OS Lab Test

U20CS110

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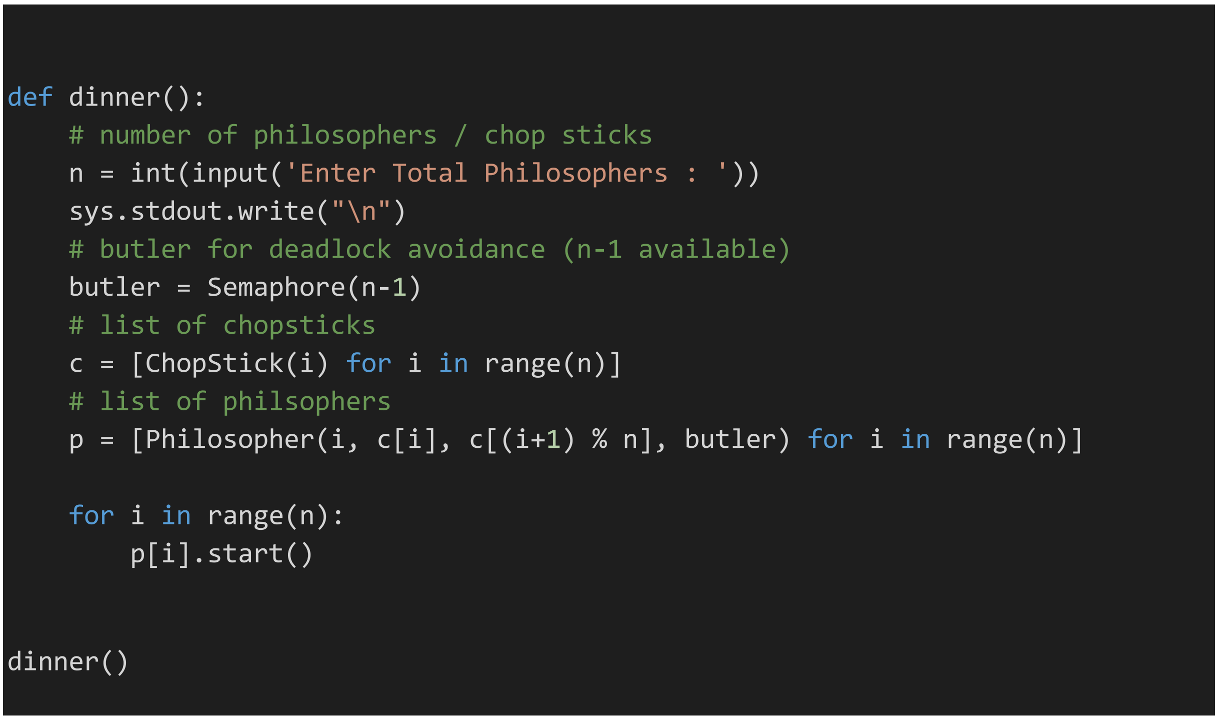
Problem Statement

Even Numbers

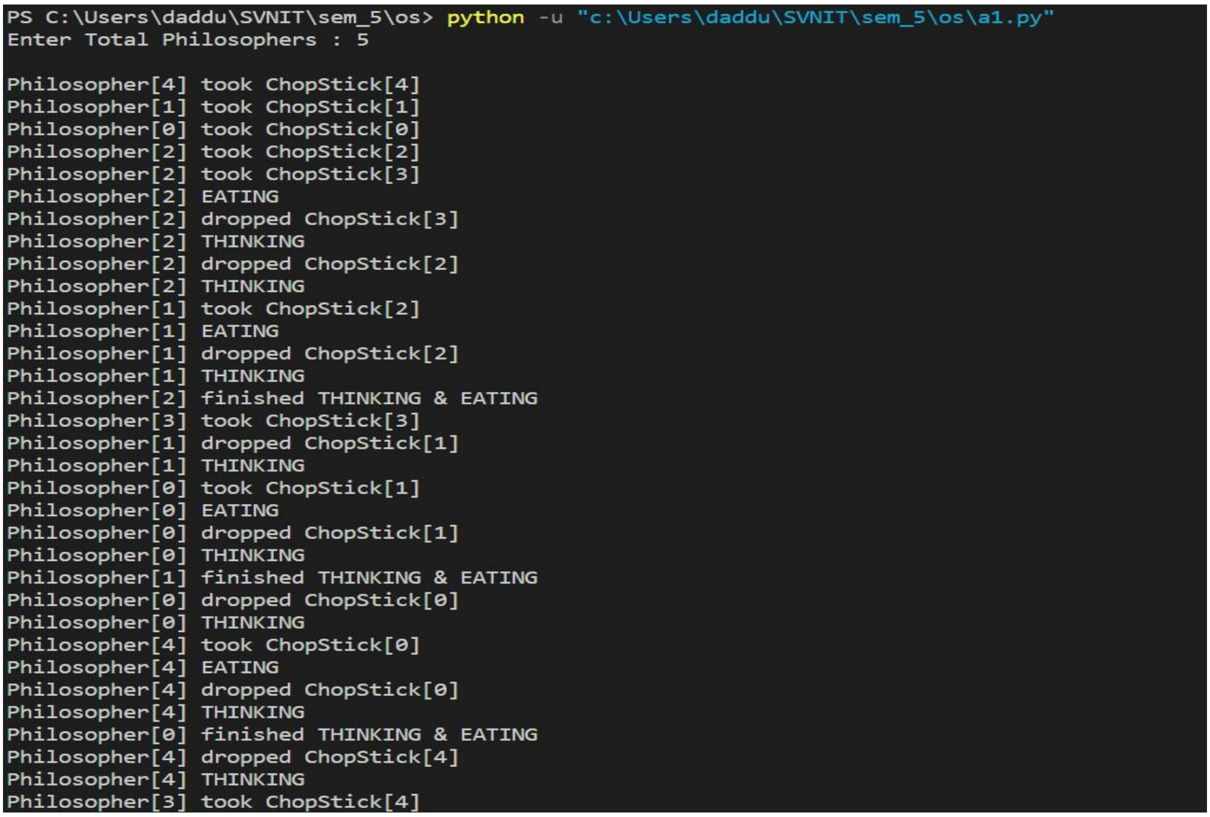
1. **The Dining Philosopher Problem states that 5 philosophers seated around a circular table with one chopstick between each pair of philosophers. ● There is one chopstick between each philosopher ● A philosopher must pick up its two nearest chopsticks in order to eat ● A philosopher must pick up first one chopstick, then the second one, not both at once Solve this problem by using Semaphore so that at least one can eat at a time.**

```python
import sys
import threading
import time


class Semaphore():
    def __init__(self, initial):
        self.lock = threading.Condition(threading.Lock())
        self.value = initial

    def up(self):
        with self.lock:
            self.value += 1
            self.lock.notify()

    def down(self):
        with self.lock:
            while self.value == 0:
                self.lock.wait()
            self.value -= 1


class ChopStick():
    def __init__(self, number):
        self.number = number           # chop stick ID
        self.user = -1                 # keep track of philosopher using it
