OS - PRODUCER_CONSUMER PROBLEM

Write a C program to simulate:
a) Producer-Consumer problem using semaphores.

Code:

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

#define BUFFER_SIZE 5

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

sem_t empty, full;
pthread_mutex_t mutex;

void* producer(void* arg){
    int item;
    for(int i=0;i<10;i++){
        item=rand()%100;
        sem_wait(&empty);
        pthread_mutex_lock(&mutex);

        buffer[in]=item;
        printf("Producer produced: %d at %d\n", item, in);
        in=(in+1)%BUFFER_SIZE;

        pthread_mutex_unlock(&mutex);
        sem_post(&full);

        sleep(1);
    }
    return NULL;
}
```

```c
void* consumer(void* arg){
    int item;
    for(int i=0;i<10;i++){
        sem_wait(&full);
        pthread_mutex_lock(&mutex);

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

        pthread_mutex_unlock(&mutex);
        sem_post(&empty);

        sleep(2);
    }
    return NULL;
}

int main(){
    pthread_t prod_thread, cons_thread;

    sem_init(&empty, 0, BUFFER_SIZE);
    sem_init(&full, 0, 0);
    pthread_mutex_init(&mutex, NULL);

    pthread_create(&prod_thread, NULL, producer, NULL);
    pthread_create(&cons_thread, NULL, consumer, NULL);

    pthread_join(prod_thread, NULL);
    pthread_join(cons_thread, NULL);

    sem_destroy(&empty);
    sem_destroy(&full);
    pthread_mutex_destroy(&mutex);

    return 0;
}
```

Output:

```
Producer produced: 41 at 0
Consumer consumed: 41 from 0
Producer produced: 67 at 1
Consumer consumed: 67 from 1
Producer produced: 34 at 2
Producer produced: 0 at 3
Consumer consumed: 34 from 2
Producer produced: 69 at 4
Producer produced: 24 at 0
Consumer consumed: 0 from 3
Producer produced: 78 at 1
Producer produced: 58 at 2
Consumer consumed: 69 from 4
Producer produced: 62 at 3
Producer produced: 64 at 4
Consumer consumed: 24 from 0
Consumer consumed: 78 from 1
Consumer consumed: 58 from 2
Consumer consumed: 62 from 3
Consumer consumed: 64 from 4

Process returned 0 (0x0)   execution time : 21.370 s
Press any key to continue.
```