**Lab 7 OS**

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**Q1**

```
#include <pthread.h>
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <semaphore.h>
int buf[10], f, r;
sem_t mutex, full, empty;
void *produce(void *arg)
{
   int i;
   for (i = 0; i < 20; i++)
   {
      sem_wait(&empty);
      sem_wait(&mutex);
      printf("produce item is %d\n", i);
      buf[(++r) % 10] = i;
      sleep(1);
      sem_post(&mutex);
      sem_post(&full);
   }
}
void *consume(void *arg)
{
   int item, i;
   for (i = 0; i < 20; i++)
   {
      sem_wait(&full);
      sem_wait(&mutex);
      item = buf[(++f) % 10];
      printf("consumed item is %d\n", item);
      sleep(1);
      sem_post(&mutex);
      sem_post(&empty);
   }
}
int main(int argc, char const *argv[])
{
   pthread_t tid1, tid2;
   sem_init(&mutex, 0, 1);
   sem_init(&full, 0, 0);
   sem_init(&empty, 0, 10);
   pthread_create(&tid1, NULL, produce, NULL);
```

```
    pthread_create(&tid2, NULL, consume, NULL);
    pthread_join(tid1, NULL);
    pthread_join(tid2, NULL);
    return 0;
}
```

```
student@c39:~/Documents/CSE-Labs2/5thSemLabs/OperatingSystems/lab7$ gcc prog1.c -o prog1.out -lpthread
SE-Labs2/5thSemLabs/OperatingSystems/lab7$ ./prog1.out
produce item is 0
produce item is 1
produce item is 2
produce item is 3
produce item is 4
produce item is 5
produce item is 6
produce item is 7
produce item is 8
produce item is 9
consumed item is 0
consumed item is 1
consumed item is 2
consumed item is 3
consumed item is 4
consumed item is 5
consumed item is 6
consumed item is 7
consumed item is 8
consumed item is 9
produce item is 10
produce item is 11
produce item is 12
produce item is 13
produce item is 14
produce item is 15
```

**Q2**

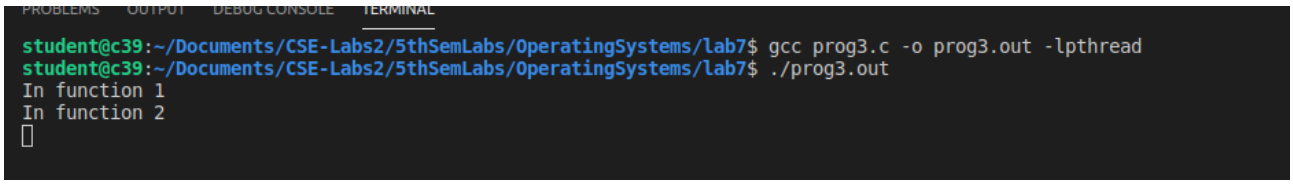
```
#include <stdlib.h>
#include <stdio.h>
#include <pthread.h>
#include <semaphore.h>
void *reader(void *rno);
void *writer(void *wno);
sem_t wrt;
pthread_mutex_t mutex;
int cnt = 1;
int numreader = 0;
void *reader(void *rno)
{
    pthread_mutex_lock(&mutex);
    numreader++;
    if (numreader == 1)
    {
        sem_wait(&wrt);
    }
    pthread_mutex_unlock(&mutex);
    printf("Reader %d: read cnt as %d\n", *((int *)rno), cnt);
    pthread_mutex_lock(&mutex);
    numreader--;
    if (numreader == 0)
    {
```

```
        sem_post(&wrt);
    }
    pthread_mutex_unlock(&mutex);
}
void *writer(void *wno)
{
    sem_wait(&wrt);
    cnt = cnt * 2;
    printf("Writer %d modified cnt to %d\n", (*((int *)wno)), cnt);
    sem_post(&wrt);
}
int main()
{
    pthread_t read[10], write[5];
    pthread_mutex_init(&mutex, NULL);
    sem_init(&wrt, 0, 1);
    int a[10] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
    for (int i = 0; i < 10; i++)
    {
        pthread_create(&read[i], NULL, (void *)reader, (void *)&a[i]);
    }
    for (int i = 0; i < 5; i++)
    {
        pthread_create(&write[i], NULL, (void *)writer, (void *)&a[i]);
    }
    for (int i = 0; i < 10; i++)
    {
        pthread_join(read[i], NULL);
    }
    for (int i = 0; i < 5; i++)
    {
        pthread_join(write[i], NULL);
    }
    pthread_mutex_destroy(&mutex);
    sem_destroy(&wrt);
    return 0;
}
```

```
student@c39:~/Documents/CSE-Labs2/5thSemLabs/OperatingSystems/lab7$ gcc prog2.c -o prog2.out -lpthread
student@c39:~/Documents/CSE-Labs2/5thSemLabs/OperatingSystems/lab7$ ./prog2.out
Reader 1: read cnt as 1
Reader 2: read cnt as 1
Reader 3: read cnt as 1
Writer 1 modified cnt to 2
Reader 6: read cnt as 2
Reader 7: read cnt as 2
Reader 8: read cnt as 2
Reader 9: read cnt as 2
Writer 4 modified cnt to 4
Reader 10: read cnt as 4
Writer 3 modified cnt to 8
Reader 4: read cnt as 8
Writer 2 modified cnt to 16
Writer 5 modified cnt to 32
Reader 5: read cnt as 32
student@c39:~/Documents/CSE-Labs2/5thSemLabs/OperatingSystems/lab7$
```

