

Operating Systems

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Lecture 0

جامعة الجميع الذكية

تسعى لتكون الكيان الأول الذي يتبنى مبدأ المجتمع التعليمي
التعاوني ويقدم العلم مقابل العمل لتنمية وبناء المجتمعات.

Course Overview and Syllabus



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EVERYONE'S SMART UNIVERSITY

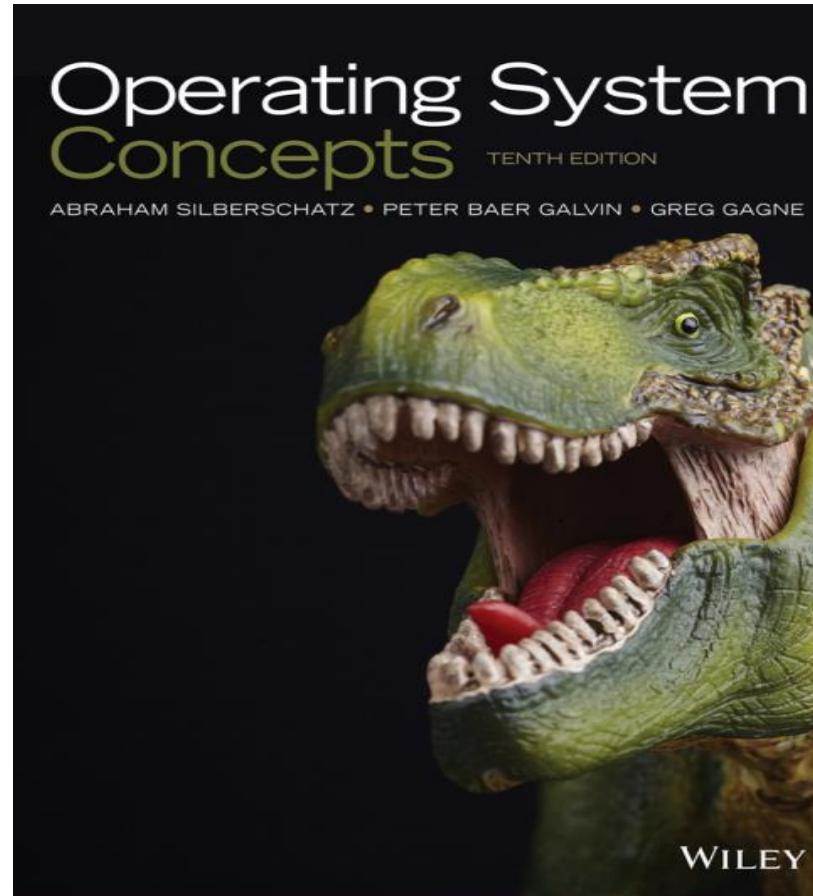
- In this course, we introduce the fundamentals of modern operating system function, design, and implementation.
- Topics include concurrency, synchronization, processes, threads, scheduling, memory management, file systems, device management, and security.

- **Credit Hours:** 3 credit hours.
- The required textbook for this course is "Operating System Concepts, " by Silberschatz, Galvin, and Gagne. Most of the material in these pages was originally taken from the 9th and 10th edition of that book.
- Lecture notes, power points slides and videos are additional resources that are prepared by me.



Chapter 01

Operating Systems Course Overview



- The course will begin with an introduction to operating systems. Over the course of the subsequent Modules (8 Modules) , we will discuss, analyze in detail each of the major components of an operating system (from processes to threads), and explore more advanced topics in the field, including , Concurrency, memory management, Scheduling, Deadlocks, File managements, and virtualization. The class will conclude with a discussion of various system-related security issues.

- Module 1: Operating System Introduction.
- Module 2: Processes and threads.
- Module 3: Process Synchronization and Concurrency.
- Module 4: Scheduling and Deadlock.
- Module 5: Memory management.
- Module 6: File Systems.
- Module 7: Operating System security.
- Module 8: Virtualization

- Module1 : Operating Systems Introduction
- We will begin this course with a high-level introduction to Operating Systems (OS).
- The Operating System acts as a platform of information exchange between your computer's hardware and the applications running on it.
- Most people are familiar with How to use Operating Systems such as Windows, Linux, but for the purposes of this course, we will focus on Concepts behind the design of Operating systems.

