Please consider the associated Links and References (Canvas, On-Line) provided in the class schedule.

Main topics:

- **Ch 1: Introduction to OS**
  - What is an Operating System? What are the OS goals?
  - Computer System Components (Users, Application Programs, OS, Hardware)
  - OS Usages
  - The Evolution of Operating Systems
    - Serial Processing: No Operating Systems
    - Simple Batch Systems: Monitor
    - Multiprogrammed Batch Systems
    - Time-Sharing Systems
  - Computer-System Architecture and the Advantageous
    - Asymmetric Multiprocessing
    - Symmetric Multiprocessing
  - Advanced OS
    - Distributed OS
    - Network OS
    - Real-time OS (Hard and Soft Deadlines)
  - Computer-System Operation
    - Dual-mode operation
  - Interrupts (what is it? what types?, Handling)
  - Storage Hierarchy
    - Speed, Cost, Volatility
    - Caching
  - Operating System Components
    - Process Management
    - Memory Management
    - Storage Management
    - File-System Management
      - Mass-Storage Management
      - Caching
      - I/O Systems
    - Protection and Security
  - Virtual Machines (what? idea and benefit)

- **Ch 2: Chapter 2: Operating System Services and Structures**
  - Operating System Services
    - User interface
    - Program execution
    - I/O operations
    - File-system manipulation
    - Communications

        - Error detection
        - Resource allocation
        - Accounting
        - Protection and security
    - System Calls (API, Types)
    - Operating System Structure
        - Simple structure (monolithic) – MS-DOS
        - Layered – an abstraction
        - Microkernel – Mach
        - Modules – Solaris
        - Hybrid

- **Ch 3: Chapter 3: Processes**
    - What is a process
    - Process Parts
        - Program code (Text Section)
        - Current Activity (Registers)
        - Data (Stack, Data Section, and Heap)
    - Process vs. Program
    - Process Management Tasks
    - Process States
    - Process Control Block
    - Context Switch
    - Process Scheduling
        - Main goals
        - Process Scheduling Queues
    - Types of Scheduler (long-term, medium-term, and short-term)
    - Process Creation and Termination (fork() and exit())
    - Interprocess Communication (IPC)
        - Shared memory
        - Message passing
    - Types of Communication
        - Indirect
        - Direct
    - Message passing Types
        - Blocking (Synchronous)
        - Non-blocking (Asynchronous)

- **Ch 4: Threads**
    - Process Characteristics
        - Resource Ownership, Scheduling/Execution
    - What is a thread?
    - Single and Multithreaded Processes

- Key Benefits of Threads in comparison with Process
- Benefits of Threads
  - Responsiveness
  - Resource Sharing
  - Economy
  - Scalability
- Single-threaded vs. Multi-threaded Approaches
- Concurrency vs. Parallelism
  - Types of parallelism
- Thread Types(models) and their advantages and disadvantages
  - User Level Thread (ULT)
  - Kernel Level Thread (KLT) - Kernel-supported thread or Lightweight Process
  - Combined
- Or (Silberschatz)
  - Many-to-One
  - One-to-One
  - Many-to-Many

- **Ch 5: CPU Scheduling**
  - What is scheduling? What are the (resource) scheduling objectives?
  - Types of Scheduling?
    - Long-term, medium-term, and short-term (CPU) scheduling
  - Scheduling and Process State Transitions
  - Queuing Diagram for Scheduling
  - CPU burst and IO burst
  - Preemptive vs. Non-preemptive Scheduling
  - Scheduling Criteria
    - User-oriented
      - Turnaround time, Response time, Waiting time
    - System-oriented
      - CPU utilization, Throughput
  - CPU Scheduling Algorithms
    - First Come First Served (FCFS)
    - Shortest Job First (SJF)
    - Shortest Remaining Time First (SRTF)
    - Highest Response Ratio Next (HRRN)
    - Round Robin (RR)
    - Virtual Round Robin (VRR)
    - Multilevel Feedback Queue (MLFQ)
    - Priority Scheduling (PR)
    - Multilevel Queue
  - Scheduling Algorithm Evaluation Approaches
    - Deterministic Modeling
    - Queueing Models

- Simulations
- Implementation