        self.lock = threading.Condition(threading.Lock())
        self.taken = False
    def take(self, user):         # used for synchronization
        with self.lock:
            while self.taken == True:
                self.lock.wait()
            self.user = user
            self.taken = True
            sys.stdout.write(
                "Philosopher[%s] took ChopStick[%s]\n" % (user, self.number))
            self.lock.notify_all()

    def drop(self, user):         # used for synchronization
        with self.lock:
            while self.taken == False:
                self.lock.wait()
            self.user = -1
            self.taken = False
            sys.stdout.write(
                "Philosopher[%s] dropped ChopStick[%s]\n" % (user,
self.number))
            sys.stdout.write("Philosopher[%s] THINKING\n" % (user))
            self.lock.notify_all()


class Philosopher (threading.Thread):
    def __init__(self, number, left, right, butler):
        threading.Thread.__init__(self)
        self.number = number            # philosopher number
        self.left = left
        self.right = right
        self.butler = butler            # philosopher as butler

    def run(self):
        for i in range(1):
            time.sleep(1)
            self.butler.down()              # start service by butler
            time.sleep(1)                 # think
            self.left.take(self.number)     # pickup left chopstick
            time.sleep(1)      # (yield makes deadlock more likely)
            self.right.take(self.number)    # pickup right chopstick
            time.sleep(1)                # eat
            sys.stdout.write("Philosopher[%s] EATING\n" % (self.number))
            self.right.drop(self.number)    # drop right chopstick
            time.sleep(1)
            self.left.drop(self.number)     # drop left chopstick
            time.sleep(1)
            self.butler.up()              # end service by butler
            time.sleep(1)
        sys.stdout.write(
            "Philosopher[%s] finished THINKING & EATING\n" % self.number)
```

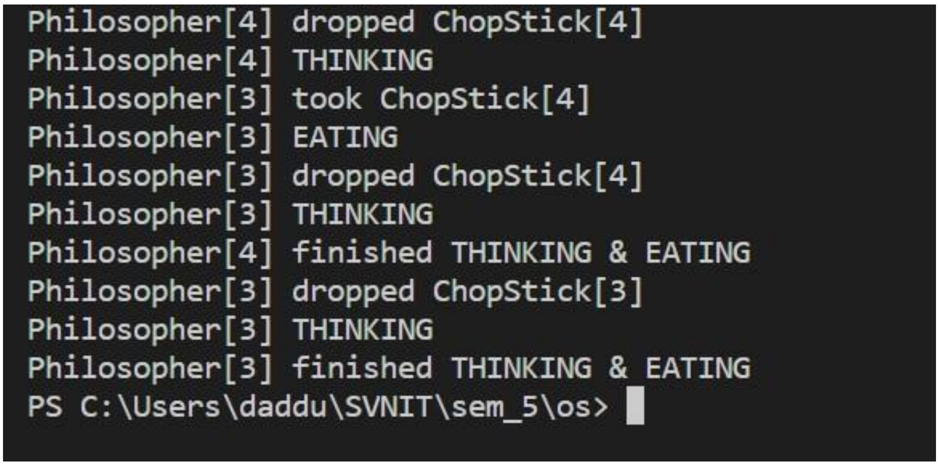


```python
def dinner():
    # number of philosophers / chop sticks
    n = int(input('Enter Total Philosophers : '))
    sys.stdout.write("\n")
    # butler for deadlock avoidance (n-1 available)
    butler = Semaphore(n-1)
    # list of chopsticks
