

SRN: PES1UG19EC326

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WEEK: 8&9

SUBJECT: OS

// using binary semaphore

```
#include<unistd.h>
```

```
#include<stdlib.h>
```

```
#include<stdio.h>
```

```
#include<pthread.h>
```

```
#define BUFF_SIZ 20
```

```
int s = 1;
```

```
int full = 0;
```

```
int empt = BUFF_SIZ;
```

```
int arr[BUFF_SIZ];
```

```
int value = 0;
```

```
void wait(int *s)
```

```
{
```

```
while(*s <= 0);
```

```
*s = *s - 1;
```

```
}
```

```
void signal(int* s)
```

```
{
```

```
*s = *s + 1;
```

```
}
```

```
void *producer(void* param)
```

```
{
```

```

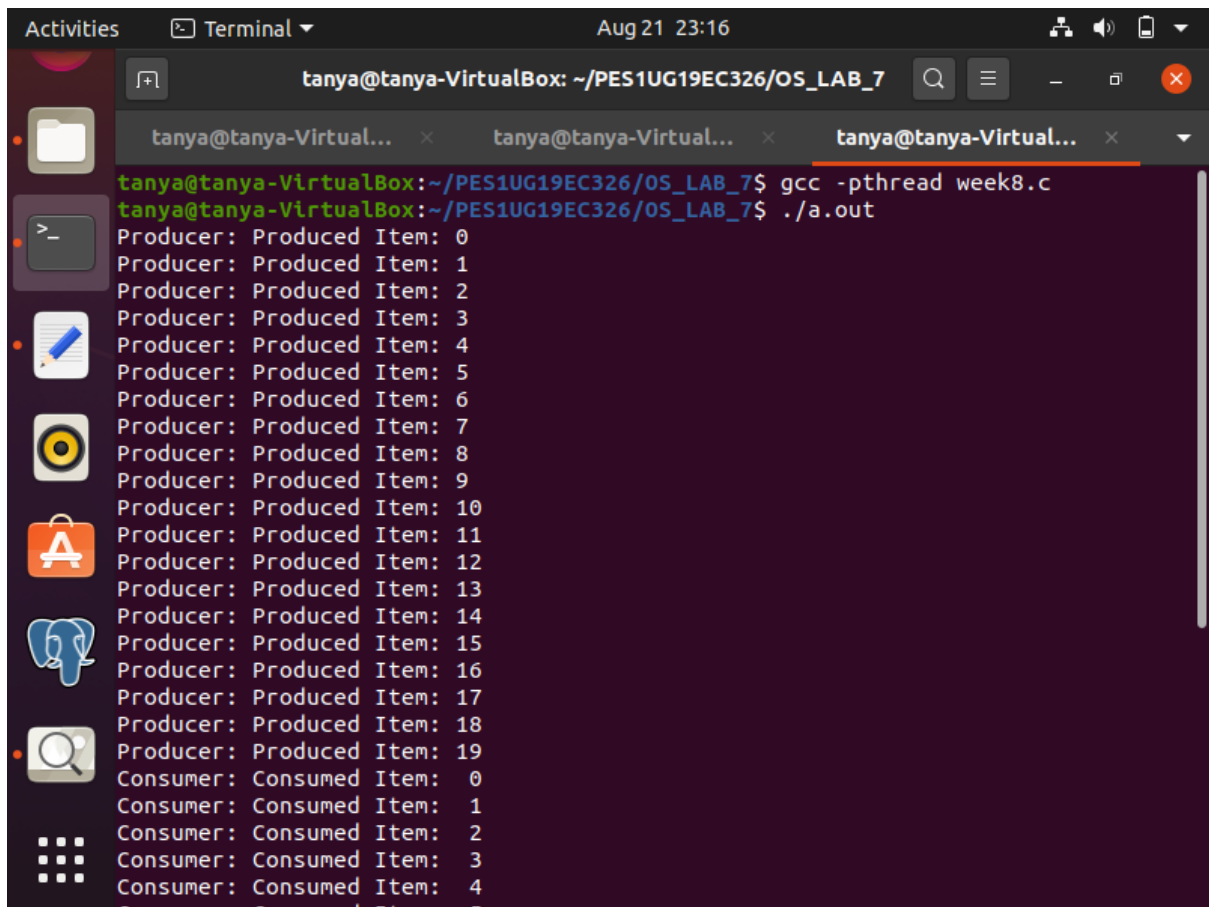
for(int i=0;i<BUFF_SIZ;i++)
{
    int new_item = value;
    value++;
    wait(&empty);
    wait(&s);