**Q3**

```
#include <stdio.h>
#include <pthread.h>
#include <semaphore.h>
#include <stdlib.h>
#include <unistd.h>
int shared;
sem_t sem1, sem2;
void *func1()
{
   sem_wait(&sem1);
   printf("In function 1\n");
   sem_wait(&sem2);
   sem_post(&sem2);
   sem_post(&sem1);
}
void *func2()
{
   sem_wait(&sem2);
   printf("In function 2\n");
   sem_wait(&sem1);
   sem_post(&sem1);
   sem_post(&sem2);
}
void main()
{
   pthread_t tid1, tid2;
   sem_init(&sem1, 0, 1);
   sem_init(&sem2, 0, 1);
   pthread_create(&tid1, NULL, func1, NULL);
   pthread_create(&tid2, NULL, func2, NULL);
   pthread_join(tid1, NULL);
   pthread_join(tid2, NULL);
}
```




**Q4**

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

```
int shared;
sem_t sem1, sem2;
void *func1()
{
   sem_wait(&sem1);
   printf("In function 1\n");
   sem_wait(&sem2);
   sem_post(&sem2);
   sem_post(&sem1);
}
void *func2()
{
   sem_wait(&sem2);
   printf("In function 2\n");
   sem_wait(&sem1);
   sem_post(&sem1);
   sem_post(&sem2);
}
void main()
{
   pthread_t tid1, tid2;
   sem_init(&sem1, 0, 1);
   sem_init(&sem2, 0, 1);
   pthread_create(&tid1, NULL, func1, NULL);
   pthread_create(&tid2, NULL, func2, NULL);
   pthread_join(tid1, NULL);
   pthread_join(tid2, NULL);
}#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <pthread.h>
#include <errno.h>
#include <sys/ipc.h>
#include <semaphore.h>
#define N 5
time_t end_time;
sem_t mutex, customers, barbers;
int count = 0;
void barber(void *arg);
void customer(void *arg);
int main(int argc, char *argv[])
{
   pthread_t id1, id2;
   int status = 0;
   end_time = time(NULL) + 20;
   sem_init(&mutex, 0, 1);
   sem_init(&customers, 0, 0);
   sem_init(&barbers, 0, 1);
   status = pthread_create(&id1, NULL, (void *)barber, NULL);
   if (status != 0)
      perror("create barbers is failure!\n");
   status = pthread_create(&id2, NULL, (void *)customer, NULL);
```

```
    if (status != 0)
        perror("create customers is failure!\n");
    pthread_join(id2, NULL);
    pthread_join(id1, NULL);
    exit(0);
}
void barber(void *arg)
{
    while (time(NULL) < end_time || count > 0)
    {
        sem_wait(&customers);
        sem_wait(&mutex);
        count--;
        printf("Barber:cut hair,count is:%d.\n", count);
        sem_post(&mutex);
        sem_post(&barbers);
        sleep(3);
    }
}
void customer(void *arg)
{
    while (time(NULL) < end_time)
    {
        sem_wait(&mutex);
        if (count < N)
        {
            count++;
            printf("Customer:add count,count is:%d\n", count);
            sem_post(&mutex);
            sem_post(&customers);
            sem_wait(&barbers);
        }
        else
            sem_post(&mutex);
        sleep(1);
    }
}
```

```
student@c39:~/Documents/CSE-Labs2/5thSemLabs/OperatingSystems/lab7$ gcc prog4.c -o prog4.out -lpthread
student@c39:~/Documents/CSE-Labs2/5thSemLabs/OperatingSystems/lab7$ ./prog4.out
Customer:add count,count is:1
Barber:cut hair,count is:0.
Customer:add count,count is:1
Customer:add count,count is:2
Barber:cut hair,count is:1.
Customer:add count,count is:2
Barber:cut hair,count is:1.
Customer:add count,count is:2
Barber:cut hair,count is:1.
Customer:add count,count is:2
Barber:cut hair,count is:1.
Customer:add count,count is:2
Barber:cut hair,count is:1.
Customer:add count,count is:2
Barber:cut hair,count is:1.
Customer:add count,count is:2
Barber:cut hair,count is:1.
Barber:cut hair,count is:0.
student@c39:~/Documents/CSE-Labs2/5thSemLabs/OperatingSystems/lab7$
```