

OPERATING SYSTEM CONCEPTS - SYLLABUS
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OPERATING SYSTEM CONCEPTS SYLLABUS									
U = understand; R = remember; M = master.									
WEEK #	HOUR #		CONTENTS						
	SEU	E.P.	Chapter	Section	Concepts	REQ.			
						U	R	M	
1	1	1	0. Prologue						
2	7	6	1. Introduction	What Operating Systems Do	Operating System (system view): resource allocator, control program.	o			
				Computer-System Organization	Interrupts; Trap/exception.	o			
				Operating-System Structure	Multiprogramming; Timesharing (multitasking).	o			
				Operating-System Operations	Interrupt driven; Dual-mode; Privileged instructions.	o			
3	11	8	2. Operating-System Structures	System Calls	System Calls.	o			
				Operating-System Design and Implementation	Policy and mechanism.	o			
				Operating-System Structure	Simple / layered / microkernel / modules / hybrid structure.	o			
4	16	12	3. Processes	Process Concept	Processes; Context switch.	o			
					Process states (transitions); PCB.		o		
				Process Scheduling	Long-term / medium / short-term scheduling.	o			
				Operations on Processes	Process APIs.				o
				Interprocess Communication	Shared memory; Message passing.	o			
5	20	15	4. Threads	Communication in Client– Server Systems	Pipes.	o			
				Overview	Threads; Benefits of threads.	o			
				Multicore Programming	Concurrency vs. parallelism.	o			
				Multithreading Models	Kernel / user threads; Motivating kernel / user threads.	o			
					Multithreading models.		o		
				Thread Libraries	Pthread APIs.				o
7	25	19	5. CPU Scheduling	Implicit Threading	Thread Pools.	o			
				Threading Issues	Thread cancellation; Signal handling; Thread-local storage; Lightweight process.	o			
				Basic Concepts	CPU / I/O burst; Scheduling timing; Scheduler; Dispatcher.	o			
				Scheduling Criteria	Scheduling criteria.		o		
				Scheduling algorithms	FCFS; SJF; Preemptive SJF; Priority; RR; Multilevel queue; Multilevel feedback queue; Gantt chart; HRRN.				o
				Thread Scheduling	Process/system-contention scope.	o			
9	34	25	6. Process Synchronization	Multiple-Processor Scheduling	Asymmetric multiprocessing vs. symmetric multiprocessing; Processor (cache) affinity.	o			
				The Critical-Section Problem	Race condition; Critical section; Critical section problem.	o			
					Solution to critical-section problem (three requirements).		o		
				Peterson's Solution	Peterson's Solution.	o	o		
				Synchronization Hardware	Interrupt masks; Test-and-set; Compare-and-swap; Spin-waiting.	o			
					Solution using test-and-set (satisfying bounded waiting).		o		
				Mutex Locks	Mutex.				o
				Semaphores	Semaphores.				o
10	37	28	7. Deadlocks	Classic Problems of Synchronization	The Bounded-Buffer problem; The Readers–Writers problem; The Dining-Philosophers problem.				
					Condition variables.				o
				Monitors	Monitors.	o			
				System Model	Deadlock.				
				Deadlock Characterization	Four necessary conditions; Resource-allocation graph.		o		
				Methods for Handling Deadlocks	Deadlock prevention / avoidance / detection / recovery.	o			
				Deadlock Prevention	Denying the four necessary conditions.			o	
11	43	33	8. Main Memory	Deadlock Avoidance	Safe state; Resource-allocation graph alg.; The banker's alg. (Safety alg.; Resource-request alg.).				o
				Deadlock Detection	Wait-for graph alg.; Detection alg..				o
				Recovery from Deadlock	Selecting a victim; Roll back; Starvation.	o			
				Background	Program loading and linking; Address binding; Logical / physical address space.	o			
				Swapping	swapping.	o			
				Contiguous Memory Allocation	base / limit; MMU; Free list.	o			
					Address translation; Free space management.		o		
				Segmentation	Segmentation.		o		
13	51	38	9. Virtual Memory		External fragmentation.	o			
				Paging	Paging; TLB; Page size issues.		o		
					Internal fragmentation.	o			
				Structure of the Page Table	Paging and Segments; Hierarchical page tables.		o		
					Hashed / inverted page tables.	o			
				Demand Paging	Demand paging; Page fault.	o			
				Copy-on-Write	Effective access time.		o		
				Page Replacement	Copy-on-write.	o			
14	55	41	10. Mass-Storage Structure		modify / dirty bit; Reference string; Belady's anomaly.	o			
				Allocation of Frames	Page replacement algs.: Optimal, FIFO, LRU; LRU approximation algs (Clock, etc.).		o		
				Thrashing	Equal / proportional / priority allocation; Global/local replacement.	o			
					Thrashing.	o			
15	58	43	11. File-System Interface	Memory-Mapped Files	Working-set model; page-fault frequency.		o		
				Other Considerations	Memory-Mapped Files; Shared memory.	o			
				Overview of Mass-Storage Structure	Page size issues.	o			
16	64	48	12. File-System Implementation	Disk Structure	I/O time.	o			
				Disk Scheduling	Disk Structure.			o	
				RAID Structure	FCFS; SSTF; SCAN; C-SCAN; LOOK; C-LOOK.				
16	64	48	13. I/O Systems	File-System Interface	RAID lv 0 / 1 / 4 / 5.	o			
				File Organization	inode number; File descriptor; Hard / symbolic link; File sharing; Access control.	o			
				Allocation Method	FCB/inode; Direct / indirect pointers; extent.	o			
16	64	48	13. I/O Systems	Free Space Management	Contiguous / linked / indexed allocation.	o			
				I/O Systems	Bitmaps; Free lists.	o			
				Application I/O Interface	Polling; interrupt-driven; Direct memory access.	o			
16	64	48	13. I/O Systems	Kernel I/O Interface	Kernel I/O structure.	o			
				Kernel I/O Subsystem	I/O Scheduling; Buffering; Caching; Spooling.	o			