Ex. No.: 8

Date:26.03.2025

PRODUCER CONSUMER USING SEMAPHORES

Aim: To write a program to implement a solution to producer consumer problem using semaphores.

Algorithm:

```
1. Initialize semaphore empty, full and mutex.
2. Create two threads- producer thread and consumer thread.
3. Wait for target thread termination.
4. Call sem_wait on empty semaphore followed by mutex semaphore before  entry into critical section.
5. Produce/Consume the item in critical section.
6. Call sem_post on mutex semaphore followed by full semaphore
7. before exiting critical section.
8. Allow the other thread to enter its critical section.
        9. Terminate after looping ten times in producer and consumer Threads each.
```

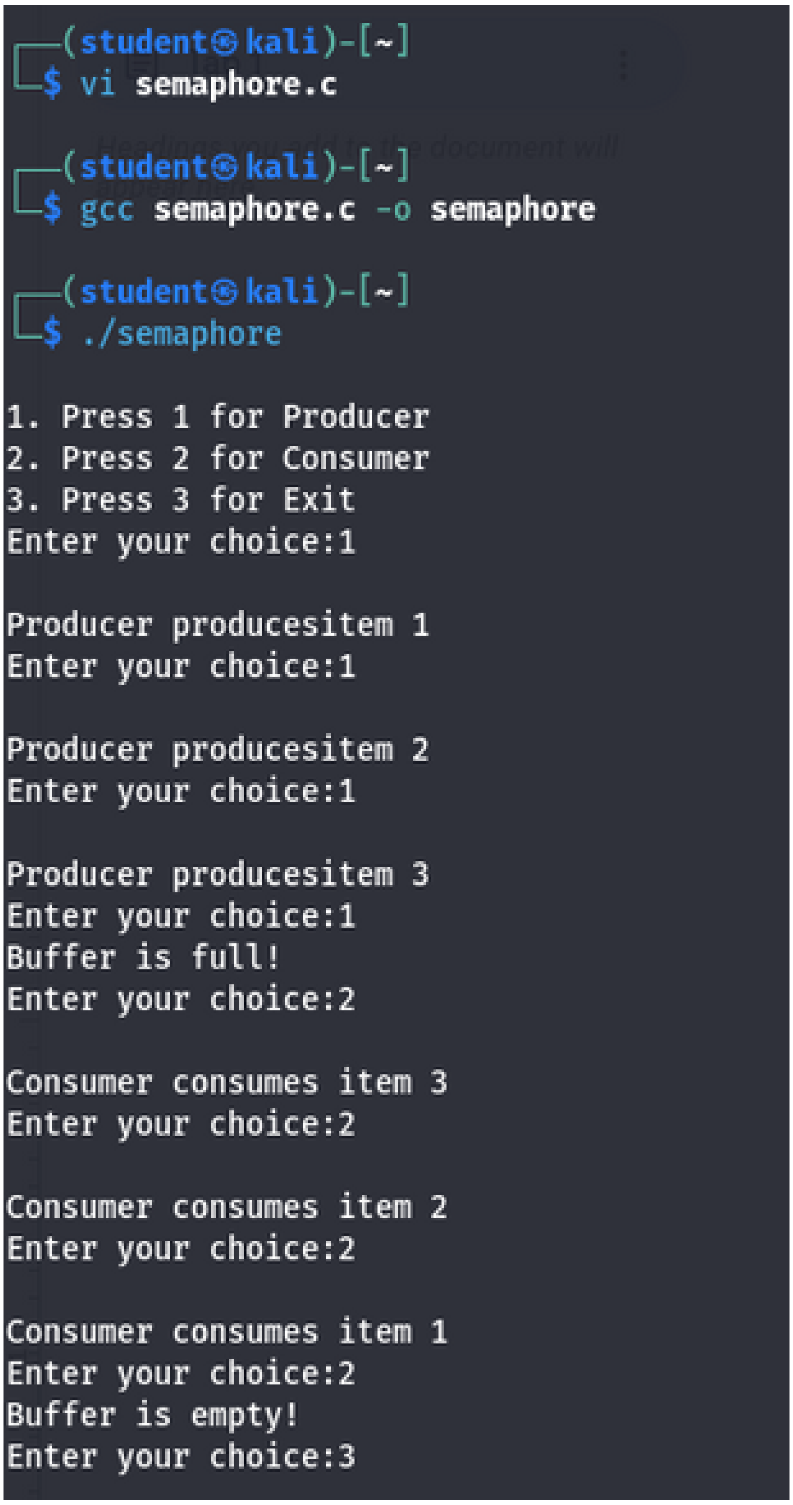
Program Code:

```
#include <stdio.h>
#include <stdlib.h>
int mutex = 1; // Initialize a mutex to 1
int full = 0;// Number of full slots as 0
int empty = 10, x = 0;// Number of empty slots as size of buffer
void producer()
{
// Decrease mutex value by 1
--mutex;
// Increase the number of full
// slots by 1
++full;
// Decrease the number of empty
// slots by 1
--empty;
// Item produced
x++;
printf("\nProducer produces"
       "item %d",
       x);

// Increase mutex value by 1
++mutex;
}

// Function to consume an item and
// remove it from buffer
void consumer()
{
// Decrease mutex value by 1
--mutex;

// Decrease the number of full
// slots by 1
--full;

// Increase the number of empty
// slots by 1
++empty;
printf("\nConsumer consumes "
       "item %d",
       x);
x--;

// Increase mutex value by 1
```

```
++mutex;
}

// Driver Code
int main()
{
int n, i;
printf("\n1. Press 1 for Producer"
      "\n2. Press 2 for Consumer"
      "\n3. Press 3 for Exit");

// Using '#pragma omp parallel for'
// can  give wrong value due to
// synchronization issues.

// 'critical' specifies that code is
// executed by only one thread at a
// time i.e., only one thread enters
// the critical section at a given time
#pragma omp critical

for (i = 1; i > 0; i++) {

   printf("\nEnter your choice:");
   scanf("%d", &n);

   // Switch Cases
   switch (n) {
   case 1:

       // If mutex is 1 and empty
       // is non-zero, then it is
```

```
    // possible to produce
    if ((mutex == 1)
        && (empty != 0)) {
        producer();
    }

    // Otherwise, print buffer
    // is full
    else {
        printf("Buffer is full!");
    }
    break;

case 2:

    // If mutex is 1 and full
    // is non-zero, then it is
    // possible to consume
    if ((mutex == 1)
        && (full != 0)) {
        consumer();
    }

    // Otherwise, print Buffer
    // is empty
    else {
        printf("Buffer is empty!");
    }
    break;

// Exit Condition
case 3:
        exit(0);

        break;

    }

}

}
```

OUTPUT:



```
┌──(student㉿kali)-[~]
└─$ vi semaphore.c

┌──(student㉿kali)-[~]
└─$ gcc semaphore.c -o semaphore

┌──(student㉿kali)-[~]
└─$ ./semaphore

1. Press 1 for Producer
2. Press 2 for Consumer
3. Press 3 for Exit
Enter your choice:1

Producer producesitem 1
Enter your choice:1

Producer producesitem 2
Enter your choice:1

Producer producesitem 3
Enter your choice:1
Buffer is full!
Enter your choice:2

Consumer consumes item 3
Enter your choice:2

Consumer consumes item 2
Enter your choice:2

Consumer consumes item 1
Enter your choice:2
Buffer is empty!
Enter your choice:3
```

RESULT:

Hence, producer consumer using semaphores has been executed successfully.