LAB- 5

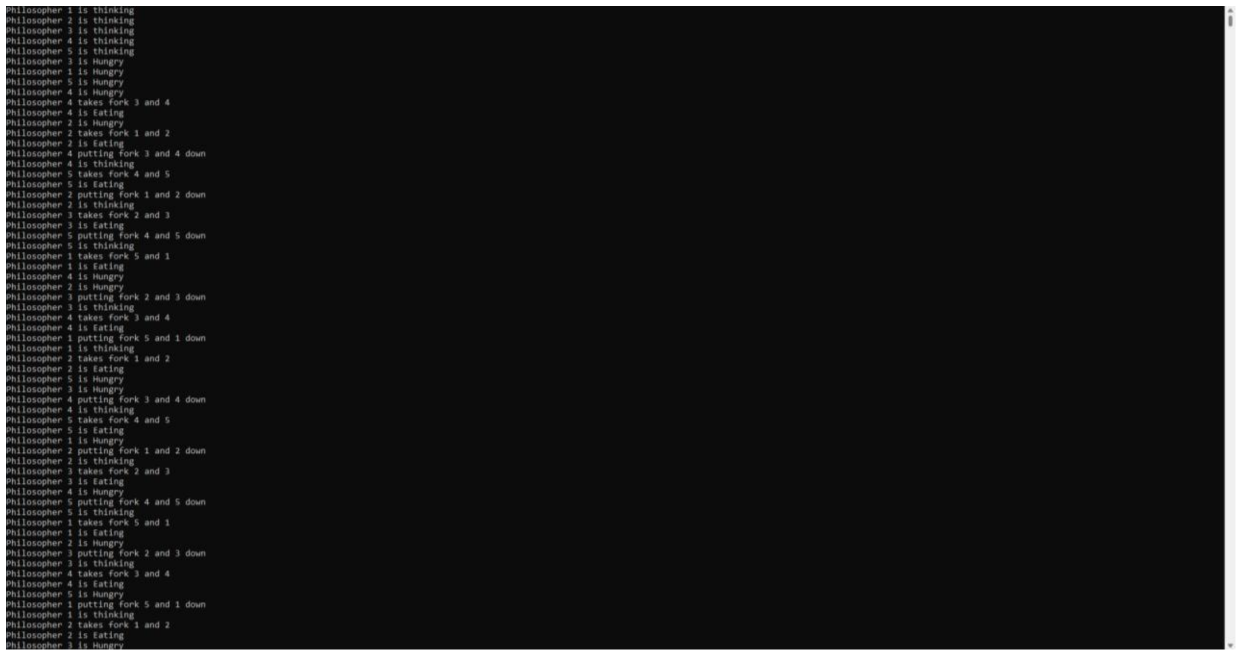
a) Write a C program to simulate the concept of Dining-Philosophersproblem.
b) Write a C program to simulate producer-consumer problem using semaphores.

a) CODE:

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

#define N 5
#define THINKING 2
#define HUNGRY 1
#define EATING 0
#define LEFT (phnum + 4) % N #define
RIGHT (phnum + 1) % N

int state[N];
int phil[N] = { 0, 1, 2, 3, 4 };

sem_t mutex;
sem_t S[N];

void test(int phnum)
{
        if (state[phnum] == HUNGRY
                && state[LEFT] != EATING &&
                state[RIGHT] != EATING) {
                state[phnum] = EATING;

                sleep(2);

                printf("Philosopher %d takes fork %d and %d\n",
                                        phnum + 1, LEFT + 1, phnum + 1);

                printf("Philosopher %d is Eating\n", phnum + 1);
                sem_post(&S[phnum]);
        }
}

void take_fork(int phnum)
{

        sem_wait(&mutex);

        state[phnum] = HUNGRY;

        printf("Philosopher %d is Hungry\n", phnum + 1);

        test(phnum);

        sem_post(&mutex);

