

**Department of Computer Science & Engineering (IOT)****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
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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-IL 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

Bhushan V. Tayade

20-08-2025

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Session	2025-26 (ODD)	Course Name	Operating System Lab
Semester	5	Course Code	23IOT1504
Roll Number	035	Name of Student	Bhushan V. Tayade

Practical Number	3
Course Outcome	<ol style="list-style-type: none">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	Implement the thread life cycle: Thread creation and termination using POSIX threads.
Problem Definition	Create a multithreaded program that simulates a quiz game. One thread acts as a countdown timer (from 10 to 1), while another thread displays a quiz question and checks the user's response. Both threads should terminate either when the user answers the question or when the countdown timer reaches zero.
Theory (100 words)	A thread is the smallest unit of CPU execution within a process. Unlike separate processes, threads share the same memory space and resources, making inter-thread communication more efficient. In Linux, the POSIX thread (pthread) library enables thread creation and management using functions such as pthread_create() for thread creation and pthread_join() for synchronization. Threads can run concurrently, allowing multiple tasks to execute simultaneously. The life cycle of a thread includes creation, execution, waiting, and termination. Proper synchronization and shared resource handling ensure consistent and efficient program execution without race conditions or deadlocks.
Procedure and Execution (100 Words)	Step for Implementation: <ol style="list-style-type: none">1. Start a new C program and include the required header files: stdio.h, stdlib.h, pthread.h, unistd.h, and string.h for input/output,



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thread handling, and timing operations.

2. Declare global variables such as time_left and answered to share data between threads and control synchronization.
3. Define the timer thread function that counts down from 10 to 1 using sleep(1) for each second.
 - Display the remaining time.
 - Stop the timer if the user answers before time runs out.
4. Define the quiz thread function that prints a question with multiple-choice options.
 - Take the user's input using scanf().
 - Mark the answer as correct or incorrect.
 - Set the answered flag to terminate the timer thread early if needed.
5. In the main function, create two threads using pthread_create() — one for the timer and one for the quiz.
6. Synchronize thread completion using pthread_join() to ensure both threads terminate properly before the program ends.
7. Display the final result indicating whether the question was answered correctly, incorrectly, or not answered within the time limit.

Code:

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

int time_left = 10;
int answered = 0;


void *timer_thread(void *arg) {
    while (time_left > 0 && !answered) {
        printf("Time left: %d seconds\n", time_left);
        sleep(1);
    }
}
```

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```
time_left--;\n}\nif (!answered)\n    printf("\\nTime's up! You did not answer in time.\\n");\npthread_exit(NULL);\n}\n\nvoid *quiz_thread(void *arg) {\n    char answer[10];\n    printf("\\nQuestion: What is the capital of India?\\n");\n    printf("A) Mumbai\\nB) Delhi\\nC) Chennai\\nD) Kolkata\\n");\n    printf("Enter your option (A/B/C/D): ");\n    scanf("%s", answer);\n\n    answered = 1;\n\n    if (strcmp(answer, "B") == 0 || strcmp(answer, "b") == 0)\n        printf("\\nCorrect Answer! Delhi is the capital of India.\\n");\n    else\n        printf("\\nIncorrect Answer.\\n");\n\n    pthread_exit(NULL);\n}\n\nint main() {\n    pthread_t t1, t2;\n\n    pthread_create(&t1, NULL, timer_thread, NULL);\n    pthread_create(&t2, NULL, quiz_thread, NULL);\n\n    pthread_join(t1, NULL);\n    pthread_join(t2, NULL);\n\n    printf("\\nQuiz Ended.\\n");\n    return 0;\n}
```

Output:

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Output Analysis	The program successfully demonstrates thread creation and termination using the POSIX pthread library. Two threads are created: one handles the countdown timer, and the other displays the quiz question. Both threads run concurrently. If the user answers before the timer reaches zero, both threads terminate immediately. If the timer reaches zero first, the program automatically ends the quiz. The output verified proper synchronization and successful thread termination, proving efficient implementation of thread life cycle operations.
Link of student Github profile where lab assignment has been uploaded	“ https://github.com/Bhushan-Tayade/YCCN-23071391.git ”
Conclusion	The experiment successfully implemented thread creation, execution, and termination using POSIX threads in Linux. The interaction between the timer and quiz threads demonstrated concurrent execution and synchronization using shared variables. The results confirmed that threads can operate independently yet coordinate effectively to achieve a common goal. This practical enhanced understanding of multithreading concepts, real-time task management, and cooperative thread termination.



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