    c = [ChopStick(i) for i in range(n)]
    # list of philsophers
    p = [Philosopher(i, c[i], c[(i+1) % n], butler) for i in range(n)]

    for i in range(n):
        p[i].start()


dinner()
```

output:



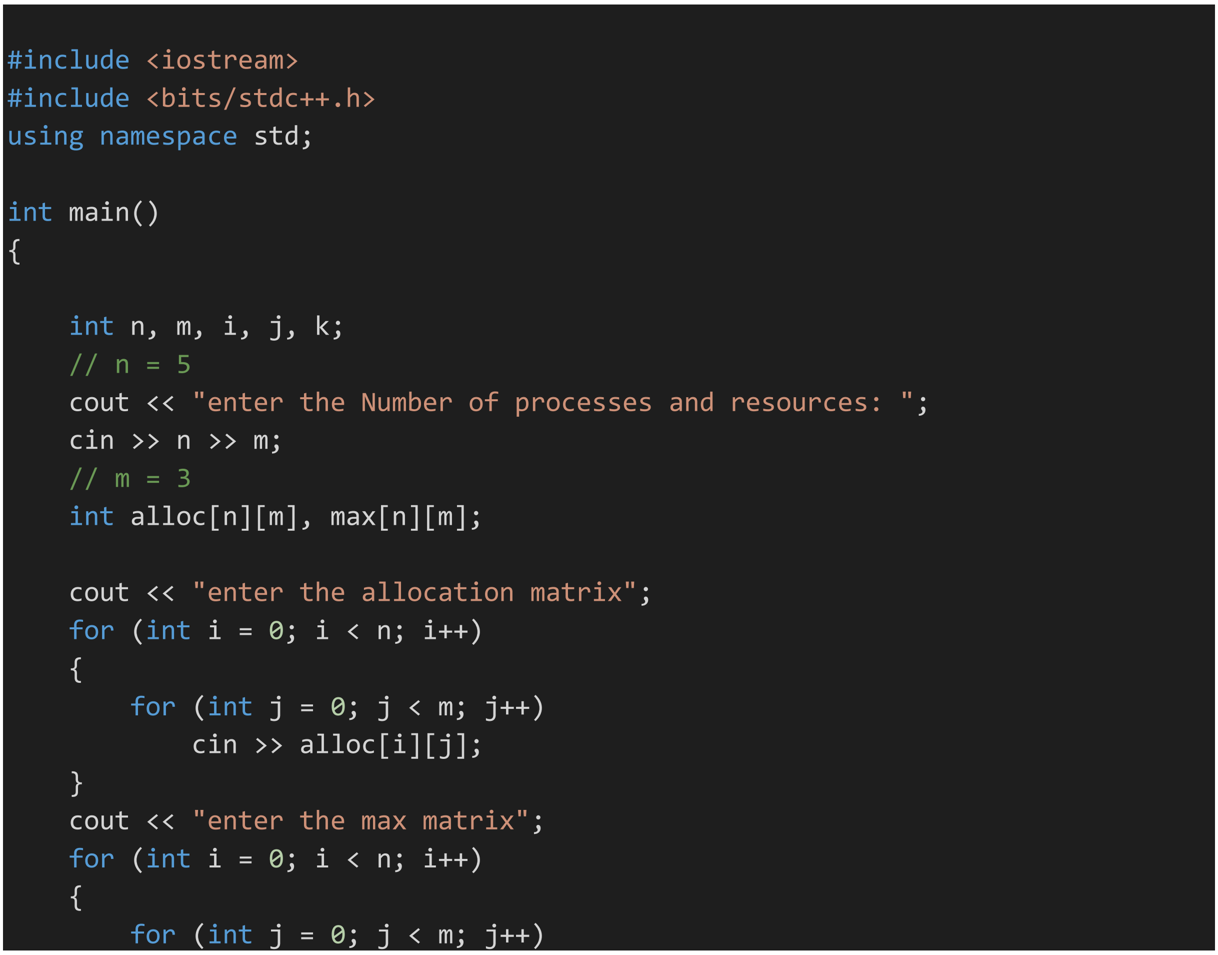
```
PS C:\Users\daddu\SVNIT\sem_5\os> python -u "c:\Users\daddu\SVNIT\sem_5\os\a1.py"
Enter Total Philosophers : 5

Philosopher[4] took ChopStick[4]
Philosopher[1] took ChopStick[1]
Philosopher[0] took ChopStick[0]
Philosopher[2] took ChopStick[2]
Philosopher[2] took ChopStick[3]
Philosopher[2] EATING
Philosopher[2] dropped ChopStick[3]
Philosopher[2] THINKING
Philosopher[2] dropped ChopStick[2]
Philosopher[2] THINKING
Philosopher[1] took ChopStick[2]
Philosopher[1] EATING
Philosopher[1] dropped ChopStick[2]
Philosopher[1] THINKING
Philosopher[2] finished THINKING & EATING
Philosopher[3] took ChopStick[3]
Philosopher[1] dropped ChopStick[1]
Philosopher[1] THINKING
Philosopher[0] took ChopStick[1]
Philosopher[0] EATING
Philosopher[0] dropped ChopStick[1]
Philosopher[0] THINKING
Philosopher[1] finished THINKING & EATING
Philosopher[0] dropped ChopStick[0]
Philosopher[0] THINKING
Philosopher[4] took ChopStick[0]
Philosopher[4] EATING
Philosopher[4] dropped ChopStick[0]