    printf("Producer:");
    printf(" Produced Item: %d\n",new_item);
    arr[i] = new_item;
    signal(&s);
    signal(&full);
}
pthread_exit(0);
}

void *consumer(void* param)
{
    for(int i=0;i<BUFF_SIZ;i++)
    {
        wait(&full);
        wait(&s);
        printf("Consumer:");
        printf(" Consumed Item: %d\n", arr[i]);
        signal(&s);
        signal(&empty);
    }
    pthread_exit(0);
}

int main()
{
    pthread_t tid_p,tid_c;
    pthread_attr_t attr1,attr2;

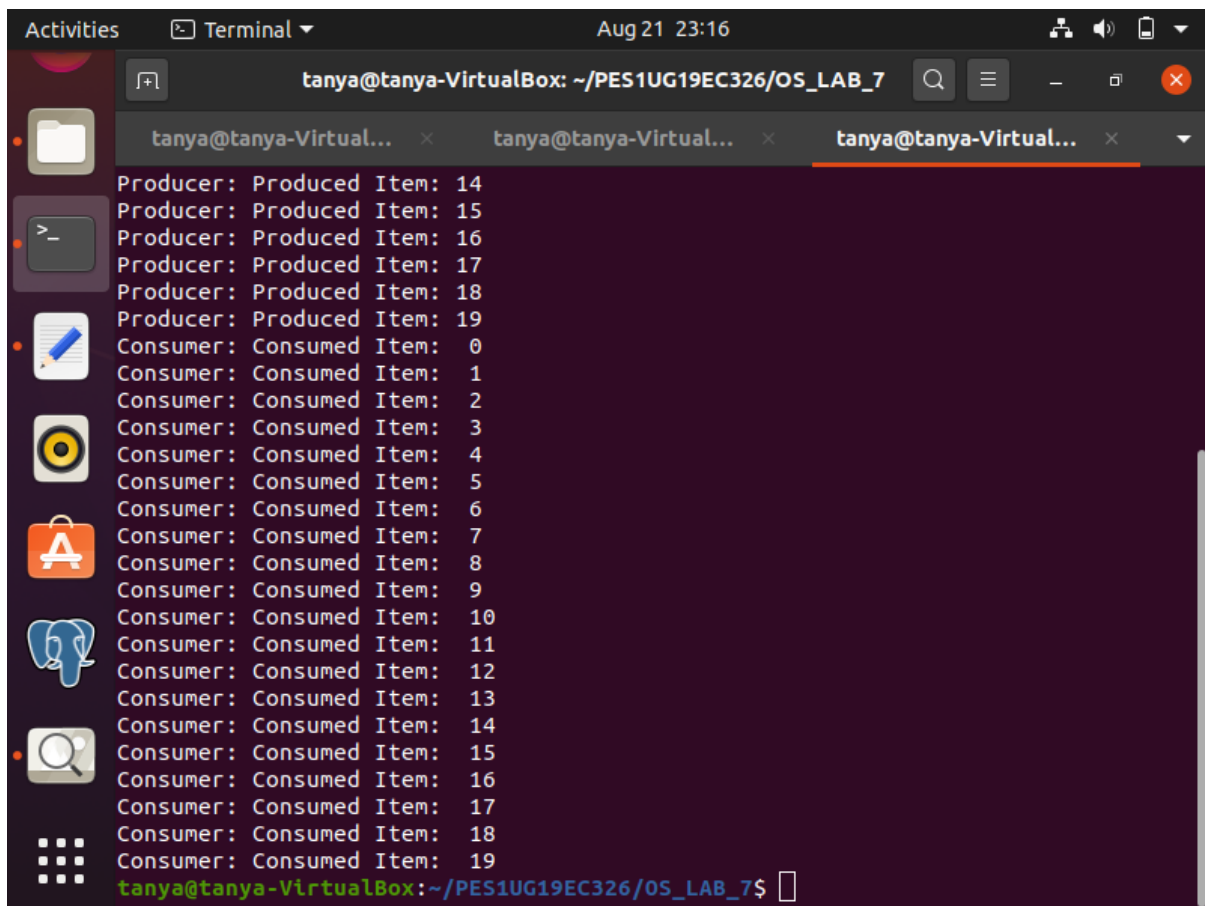
```

```
pthread_attr_init(&attr1);
pthread_attr_init(&attr2);
pthread_create(&tid_p,&attr1,producer,NULL);
pthread_create(&tid_c,&attr2,consumer,NULL);
pthread_join(tid_p,NULL);
pthread_join(tid_c,NULL);
return 0;
}
```



