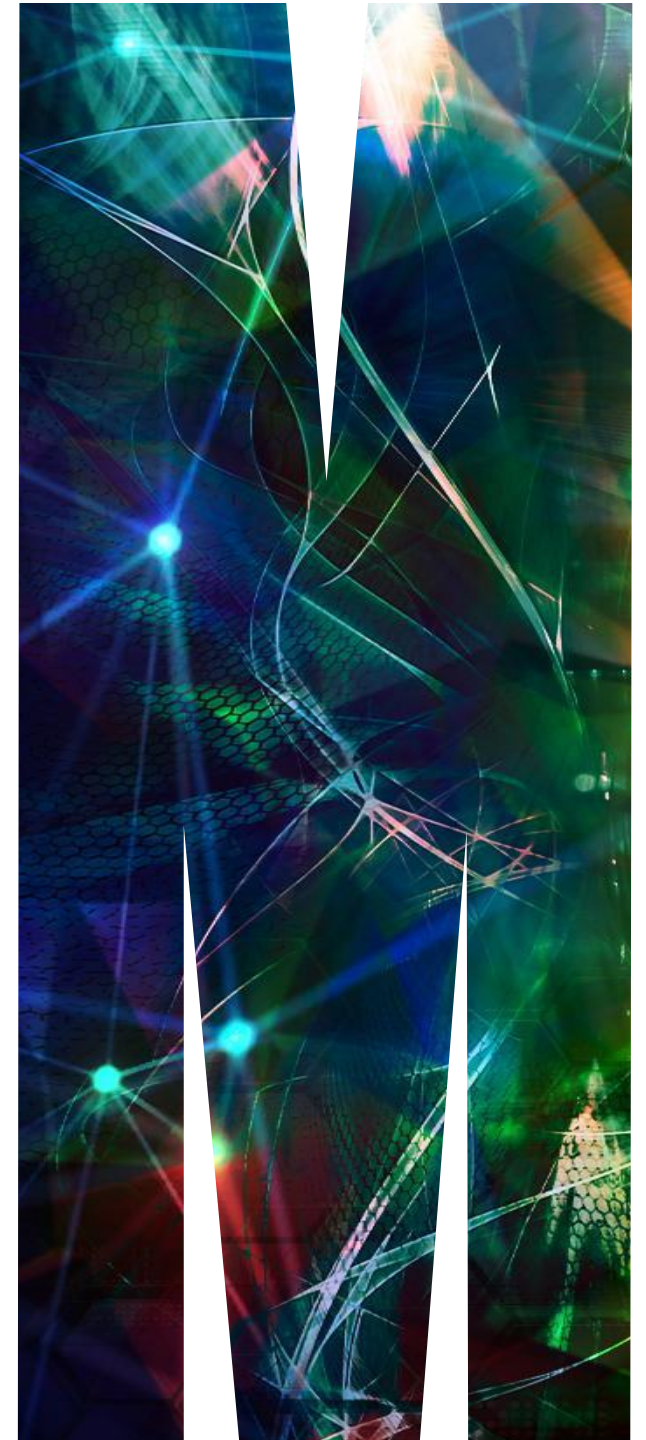


FIT2100 - OPERATING SYSTEMS

WEEK 8 - WORKSHOP 07

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CONTENT

WORKSHOP TOPICS

- Concurrency Problems
- Semaphores
- MUTEX
- Deadlock basics and conditions

Week 8 Learning Objectives

Threads and Concurrency

- Understand the concept of concurrent execution
- Understand the role of semaphores in managing concurrent access to shared resources
- Understanding the concept of Mutual Exclusion (MUTEX)
- Learn how deadlocks occur and the implications they have on system stability and performance

RECAP TIME - CONCURRENCY PROBLEMS

MULTIPLE CHOICE / DISCUSSION QUESTIONS (10 mins)

PolLEV Time - Engage and Interact



CONCURRENCY PROBLEMS

RACE CONDITIONS (5 MINS)

A program has two threads, Thread A and Thread B. Thread A increments a shared counter by 3 every time it gains control. Thread B multiplies the shared counter by 2 every time it gains control. If the shared counter starts at 1 and both threads gain control three times in the sequence A-B-A-B-A-B, what is the final value of the counter?

RECAP TIME - SEMAPHORES

MULTIPLE CHOICE / DISCUSSION QUESTIONS (10 mins)

PolLEV Time - Engage and Interact



SEMAPHORES

SEMAPHORE OPERATIONS (3 MINS)

Given a counting semaphore initialized to 5, if 3 processes execute “semWait” operation and 2 processes execute “semSignal” operation, what will be the final value of the semaphore?

SEMAPHORES

BINARY SEMAPHORES (3 MINS)

A binary semaphore starts at 1 (unlocked). If 3 different processes each try to execute “semWait” one after the other without any “semSignal” in between, how many processes will be blocked?

RECAP TIME - MUTEXES

MULTIPLE CHOICE / DISCUSSION QUESTIONS (10 mins)

PolLEV Time - Engage and Interact



MUTEXES

OVERHEAD CALCULATIONS (5 MINS)

Consider a system with 4 processes. Each process wants to execute its critical section 5 times, and each time it enters its critical section, it stays there for 2 milliseconds. If using a mutex causes an overhead of 0.5 milliseconds every time a process enters or exits the critical section, how much total overhead is introduced by the mutex for all processes?

MUTEXES

OVERHEAD CALCULATIONS (3 MINS)

In a certain system, mutexes are used so frequently that 15% of the system's time is spent managing them. If the system runs for 200 hours, how many hours is spent managing mutexes?

RECAP TIME - DEADLOCKS

MULTIPLE CHOICE / DISCUSSION QUESTIONS (10 mins)

PolLEV Time - Engage and Interact



DEADLOCKS

DEADLOCKS (5 MINS)

A system has 7 resources of the same type.

These are allocated to processes P1, P2, and P3, as 2, 2, and 1 respectively.

If the maximum demand of P1, P2, and P3 are 7, 5, and 3 respectively, can a deadlock state exist?

DEADLOCKS

BANKERS ALGORITHM (15 MINS)

Process	Allocation			Max		
	A	B	C	A	B	C
P1	0	1	0	7	5	3
P2	2	0	0	3	2	2
P3	3	0	2	9	0	2
P4	2	1	1	2	2	2

Assume there are 10 units of resource A, 5 units of resource B and 7 units of resource C. Determine a safe sequence of processes that should be running to avoid any deadlocks

Summary

- Topics covered
 - Concurrency Problems
 - Semaphores
 - MUTEX
 - Deadlock basics and conditions
- Next week
 - **Problem Solving Assessment 2 (PSA2)**