

OS Practical No. 6

Aim :

Considered there are N philosophers seated around a circular table with one chopstick between each pair of philosophers. There is one chopstick between each philosopher. A philosopher may eat if he can pick up the two chopsticks adjacent to him. One chopstick may be picked up by any one of its adjacent followers but not both.

Write a program to solve the problem using process synchronization technique.

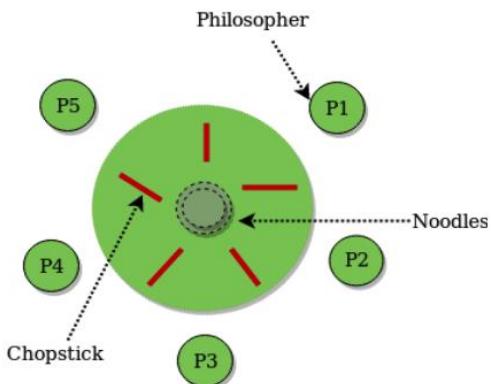


Fig: 1. Dining Philosopher Problem

Code :

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

#define N 5 // Number of philosophers
sem_t chopstick[N];
void* philosopher(void* num)
{
    int id = *((int*)num);
    printf("Philosopher %d is thinking \n", id);
    sleep(1);

    // Pick left chopstick
    sem_wait(&chopstick[id]);
    printf("Philosopher %d picked LEFT chopstick\n", id);

    // Pick right chopstick
    sem_wait(&chopstick[(id + 1) % N]);
```

```

printf("Philosopher %d picked RIGHT chopstick\n", id);

// Eating
printf("Philosopher %d is eating \rho\n", id);
sleep(2);

// Put down chopsticks
sem_post(&chopstick[id]);
sem_post(&chopstick[(id + 1) % N]);

printf("Philosopher %d finished eating and released chopsticks\n", id);

return NULL;
}

int main()
{
    pthread_t phil[N];
    int id[N];

    // Initialize semaphores
    for (int i = 0; i < N; i++)
        sem_init(&chopstick[i], 0, 1);

    // Create philosopher threads
    for (int i = 0; i < N; i++)
    {
        id[i] = i;
        pthread_create(&phil[i], NULL, philosopher, &id[i]);
    }

    // Join threads
    for (int i = 0; i < N; i++)
        pthread_join(phil[i], NULL);

    // Destroy semaphores
    for (int i = 0; i < N; i++)
        sem_destroy(&chopstick[i]);
return 0;
}

```

Output :

```
saumyaudgirkar@Saumyas-MacBook-Air ~ % git --version
git version 2.52.0
saumyaudgirkar@Saumyas-MacBook-Air ~ % nano dining_philosop...ers.c
saumyaudgirkar@Saumyas-MacBook-Air ~ % gcc dining_philosop...ers.c -o dining -lpthread
dining_philosop...ers.c:46:9: warning: 'sem_init' is deprecated [-Wdeprecated-declarations]
  46 |     sem_init(&chopstick[i], 0, 1);
      ^

/Library/Developer/CommandLineTools/SDKs/MacOSX.sdk/usr/include/sys/semaphore.h:55:42: note: 'sem_init'
' has been explicitly marked deprecated here
  55 | int sem_init(sem_t *, int, unsigned int) __deprecated;
      ^

/Library/Developer/CommandLineTools/SDKs/MacOSX.sdk/usr/include/sys/cdefs.h:223:40: note: expanded from macro '__deprecated'
  223 | #define __deprecated __attribute__((__deprecated__))
      ^
dining_philosop...ers.c:61:9: warning: 'sem_destroy' is deprecated [-Wdeprecated-declarations]
  61 |     sem_destroy(&chopstick[i]);
      ^

/Library/Developer/CommandLineTools/SDKs/MacOSX.sdk/usr/include/sys/semaphore.h:53:26: note: 'sem_dest...
roy' has been explicitly marked deprecated here
  53 | int sem_destroy(sem_t *) __deprecated;
      ^

/Library/Developer/CommandLineTools/SDKs/MacOSX.sdk/usr/include/sys/cdefs.h:223:40: note: expanded from macro '__deprecated'
  223 | #define __deprecated __attribute__((__deprecated__))
      ^
2 warnings generated.
saumyaudgirkar@Saumyas-MacBook-Air ~ % ./dining
Philosopher 0 is thinking ||
Philosopher 3 is thinking ||
Philosopher 4 is thinking ||
Philosopher 2 is thinking ||
Philosopher 1 is thinking ||
Philosopher 0 picked LEFT chopstick
Philosopher 0 picked RIGHT chopstick
Philosopher 0 is eating 🍲
Philosopher 4 picked LEFT chopstick
Philosopher 2 picked LEFT chopstick
Philosopher 2 picked RIGHT chopstick
Philosopher 2 is eating 🍲
Philosopher 3 picked LEFT chopstick
Philosopher 3 picked RIGHT chopstick
Philosopher 3 is eating 🍲
Philosopher 1 picked LEFT chopstick
Philosopher 4 picked RIGHT chopstick
Philosopher 4 is eating 🍲
Philosopher 1 picked RIGHT chopstick
Philosopher 1 is eating 🍲
Philosopher 3 finished eating and released chopsticks
Philosopher 1 finished eating and released chopsticks
Philosopher 0 finished eating and released chopsticks
Philosopher 4 finished eating and released chopsticks
Philosopher 2 finished eating and released chopsticks
saumyaudgirkar@Saumyas-MacBook-Air ~ %
```