Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110
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Department of Computer Technology

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

Session 2025-2026

Vision: Dream of where you want.	**Mission:** Means to achieve Vision

Program Educational Objectives of the program (PEO): (broad statements that describe the professional and career accomplishments)

PEO1	**Preparation**	**P: Preparation**	**Pep-CL abbreviation pronounce as Pep-si-lL easy to recall**
PEO2	**Core Competence**	**E: Environment (Learning Environment)**	
PEO3	**Breadth**	**P: Professionalism**	
PEO4	**Professionalism**	**C: Core Competence**	
PEO5	**Learning Environment**	**L: Breadth (Learning in diverse areas)**	

Program Outcomes (PO): (statements that describe what a student should be able to do and know by the end of a program)

Keywords of POs:
Engineering knowledge, Problem analysis, Design/development of solutions, Conduct Investigations of Complex Problems, Engineering Tool Usage, The Engineer and The World, Ethics, Individual and Collaborative Team work, Communication, Project Management and Finance, Life-Long Learning

PSO Keywords: Cutting edge technologies, Research

"I am an engineer, and I know how to apply engineering knowledge to investigate, analyse and design solutions to complex problems using tools for entire world following all ethics in a collaborative way with proper management skills throughout my life." *to contribute to the development of cutting-edge technologies and Research*.

Integrity: I will adhere to the Laboratory Code of Conduct and ethics in its entirety.

Name and Signature of Student and Date
(Signature and Date in Handwritten)

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Session	**2025-26 (ODD)**	**Course Name**	**Operating System Lab**
Semester	**5**	**Course Code**	**23IOT1504**
Roll No	**35**	**Name of Student**	**Bhushan Tayade**

Practical Number	8
Course Outcome	1. Understand Computer System Configuration and Simulate system resources efficiently using Linux Commands (CO1) 2. Analyse operating system functionalities utilizing system calls, thread programming and process scheduling algorithms (CO2) 3. Apply Synchronization primitives to implement a Deadlock-free solution(CO3) 4. Simulate Disk scheduling, Memory allocation, File allocation, page replacement algorithms (CO4)
Aim	Develop a program to provide synchronization among the 5 philosophers in Dining Philosophers problem using semaphore
Problem Definition	Develop a C program to implement synchronization among five philosophers sitting around a circular table using semaphores. Each philosopher alternates between thinking and eating. To eat, a philosopher needs to pick up both the left and right chopsticks (semaphores). The program should prevent deadlock and starvation by ensuring that no two adjacent philosophers eat simultaneously.
Theory (100 words)	The **Dining Philosophers Problem** is a classic synchronization problem introduced by **Edsger Dijkstra** to illustrate issues related to resource sharing and process synchronization. **Concept:** • There are **five philosophers** sitting around a table. • Each philosopher has a **plate of food** and a **chopstick** on either side. • To eat, a philosopher needs **two chopsticks** (the one on the left and the one on the right). • A **semaphore** is used to control access to each chopstick so that no two philosophers use the same one simultaneously. **Challenges:** 1. **Deadlock:** Occurs when every philosopher picks up one chopstick and waits indefinitely for the other. 2. **Starvation:** A philosopher may never get both chopsticks due to others continuously eating.

Procedure and Execution (100 Words)	Step for Implementation: 1. **Initialize semaphores** for each chopstick and a mutex for synchronization. 2. **Create philosopher threads** to simulate thinking and eating behavior. 3. **Define states:** THINKING, HUNGRY, and EATING. 4. **Wait and signal** using semaphores to manage chopstick usage. 5. Ensure only philosophers whose neighbors are not eating can start eating. 6. **Run simulation** and observe the sequence of philosophers eating and thinking.