- First, we will start with, what operating systems are, what they do, and how they are designed and constructed.
- Then, we give a brief overview of Computer-System Organization and Architecture
- We will conclude this module with a discussion of the general OS structure and its basic Operations

- Module2 : Processes and threads
 - We will discuss two central building blocks of modern operating systems: **Processes** and **Threads**.
 - **Processes** (instances of a running computer program) and **threads** (a specific task running within a program) are integral to the understanding of how an OS executes a program and the communication of information between each of the computer's architectural layers.

- Module2 : Processes and threads
 - We will start with an overview of each concept, including definitions, uses, and types.
 - We will then discuss the similarities and differences between processes and threads.
 - We will conclude this unit with a discussion on Context Switches and the important role they play in CPU scheduling, which will be discussed more in depth in Module 5.

- Module3 : Processes Synchronization (Concurrency)
 - Because a number of different entities will need to access data, it is important to learn how to maintain a consistent view of data across the OS.
 - This is why we need a good synchronization management system.

- Module3 : Processes Synchronization (Concurrency)
- We will begin this section with an overview of why synchronization is so important to an Operating System and the problems that could arise if synchronization is not handled properly.

- Module3 : Processes Synchronization (Concurrency)
- The discussion will continue with an overview of Race Conditions (or system flaws in which the output of a given process is problematically dependent on the sequence of other events), and finally, Semaphores as a way of preventing Race.

- Module4 : Scheduling and Deadlocks
 - Central Process Unit (CPU) scheduling deals with having more processes/threads than processors to handles those tasks, meaning how the CPU determines which jobs it is going to handle in what order.

- Module4 : Scheduling and Deadlocks
- A good understanding of how a CPU scheduling algorithm works is essential to understanding how an Operating System works; a good algorithm will optimally allocate resources, allowing an efficient execution of all running programs.
- A poor algorithm, however, could result in any number of issues, from process being "starved out" to inefficient executing, resulting in poor computer performance

- Module4 : Scheduling and Deadlocks
 - In this Module, we will first discuss the CPU problem statement and the criteria of a good scheduling algorithm. Then, we will move on to learning about types of CPU scheduling, such as preemptive and non-preemptive. Finally, we will conclude the module with a discussion on some of the more common algorithms found in Operating Systems.

- Module 4 : Scheduling and Deadlocks
 - The second part of this Module is about Deadlock.
 - Deadlock is a paralyzing process state resulting from improper CPU scheduling, process management, and synchronization management. During this time, processes are blocked as they compete for system resources or only communicate with each other.
 - Although it cannot be guaranteed that deadlock may be avoided 100% of the time, it is important to know how to avoid the deadlocked state and how to recover from it once it has been achieved.



- Module 4 : Scheduling and Deadlocks

- We will build upon the previous two units of CPU Scheduling and Processes and Threads when discussing Deadlock. First, we will discuss what deadlock is by establishing a working definition and the conditions in which it presents itself. Then, we will talk about how to prevent and avoid deadlock. Finally, we will learn about deadlock detection, as well as methods for recovering from a deadlocked state.

- Module5 : Memory Management
 - Memory is the oil that keeps the computer running smoothly. It is present in various forms throughout the entire computer system.
 - It is a must for software developers to have a solid understanding of the role memory plays to be able to efficiently use memory in the programs, as well as understand what is going on "under the hood" should a problem arise.

- Module 5 : Memory Management
 - We will discuss the role of memory in an Operating System, first with an overview of the memory hierarchy and how memory and the OS interact with each other. Next, we will move on to discussing how memory is allocated for different purposes. Finally, we will discuss the two main topics regarding memory access: segmentation and paging.

- Module6 : File Systems
 - File systems play an important role in the operating system. From the user's perspective, the file system is a simple filing cabinet. However, behind the scenes there is much complexity. We will discuss a general overview of file systems, a look at file allocation and methods as well as disk allocation algorithms.

- Module7 : Operating System Security
 - Security is an important part of operating systems. There are many threats today to computer systems. This unit will begin with a brief overview of security issues, look at types of malware and discuss several security techniques, such as access controls, intrusion detection, and malware defense.

- Module8 : Virtualization
- The term virtualization has many meanings, and aspects of virtualization permeate all aspects of computing. Virtual machines are one instance of this trend.
- Generally, with a virtual machine, guest operating systems and applications run in an environment that appears to them to be native hardware and that behaves toward them as native hardware would but that also protects, manages, and limits them.

- Module8 : Virtualization
 - This Module, delves into the uses, benefits, features, and implementation of virtual machines.
 - Virtual machines can be implemented in several ways, and this Module describes these options.

End of Chapter 1

