at 1
Producer 1: Insert Item 719885386 at 2
Producer 5: Insert Item 596516649 at 3
Consumer 2: Remove Item 1681692777 from 4
Consumer 2: Remove Item 424238335 from 0
Consumer 2: Remove Item 1649760492 from 1
Producer 3: Insert Item 1189641421 at 4
Consumer 1: Remove Item 719885386 from 2
Consumer 3: Remove Item 596516649 from 3
Producer 4: Insert Item 1025202362 at 0
Producer 2: Insert Item 1350490027 at 1
Consumer 2: Remove Item 1189641421 from 4
Producer 1: Insert Item 783368690 at 2
Producer 3: Insert Item 2044897763 at 3
Producer 5: Insert Item 1102520059 at 4
Consumer 3: Remove Item 1025202362 from 0
Consumer 3: Remove Item 1350490027 from 1
Consumer 4: Remove Item 783368690 from 2
Producer 3: Insert Item 1540383426 at 0
Consumer 2: Remove Item 2044897763 from 3
Consumer 5: Remove Item 1102520059 from 4
Producer 4: Insert Item 1967513926 at 1
Producer 2: Insert Item 1365180540 at 2
Consumer 5: Remove Item 1540383426 from 0
Producer 5: Insert Item 304089172 at 3
Producer 3: Insert Item 1303455736 at 4
Consumer 4: Remove Item 1967513926 from 1
Consumer 4: Remove Item 1365180540 from 2
Producer 4: Insert Item 35005211 at 0
Consumer 4: Remove Item 304089172 from 3
Consumer 5: Remove Item 1303455736 from 4
Consumer 3: Remove Item 35005211 from 0
Producer 2: Insert Item 521595368 at 1
Producer 5: Insert Item 294702567 at 2