Code:

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

#define NUM_PHILOSOPHERS 5
#define THINKING 0
#define HUNGRY 1
#define EATING 2

sem_t mutex;
sem_t S[NUM_PHILOSOPHERS];
int state[NUM_PHILOSOPHERS];
int phil[NUM_PHILOSOPHERS] = {0, 1, 2, 3, 4};

void test(int i) {
   if (state[i] == HUNGRY &&
      state[(i + 4) % NUM_PHILOSOPHERS] != EATING &&
      state[(i + 1) % NUM_PHILOSOPHERS] != EATING) {
      state[i] = EATING;
      sleep(1);
      printf("Philosopher %d takes fork %d and %d\n", i + 1, (i + 4)
% NUM_PHILOSOPHERS + 1, i + 1);
      printf("Philosopher %d is Eating\n", i + 1);
      sem_post(&S[i]);
   }
}

void take_fork(int i) {
   sem_wait(&mutex);
   state[i] = HUNGRY;
   printf("Philosopher %d is Hungry\n", i + 1);
   test(i);
   sem_post(&mutex);
   sem_wait(&S[i]);
   sleep(1);
}
```

```
void put_fork(int i) {
    sem_wait(&mutex);
    state[i] = THINKING;
    printf("Philosopher %d puts down fork %d and %d\n", i + 1, (i +
4) % NUM_PHILOSOPHERS + 1, i + 1);
    printf("Philosopher %d is Thinking\n", i + 1);
    test((i + 4) % NUM_PHILOSOPHERS);
    test((i + 1) % NUM_PHILOSOPHERS);
    sem_post(&mutex);
}

void* philosopher(void* num) {
    while (1) {
        int i = *(int*)num;
        sleep(1);
        take_fork(i);
        sleep(2);
        put_fork(i);
    }
}

int main() {
    int i;
    pthread_t thread_id[NUM_PHILOSOPHERS];
    sem_init(&mutex, 0, 1);
    for (i = 0; i < NUM_PHILOSOPHERS; i++)
        sem_init(&S[i], 0, 0);

    for (i = 0; i < NUM_PHILOSOPHERS; i++)
        pthread_create(&thread_id[i], NULL, philosopher, &phil[i]);

    for (i = 0; i < NUM_PHILOSOPHERS; i++)
        pthread_join(thread_id[i], NULL);
}
```

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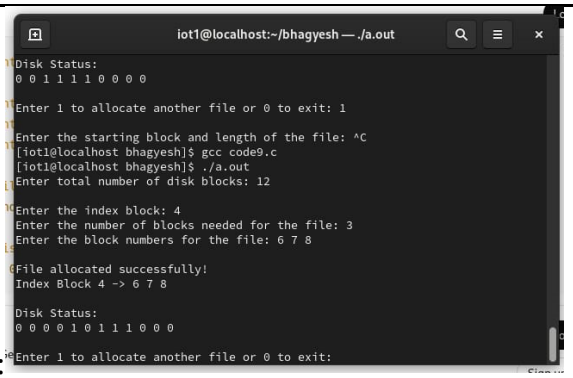
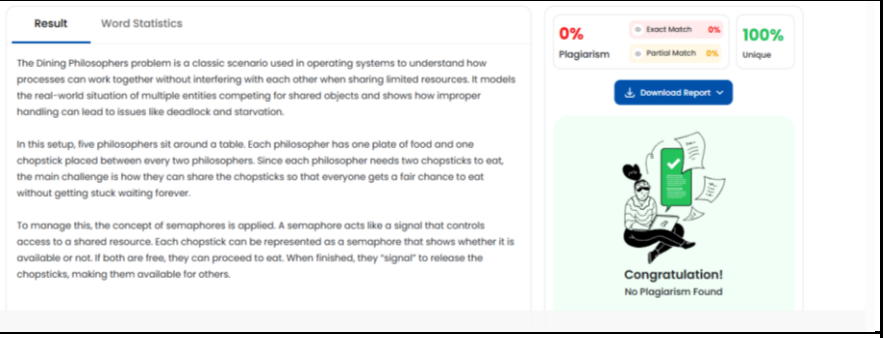
	Output: 
Output Analysis	• No two adjacent philosophers eat at the same time. • Each philosopher alternates between eating and thinking. • The use of semaphores ensures synchronization and avoids deadlock.
Link of student Github profile where lab assignment has been uploaded	"https://github.com/Bhushan-Tayade/YCCN-23071391.git"
Conclusion	This practical illustrates how concurrency and synchronization can be efficiently managed in operating systems using semaphores.
Plag Report (Similarity index < 12%)	
Date	30/10/25