Miami Dade College

Course Description

CGS3763 | Operating System Principles | 4.00 credits

This upper division course, for students majoring in Information Systems Technology, introduces fundamental operating system topics and includes both computer system and operating system structure. Students will learn how processes threads, concurrent programming, interrupt handling, CPU scheduling and process synchronization, and I/O system memory management affect the system structure. Additionally, students will learn how virtual memory, deadlocks, file system, and command interpreter relate to client/server systems. Prerequisite: COP1334.

Course Competencies:

Competency 1: The student will analyze and evaluate computer system hardware by:

1. Distinguishing the essential elements of a computer system and their interrelationships
2. Inspecting the steps taken by a processor to execute an instruction
3. Investigating why and how a processor uses interrupts
4. Differentiating the levels of a typical computer memory hierarchy
5. Evaluating the essential characteristics of multiprocessor and multicore architectures
6. Discussing the concept of locality and analyzing the performance of a multilevel memory hierarchy
7. Examining the operation of a stack and its use to support procedure call and return

Competency 2: The student will analyze and evaluate the operating system and its key principles by:

1. Differentiating and categorizing the key functions of an operating system (OS)
2. Examining the evolution of operating systems and milestones in OS research
3. Examining the key design areas that have been instrumental in the development of modern operating systems
4. Comparing and contrasting key features and functionality of major operating systems, such as Windows and UNIX

Competency 3: The student will analyze and evaluate process management by:

1. Defining "process" and explaining the relationship between processes and process control blocks
2. Examining the concept of a process state and discussing the state transitions the processes undergo
3. Examining the purpose of the data structures and data structure elements used by an OS to manage processes
4. Assessing the requirements for process control by the OS
5. Assessing the issues involved in the execution of the OS code
6. Assessing the key security issues that relate to operating systems

Competency 4: The student will analyze and evaluate threads and thread management by:

1. Distinguishing between process and thread
2. Evaluating the basic design issues for threads
3. Comparing the difference between user-level threads and kernel-level threads
4. Assessing the thread management facility in Windows
5. Assessing the thread management facility in Linux

Competency 5: The student will analyze concurrent processes by:

1. Examining concepts related to concurrency, including race conditions, OS concerns, and mutual exclusion requirements
2. Comparing hardware approaches to supporting mutual exclusion
3. Examining semaphores

Competency 6: The student will evaluate and solve deadlocks by categorizing the conditions that cause deadlocks.

1. Assessing deadlock prevention strategies related to each of the conditions for deadlock
2. Comparing the concurrency and synchronization methods used in Linux and Windows

Competency 7: The student will examine memory management by:

1. Analyzing the principal requirements for memory management
2. Analyzing memory partitioning and the various techniques used for memory partitioning
3. Supporting the principle of paging within main memory
4. Assessing key security issues related to memory management

Competency 8: The student will evaluate the virtual memory facility in operating systems by:

1. Comparing and contrasting virtual memory and main memory
2. Examining the hardware and control structures that support virtual memory
3. Assessing the various OS mechanisms used to implement virtual memory
4. Contrasting the virtual memory management mechanisms in Linux and Windows

Competency 9: The student will evaluate processor scheduling by:

1. Distinguishing between long-, medium-, and short-term scheduling
2. Assessing the performance of different scheduling policies

Competency 10: The student will value design considerations for thread scheduling and real-time processes by:

1. Examining thread granularity
2. Assessing the key design issues in multiprocessor thread scheduling and key approaches to scheduling
3. Evaluating the requirements imposed by real-time scheduling
4. Comparing the scheduling methods used by Linux and Windows

Competency 11: The student will analyze and evaluate Input/Output (I/O) devices by:

1. Considering key concepts of I/O devices on computers
2. Formulating the organization of the I/O function
3. Assessing the key issues in the design of OS support for I/O
4. Relating performance implications of various I/O buffering alternatives
5. Comparing the I/O mechanisms in Linux and Windows

Competency 12: The student will analyze and evaluate file organization schemes and file management by:

1. Examining the basic concepts of files and file systems
2. Assessing the principal techniques for file organization and access
3. Examining file directories

Learning Outcomes:

- Use computer and emerging technologies effectively