        sem_wait(&S[phnum]);

        sleep(1);
}

void put_fork(int phnum)
{

        sem_wait(&mutex);

        state[phnum] = THINKING;

        printf("Philosopher %d putting fork %d and %d down\n",phnum + 1,
                LEFT + 1, phnum + 1);
        printf("Philosopher %d is thinking\n", phnum + 1);

        test(LEFT);
        test(RIGHT);

        sem_post(&mutex);
}

void* philosopher(void* num)
```

```
{

        while (1) {

                int* i = num;

                sleep(1);

                take_fork(*i);

                sleep(0);

                put_fork(*i);
        }
}

int main()
{

        int i;
        pthread_t thread_id[N];
        sem_init(&mutex, 0, 1);

        for (i = 0; i < N; i++)

                sem_init(&S[i], 0, 0);for

        (i = 0; i < N; i++) {

                // create philosopher processes
                pthread_create(&thread_id[i], NULL,
                                        philosopher, &phil[i]);

                printf("Philosopher %d is thinking\n", i + 1);
        }

        for (i = 0; i < N; i++)

                pthread_join(thread_id[i], NULL);
}
```

OUTPUT:

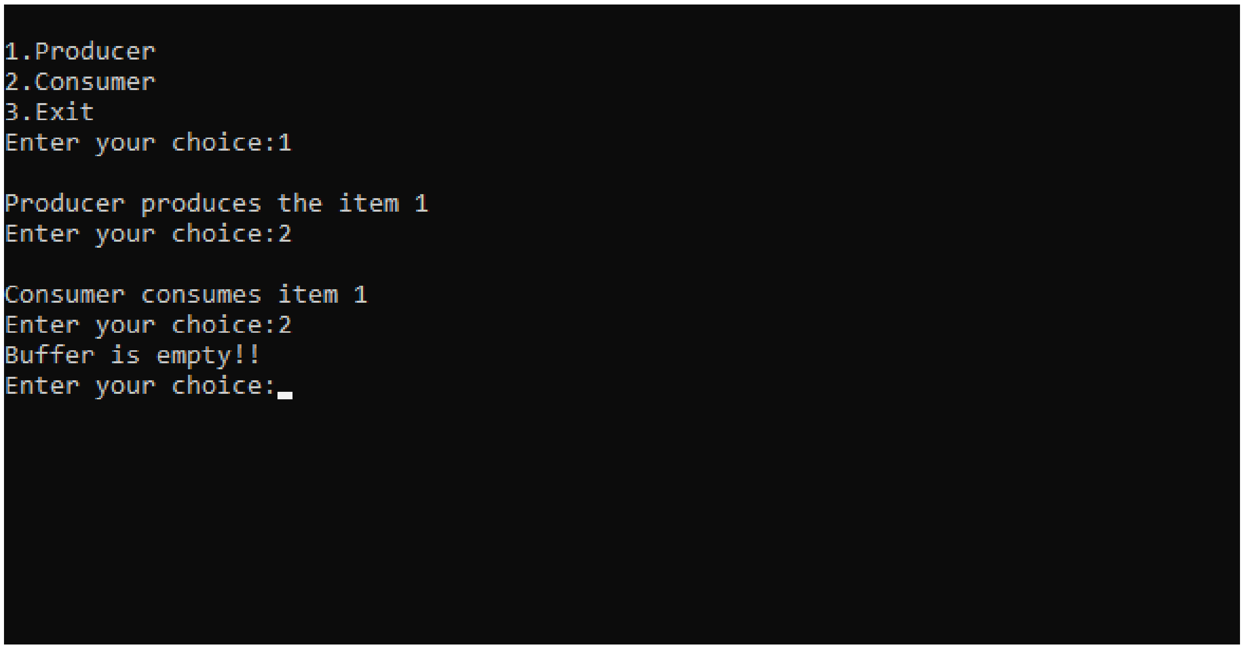