Philosopher[4] THINKING
Philosopher[0] finished THINKING & EATING
Philosopher[4] dropped ChopStick[4]
Philosopher[4] THINKING
Philosopher[3] took ChopStick[4]
```



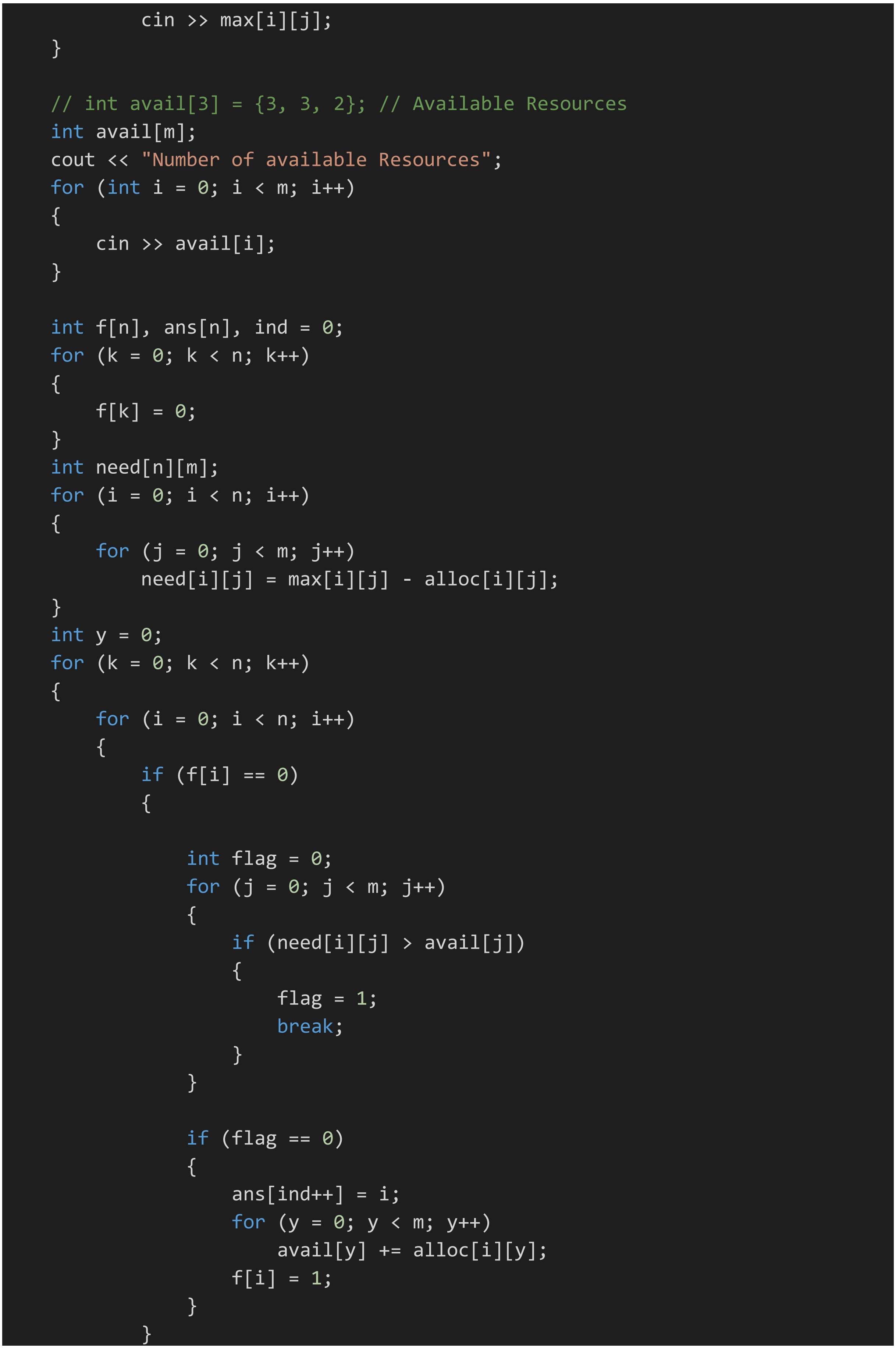
```
Philosopher[4] dropped ChopStick[4]
Philosopher[4] THINKING
Philosopher[3] took ChopStick[4]
Philosopher[3] EATING
Philosopher[3] dropped ChopStick[4]
Philosopher[3] THINKING
Philosopher[4] finished THINKING & EATING
Philosopher[3] dropped ChopStick[3]
Philosopher[3] THINKING
Philosopher[3] finished THINKING & EATING
PS C:\Users\daddu\SVNIT\sem_5\os> 
```

2. Implement an algorithm for deadlock detection. It may contain given datasets: Available Vector of length m Indicates a number of available resources of each type. Allocation Matrix of size n*m A[i,j] indicates the number of jth resource type allocated to the ith process. Request Matrix of size n*m Indicates request of each process. Request[i,j] tells the number of instances the Pi process is requesting of jth resource type. The output should indicate whether there is any deadlock or not.

Ans:

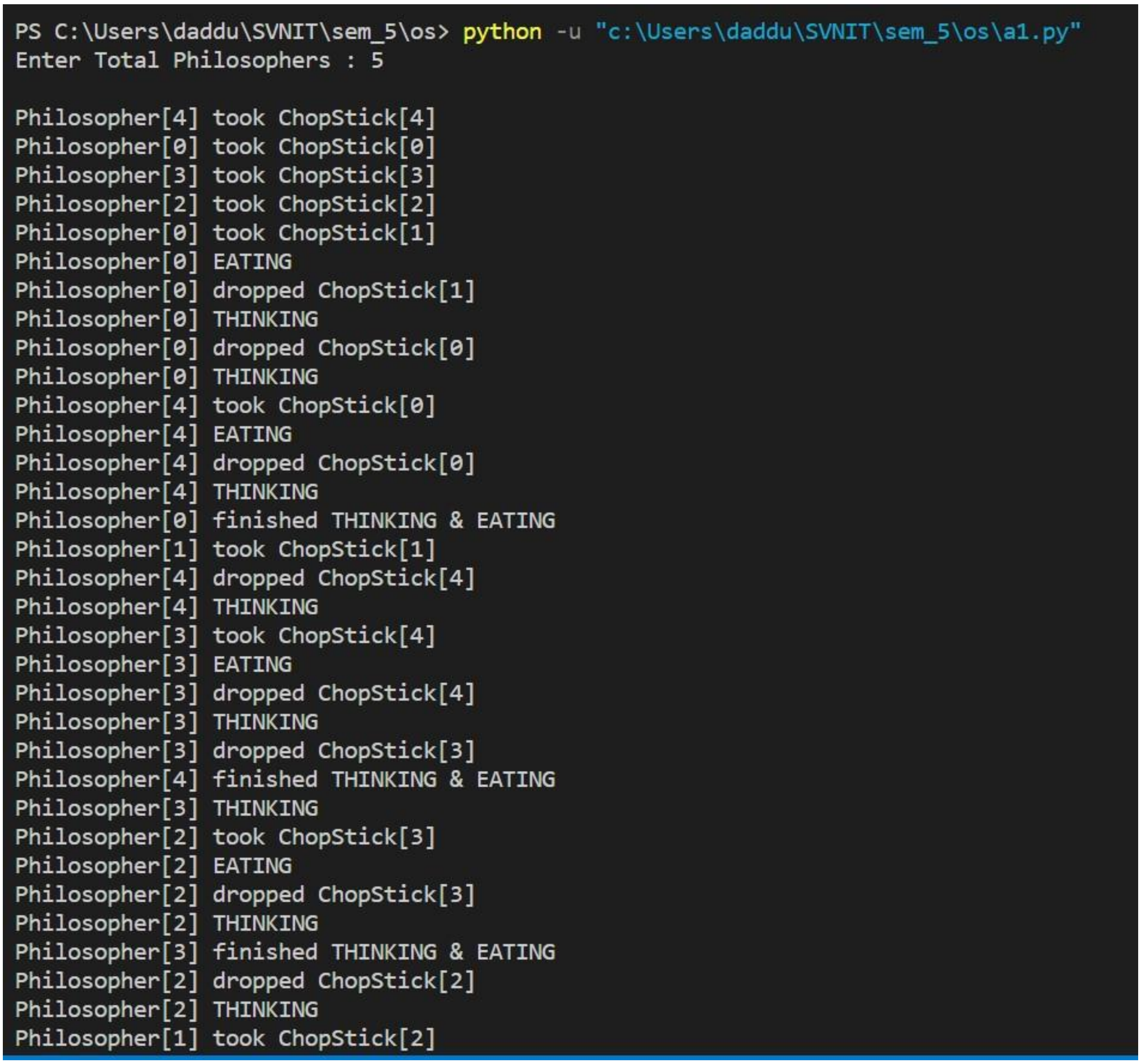


```cpp
#include <iostream>
#include <bits/stdc++.h>
using namespace std;

int main()
