

Operating Systems (CT-353)

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Lab 05: Process Synchronization

- **Readers-Writers Problem:**

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

sem_t x, y;
pthread_t writethreads[100], readerthreads[100];
int readercount = 0;

void *reader(void *param)
{
    sem_wait(&x);          // Lock the reader count
    readercount++;

    if (readercount == 1)  // First reader locks the writer
        sem_wait(&y);

    sem_post(&x);          // Release the reader count lock
    printf("%d reader is inside\n", readercount);
    usleep(3);            // Simulate reading
    sem_wait(&x);          // Lock the reader count
    readercount--;

    if (readercount == 0)  // Last reader releases the writer
        sem_post(&y);

    sem_post(&x);          // Release the reader count lock
    printf("%d Reader is leaving\n", readercount + 1); // Corrected print
    return NULL;
}
```

```

void *writer(void *param)
{
    printf("Writer is trying to enter\n");
    sem_wait(&y);          // Lock writer access
    printf("Writer has entered\n");
    sem_post(&y);          // Release writer lock
    printf("Writer is leaving\n");
    return NULL;
}

int main()
{
    int n2, i;
    printf("Enter the number of readers:\n");
    scanf("%d", &n2);

    // Initialize semaphores
    sem_init(&x, 0, 1); // Mutex for reader count
    sem_init(&y, 0, 1); // Semaphore for writer access

    // Create reader and writer threads
    for (i = 0; i < n2; i++)
    {
        pthread_create(&readerthreads[i], NULL, reader, NULL); // Create reader thread
        pthread_create(&writerthreads[i], NULL, writer, NULL); // Create writer thread
    }

    // Wait for threads to finish
    for (i = 0; i < n2; i++)
    {
        pthread_join(readerthreads[i], NULL);
        pthread_join(writerthreads[i], NULL);
    }

    // Destroy semaphores
    sem_destroy(&x);
    sem_destroy(&y);

    return 0;
}

```

Output:

Enter the number of readers:

3

1 reader is inside

3 Reader is leaving

Writer is trying to enter

Writer is trying to enter

2 reader is inside

2 Reader is leaving

Writer is trying to enter

3 reader is inside

1 Reader is leaving

Writer has entered

Writer is leaving

Writer has entered

Writer is leaving

Writer has entered

Writer is leaving