The screenshot shows a terminal window titled "tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7". The terminal displays the compilation and execution of a C program. The command `gcc -pthread week8.c` is used to compile the program, and `./a.out` is used to run it. The output shows the producer thread producing 20 items (0 to 19) and the consumer thread consuming 5 items (0 to 4). The terminal window has a dark background and a sidebar with various application icons on the left. The top of the window shows the date and time as "Aug 21 23:16".

```
tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7
tanya@tanya-VirtualBox:~/PES1UG19EC326/OS_LAB_7$ gcc -pthread week8.c
tanya@tanya-VirtualBox:~/PES1UG19EC326/OS_LAB_7$ ./a.out
Producer: Produced Item: 0
Producer: Produced Item: 1
Producer: Produced Item: 2
Producer: Produced Item: 3
Producer: Produced Item: 4
Producer: Produced Item: 5
Producer: Produced Item: 6
Producer: Produced Item: 7
Producer: Produced Item: 8
Producer: Produced Item: 9
Producer: Produced Item: 10
Producer: Produced Item: 11
Producer: Produced Item: 12
Producer: Produced Item: 13
Producer: Produced Item: 14
Producer: Produced Item: 15
Producer: Produced Item: 16
Producer: Produced Item: 17
Producer: Produced Item: 18
Producer: Produced Item: 19
Consumer: Consumed Item: 0
Consumer: Consumed Item: 1
Consumer: Consumed Item: 2
Consumer: Consumed Item: 3
Consumer: Consumed Item: 4
```

A screenshot of a terminal window titled 'tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7'. The terminal displays the output of a program. The first 10 lines show 'Producer: Produced Item: 14' through 'Producer: Produced Item: 19'. The next 10 lines show 'Consumer: Consumed Item: 0' through 'Consumer: Consumed Item: 19'. The prompt 'tanya@tanya-VirtualBox:~/PES1UG19EC326/OS_LAB_7\$' is visible at the bottom. The terminal window has a dark background and a sidebar on the left with various application icons.

```
Aug 21 23:16
tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7
Producer: Produced Item: 14
Producer: Produced Item: 15
Producer: Produced Item: 16
Producer: Produced Item: 17
Producer: Produced Item: 18
Producer: Produced Item: 19
Consumer: Consumed Item: 0
Consumer: Consumed Item: 1
Consumer: Consumed Item: 2
Consumer: Consumed Item: 3
Consumer: Consumed Item: 4
Consumer: Consumed Item: 5
Consumer: Consumed Item: 6
Consumer: Consumed Item: 7
Consumer: Consumed Item: 8
Consumer: Consumed Item: 9
Consumer: Consumed Item: 10
Consumer: Consumed Item: 11
Consumer: Consumed Item: 12
Consumer: Consumed Item: 13
Consumer: Consumed Item: 14
Consumer: Consumed Item: 15
Consumer: Consumed Item: 16
Consumer: Consumed Item: 17
Consumer: Consumed Item: 18
Consumer: Consumed Item: 19
tanya@tanya-VirtualBox:~/PES1UG19EC326/OS_LAB_7$
```

