WEEK 5

a)Write a C program to simulate the concept of Dining-Philosophers problem.

b)Write a C program to simulate producer-consumer problem using semaphores.

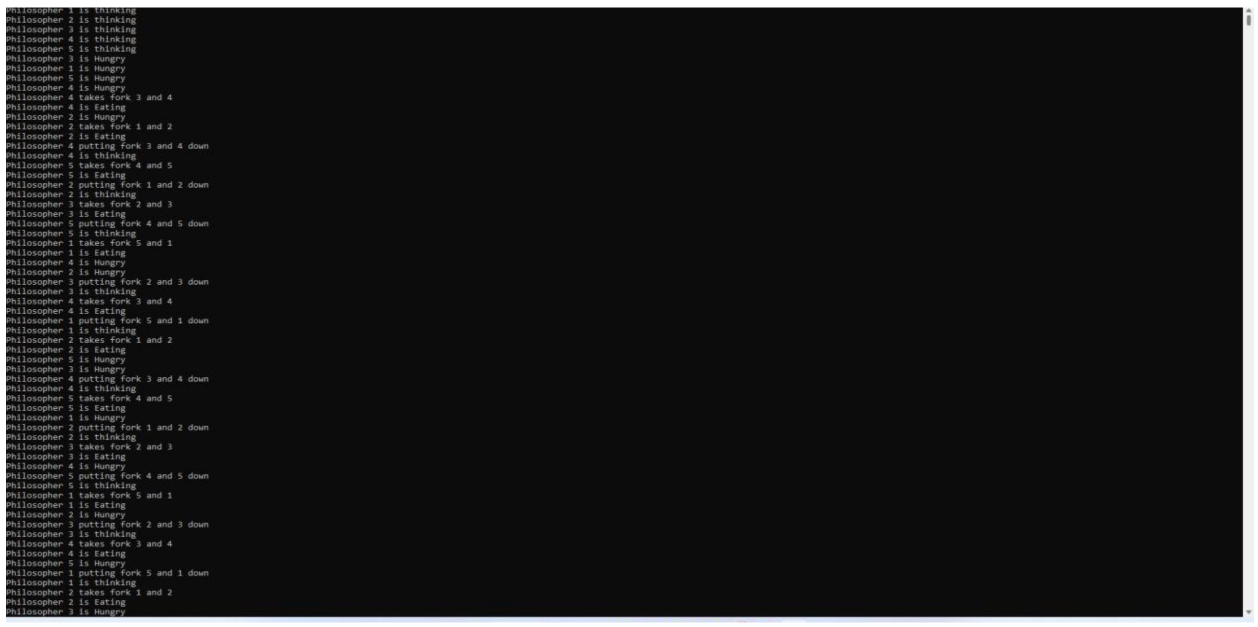
a)CODE:

```
#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
```

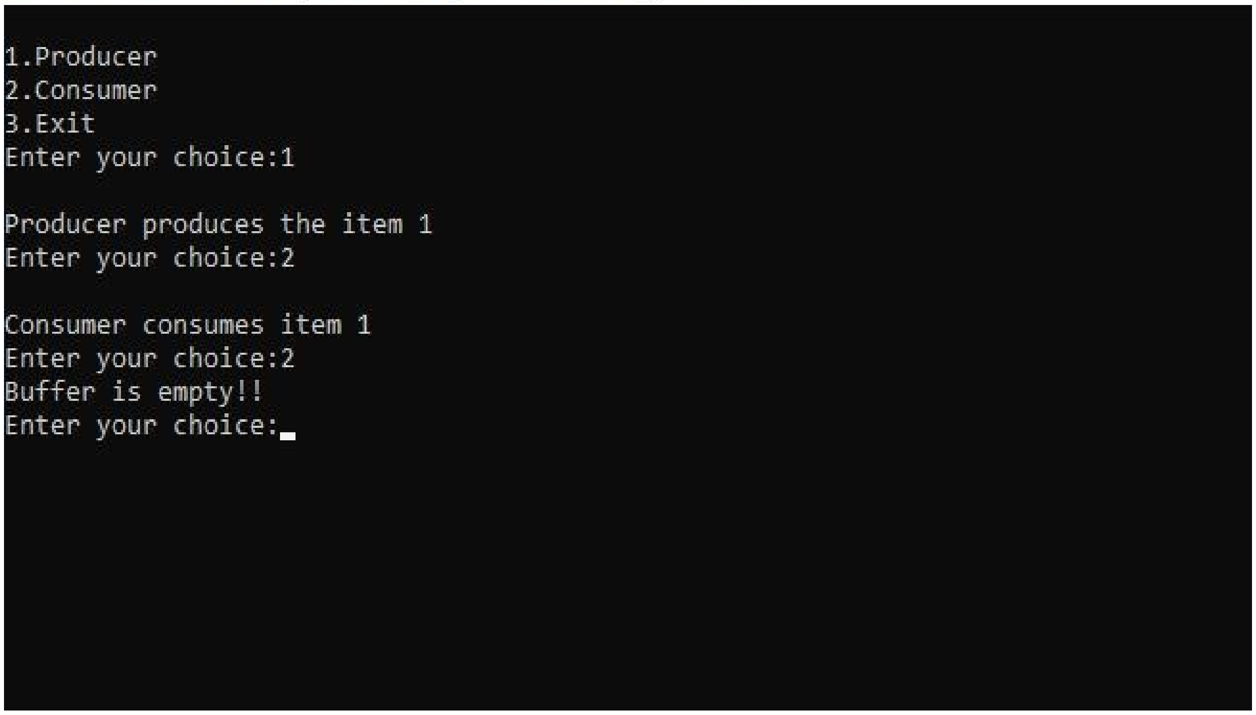
b)CODE:

```
#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:_
```