```
Philosopher 1 is thinking
Philosopher 2 is thinking
Philosopher 3 is thinking
Philosopher 4 is thinking
Philosopher 5 is thinking
Philosopher 3 is Hungry
Philosopher 1 is Hungry
Philosopher 5 is Hungry
Philosopher 4 is Hungry
Philosopher 4 takes fork 3 and 4
Philosopher 4 is Eating
Philosopher 2 is Hungry
Philosopher 2 takes fork 1 and 2
Philosopher 2 is Eating
Philosopher 4 putting fork 3 and 4 down
Philosopher 4 is thinking
Philosopher 5 takes fork 4 and 5
Philosopher 5 is Eating
Philosopher 2 putting fork 1 and 2 down
Philosopher 2 is thinking
Philosopher 3 takes fork 2 and 3
Philosopher 3 is Eating
Philosopher 5 putting fork 4 and 5 down
Philosopher 5 is thinking
Philosopher 1 takes fork 5 and 1
Philosopher 1 is Eating
Philosopher 4 is Hungry
Philosopher 2 is Hungry
Philosopher 3 putting fork 2 and 3 down
Philosopher 3 is thinking
Philosopher 4 takes fork 3 and 4
Philosopher 4 is Eating
Philosopher 1 putting fork 5 and 1 down
Philosopher 1 is thinking
Philosopher 2 takes fork 1 and 2
Philosopher 2 is Eating
Philosopher 5 is Hungry
Philosopher 3 is Hungry
Philosopher 4 putting fork 3 and 4 down
Philosopher 4 is thinking
Philosopher 5 takes fork 4 and 5
Philosopher 5 is Eating
Philosopher 1 is Hungry
Philosopher 2 putting fork 1 and 2 down
Philosopher 2 is thinking
Philosopher 3 takes fork 2 and 3
Philosopher 3 is Eating
Philosopher 4 is Hungry
Philosopher 5 putting fork 4 and 5 down
Philosopher 5 is thinking
Philosopher 1 takes fork 5 and 1
Philosopher 1 is Eating
Philosopher 2 is Hungry
Philosopher 3 putting fork 2 and 3 down
Philosopher 3 is thinking
Philosopher 4 takes fork 3 and 4
Philosopher 4 is Eating
Philosopher 5 is Hungry
Philosopher 1 putting fork 5 and 1 down
Philosopher 1 is thinking
Philosopher 2 takes fork 1 and 2
Philosopher 2 is Eating
Philosopher 3 is Hungry
```

b) CODE:

```
#include<stdio.h>
#include<stdlib.h>
int mutex=1,full=0,empty=3,x=0;int
main()
{
    int n;
    void producer();
    void consumer();int
    wait(int);
    int signal(int);
    printf("\n1.Producer\n2.Consumer\n3.Exit");while(1)
    {
        printf("\nEnter your choice:");
        scanf("%d",&n);
        switch(n)
        {
            case 1:     if((mutex==1)&&(empty!=0))
                            producer();
                        else
                            printf("Buffer is full!!");
                        break;
            case 2:     if((mutex==1)&&(full!=0))
                            consumer();
                        else
                            printf("Buffer is empty!!");
                        break;
            case 3:
                        exit(0);
                        break;
        }
    }

    return 0;
}

int wait(int s)
{
    return (--s);
}

int signal(int s)
{
    return(++s);
}

void producer()
{
    mutex=wait(mutex);
    full=signal(full);
    empty=wait(empty);
    x++;
    printf("\nProducer produces the item %d",x);
    mutex=signal(mutex);
}

void consumer()
{
    mutex=wait(mutex);
    full=wait(full);
    empty=signal(empty);
    printf("\nConsumer consumes item %d",x);x--;
    mutex=signal(mutex);
}
```

OUTPUT:



```
1.Producer
2.Consumer
3.Exit
Enter your choice:1

Producer produces the item 1
Enter your choice:2

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