//using semaphore -avoid critical section problems in a concurrent system

```
#include <stdio.h>
```

```
#include <string.h>
```

```
#include <stdlib.h>
```

```
#include <stdbool.h> // Boolean data type
```

```
#include <pthread.h> // allows a program to control multiple different flows of work that overlap in time
```

```
#include <unistd.h> // header file that provides access to the POSIX operating system API
```

```
#include <semaphore.h> // define the sem_t type
```

```
#define BUFFER_SIZE 75 // total number of slots
```

```
int *buf;
```

```
int start = 0, end = 0;
```

```
sem_t mutex; // enforce mutual exclusion to shared data
```

```
sem_t empty; // keep track of the number of empty spots
```

```
sem_t full; // keep track of the number of full spots
```

```

void *consumer();

void *producer();


void *producer()
{
    int item = 0;
    while (true)
    {
        sem_wait(&empty);//lock

        sem_wait(&mutex);

        item++;

        printf("Produced: Produced Item: %d\n", item);

        buf[start] = item;

        sem_post(&mutex);//unlock

        sem_post(&full);

        start = (start + 1) % BUFFER_SIZE;//using circular queue
    }
}

void *consumer()
{
    while (true)
    {
        sem_wait(&full);

        sem_wait(&mutex);

        int consumed = buf[end];

        printf("Consumer: Consumed Item: %d\n", consumed);

        sleep(1);

        end = (end + 1) % BUFFER_SIZE;

        sem_post(&mutex);

        sem_post(&empty);
    }
}

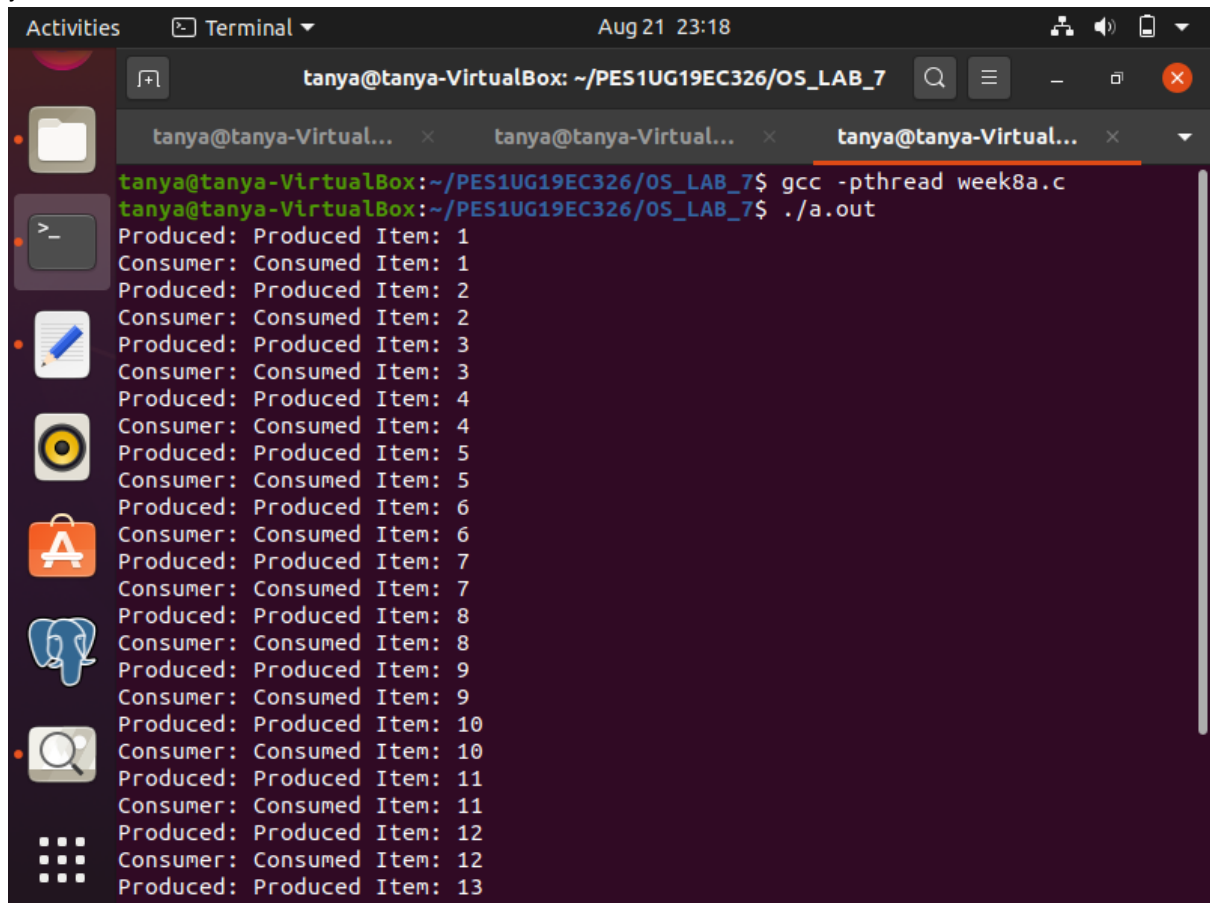
```

```

}

int main()
{
    buf = (int *)malloc(sizeof(int) * BUFFER_SIZE);
    pthread_t thread1, thread2;
    sem_init(&mutex, 0, 1);
    sem_init(&empty, 0, 1);
    sem_init(&full, 0, 0);
    pthread_create(&thread1, NULL, producer, NULL);
    sleep(1);
    pthread_create(&thread2, NULL, consumer, NULL);
    pthread_join(thread1, NULL);
    pthread_join(thread2, NULL);
    free(buf);
    return 0;
}