{

    int n, m, i, j, k;
    // n = 5
    cout << "enter the Number of processes and resources: ";
    cin >> n >> m;
    // m = 3
    int alloc[n][m], max[n][m];

    cout << "enter the allocation matrix";
    for (int i = 0; i < n; i++)
    {
        for (int j = 0; j < m; j++)
            cin >> alloc[i][j];
    }
    cout << "enter the max matrix";
    for (int i = 0; i < n; i++)
    {
        for (int j = 0; j < m; j++)
```



```
            cin >> max[i][j];
    }

    // int avail[3] = {3, 3, 2}; // Available Resources
    int avail[m];
    cout << "Number of available Resources";
    for (int i = 0; i < m; i++)
    {
        cin >> avail[i];
    }

    int f[n], ans[n], ind = 0;
    for (k = 0; k < n; k++)
    {
        f[k] = 0;
    }
    int need[n][m];
    for (i = 0; i < n; i++)
    {
        for (j = 0; j < m; j++)
            need[i][j] = max[i][j] - alloc[i][j];
    }
    int y = 0;
    for (k = 0; k < n; k++)
    {
        for (i = 0; i < n; i++)
        {
            if (f[i] == 0)
            {

                int flag = 0;
                for (j = 0; j < m; j++)
                {
                    if (need[i][j] > avail[j])
                    {
                        flag = 1;
