

## **CSE 4/521: Introduction to Operating Systems**

Text book: Operating System Concepts (Silberschatz, Galvin and Gagne)

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The following syllabus introduces students to the general principles of operating systems. The syllabus in this introductory course provides students with a clear and solid understanding of the well-established concepts implemented in a typical operating system.

Disclaimer: All tests/assignments/exams would only be based on the concepts mentioned in the syllabus. No questions would be asked on anything else outside the stated syllabus. The projects, on the other hand, would require you to learn few concepts by yourself via online sources.

### **1. Introduction**

1.1 What Operating Systems Do, 1.3 Computer-System Architecture, 1.4 Operating-System Structure, 1.5 Operating-System Operations, 1.6 Process Management, 1.7 Memory Management, 1.8 Storage Management, 1.9 Protection and Security, 1.10 Kernel Data Structure, 1.11 Computing Environments, 1.12 Open-Source Operating Systems, 1.13 Summary

*(Omit: 1.2 Computer-System Organization)*

### **2. Operating System Structures**

2.1 Operating-System Services, 2.2 User and Operating-System Interface, 2.3 System Calls, 2.4 Types of System Calls, 2.5 System Programs, 2.7 Operating-System Structure, 2.8 Operating-System Debugging, 2.11 Summary

*(Omit: 2.6 Operating-System Design and Implementation, 2.9 Operating-System Generation, 2.10 System Boot)*

### **3. Processes**

3.1 Process Concept, 3.2 Process Scheduling, 3.3 Operations on Processes, 3.4 Inter-process Communication, 3.5 Examples of IPC Systems, 3.7 Summary

*(Omit: 3.6 Communication in Client-Server Systems)*

### **4. Threads**

4.1 Overview, 4.2 Multicore Programming, 4.3 Multithreading Models, 4.4 Thread Libraries, 4.5 Implicit Threading, 4.7 Operating-System Examples, 4.8 Summary

*(Omit: 4.6 Threading Issues)*

### **5. Process Synchronization**

5.1 Background, 5.2 The Critical-Section Problem, 5.4 Synchronization Hardware, 5.5 Mutex Locks, 5.6 Semaphores, 5.7 Classic Problems of Synchronization, 5.9 Synchronization Examples, 5.11 Summary

*(Omit: 5.3 Peterson's Solution, 5.8 Monitors, 5.10 Alternative Approaches)*

### **6. CPU Scheduling**

6.1 Basic Concepts, 6.2 Scheduling Criteria, 6.3 Scheduling Algorithms, 6.4 Thread Scheduling, 6.6 Real-Time CPU Scheduling, 6.7 Operating-System Examples, 6.9 Summary

*(Omit: 6.5 Multiple-Processor Scheduling, 6.8 Algorithm Evaluation)*

## **7. Deadlocks**

7.1 System Model, 7.2 Deadlock Characterization, 7.3 Methods for Handling Deadlocks, 7.4 Deadlock Prevention, 7.8 Summary

*(Omit: 7.5 Deadlock Avoidance, 7.6 Deadlock Detection, 7.7 Recovery from Deadlock)*

## **8. Main Memory**

8.1 Background, 8.2 Swapping, 8.3 Contiguous Memory Allocation, 8.4 Segmentation, 8.5 Paging, 8.6 Structure of the Page Table, 8.9 Summary

*(Omit: 8.7 Example: Intel 32 and 64-bit Architectures, 8.8 Example ARM Architecture)*

## **9. Virtual Memory**

9.1 Background, 9.2 Demand Paging, 9.3 Copy-on-Write, 9.4 Page Replacement, 9.5 Allocation of Frames, 9.6 Thrashing, 9.10 Operating-System Examples, 9.11 Summary

*(Omit: 9.7 Memory-Mapped Files, 9.8 Allocating Kernel Memory, 9.9 Other Considerations)*

## **10. Mass-Storage Structure**

10.1 Overview of Mass-Storage Structure, 10.2 Disk Structure, 10.4 Disk Scheduling, 10.7 RAID Structure, 10.8 Stable-Storage Implementation, 10.9 Summary

*(Omit: 10.3 Disk Attachment, 10.5 Disk Management, 10.6 Swap-Space Management)*

## **11. OMIT**

## **12. File-System Implementation**

12.1 File-System Structure, 12.2 File-System Implementation (no 12.2.3 virtual file system), 12.3 Directory Implementation, 12.4 Allocation Methods, 12.5 Free-Space Management, 12.10 Summary

*(Omit: 12.2.3 Virtual File System, 12.6 Efficiency and Performance, 12.7 Recovery, 12.8 NFS, 12.9 Example: The WAFL File System)*

## **13. I/O Systems**

13.3 Application I/O Interface, 13.4 Kernel I/O Subsystem, 13.5 Transforming I/O Requests to Hardware Operations, 13.7 Performance, 13.8 Summary

*(Omit: 13.1 Overview, 13.2 I/O Hardware, 13.6 STREAMS)*

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