```



```

Aug 21 23:18
tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7
tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7$ gcc -pthread week8a.c
tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7$ ./a.out
Produced: Produced Item: 1
Consumer: Consumed Item: 1
Produced: Produced Item: 2
Consumer: Consumed Item: 2
Produced: Produced Item: 3
Consumer: Consumed Item: 3
Produced: Produced Item: 4
Consumer: Consumed Item: 4
Produced: Produced Item: 5
Consumer: Consumed Item: 5
Produced: Produced Item: 6
Consumer: Consumed Item: 6
Produced: Produced Item: 7
Consumer: Consumed Item: 7
Produced: Produced Item: 8
Consumer: Consumed Item: 8
Produced: Produced Item: 9
Consumer: Consumed Item: 9
Produced: Produced Item: 10
Consumer: Consumed Item: 10
Produced: Produced Item: 11
Consumer: Consumed Item: 11
Produced: Produced Item: 12
Consumer: Consumed Item: 12
Produced: Produced Item: 13

```

//using pipes

```
#include <stdio.h>

#include <stdlib.h>

#include <stdbool.h>

#include <unistd.h>

#include <wait.h>

void producer(FILE *);

void consumer(FILE *);

void producer(FILE *pipe_write)
{
    int item = 0;

    for (int i = 0; i < 5; ++i)
    {
        item++;

        fprintf(pipe_write, "%d ", item);

        printf("Producer: Produced Item: %d\n", item);
    }

    fclose(pipe_write);

    exit(0);
}

void consumer(FILE *pipe_read)
{
    int consumed, n;

    while (true)
    {
        n = fscanf(pipe_read, "%d", &consumed);

        if (n == 1)

            printf("Consumer: Consumed Item: %d\n", consumed);

        else

            break;
    }
}
```

```

    fclose(pipe_read);
    exit(0);
}
int main()
{
    int file_descriptor[2];
    if (pipe(file_descriptor) < 0)
        exit(1);
    FILE *pipe_read = fdopen(file_descriptor[0], "r");
    FILE *pipe_write = fdopen(file_descriptor[1], "w");
    pid_t producer_pid = fork();
    if (producer_pid == 0)
    {
        fclose(pipe_read);
        producer(pipe_write);
    }
    pid_t consumer_pid = fork();
    if (consumer_pid == 0)
    {
        fclose(pipe_write);
        consumer(pipe_read);
    }
    fclose(pipe_read);
    fclose(pipe_write);
    wait(NULL);
    wait(NULL);
    return 0;
}

```


Activities Terminal Aug 21 23:22

tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7

tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7\$ gcc -pthread week9.c

tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7\$./a.out

Producer: Produced Item: 1

Producer: Produced Item: 2

Producer: Produced Item: 3

Producer: Produced Item: 4

Producer: Produced Item: 5

Consumer: Consumed Item: 1

Consumer: Consumed Item: 2

Consumer: Consumed Item: 3

Consumer: Consumed Item: 4

Consumer: Consumed Item: 5

tanya@tanya-VirtualBox: ~/PES1UG19EC326/OS_LAB_7\$