                        break;
                    }
                }

                if (flag == 0)
                {
                    ans[ind++] = i;
                    for (y = 0; y < m; y++)
                        avail[y] += alloc[i][y];
                    f[i] = 1;
                }
            }
        }
    }

    int flag = 1;

    // To check if sequence is safe or not
    for (int i = 0; i < n; i++)
    {
        if (f[i] == 0)
        {
            flag = 0;
            cout << "Deadlock occurs";
            break;
        }
    }

    if (flag == 1)
    {
        cout << "Deadlock will not occur and process sequence will be Sequence" << endl;
        for (i = 0; i < n - 1; i++)
            cout << " P" << ans[i] << " ->";
        cout << " P" << ans[n - 1] << endl;
    }

    return 0;
}
```

Output:



```
PS C:\Users\daddu\SVNIT\sem_5\os> python -u "c:\Users\daddu\SVNIT\sem_5\os\a1.py"
Enter Total Philosophers : 5

Philosopher[4] took ChopStick[4]
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Philosopher[3] took ChopStick[3]
Philosopher[2] took ChopStick[2]
Philosopher[0] took ChopStick[1]
Philosopher[0] EATING
Philosopher[0] dropped ChopStick[1]
Philosopher[0] THINKING
Philosopher[0] dropped ChopStick[0]
Philosopher[0] THINKING
Philosopher[4] took ChopStick[0]
Philosopher[4] EATING
Philosopher[4] dropped ChopStick[0]
Philosopher[4] THINKING
Philosopher[0] finished THINKING & EATING
Philosopher[1] took ChopStick[1]
Philosopher[4] dropped ChopStick[4]
Philosopher[4] THINKING
Philosopher[3] took ChopStick[4]
Philosopher[3] EATING
Philosopher[3] dropped ChopStick[4]
Philosopher[3] THINKING
Philosopher[3] dropped ChopStick[3]
Philosopher[4] finished THINKING & EATING
Philosopher[3] THINKING
Philosopher[2] took ChopStick[3]
Philosopher[2] EATING
Philosopher[2] dropped ChopStick[3]
Philosopher[2] THINKING
Philosopher[3] finished THINKING & EATING
Philosopher[2] dropped ChopStick[2]
Philosopher[2] THINKING
Philosopher[1] took ChopStick[2]
```

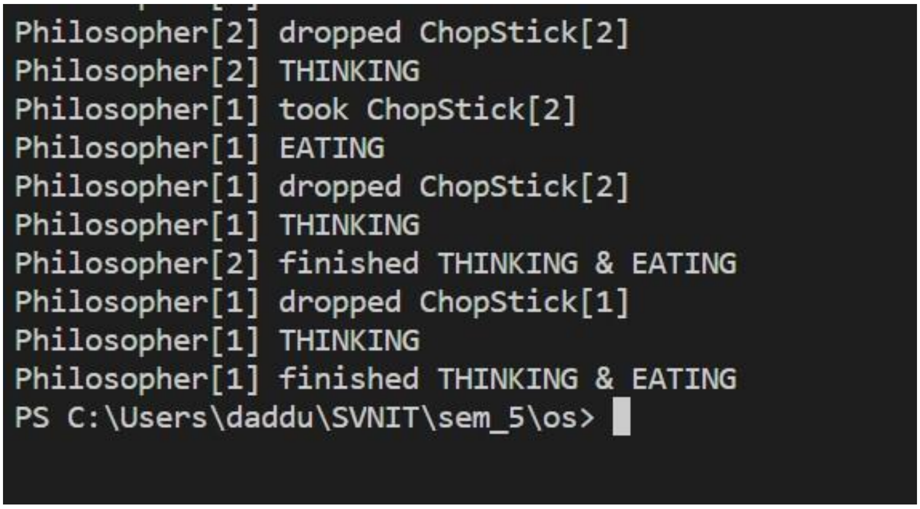

```
Philosopher[2] dropped ChopStick[2]
Philosopher[2] THINKING
Philosopher[1] took ChopStick[2]
Philosopher[1] EATING
Philosopher[1] dropped ChopStick[2]
Philosopher[1] THINKING
Philosopher[2] finished THINKING & EATING
Philosopher[1] dropped ChopStick[1]
Philosopher[1] THINKING
Philosopher[1] finished THINKING & EATING
PS C:\Users\daddu\SVNIT\sem_5\os>
```