THOMPSON RIVERS UNIVERSITY

Course Outline

Department of Computing Science
Faculty of Science

COMP 3410
Operating Systems (3,1,0)
Fall 2015

Instructor: Phone/Voice Mail:
Office: E-Mail:

Course Description

The purpose of this course is to provide students basic knowledge of operating systems, difference between the kernel and user modes, concepts of application program interfaces, methods and implementations of interrupts. Students are introduced to the schedulers, policies, processes, threads, memory management, virtual memory, protection, access control, and authentication. Students learn system calls in different popular operating systems used in the industry.

Course/Learning Outcome:

Upon successful completion of the course, the student will demonstrate the ability to:

1. Explain the objectives and functions of modern operating systems.
2. Describe how computing resources are used by application software and managed by system software.
3. Describe reasons for using interrupts, dispatching, and context switching to support concurrency in an operating system.
4. Evaluate the trade-offs in terms of memory size (main memory, cache memory, auxiliary memory) and processor speed.
5. Articulate the need for protection and security in an operating system.

Prerequisites

COMP 2230: Data Structures, Algorithm Analysis and Program Design

Texts/Materials

Required Text:

A. Silberschatz, P.B. Galvin, G. Gagne, *Operating System Concepts with Java*, John Wiley & Sons, 2009, 8th Ed.,
ISBN: 978-0470-509-494 (will be supplemented by selected materials on current operating systems)

Recommended Text:

A. Silberschatz, P.B. Galvin, G. Gagne, *Operating Systems Concepts*, John Wiley & Sons 2002, 8th Ed.,
ISBN: 0-470-12872-0

Additional References (available in the library):

- William Stallings, *Operating Systems (Internals and Design Principles)*, Pearson Prentice Hall, 6th Ed., **2009**,
  ISBN: 0-13-601697-9.
- A. S. Tanenbaum, *Modern Operating Systems*, Pearson Prentice Hall, 3rd Ed., **2008**, ISBN: 0-13-6019196.
- Gary Nutt, *Operating Systems,* Addison-Wesley, 3rd Ed., **2004**, ISBN: 0-201-77344-9.

Syllabus - Lecture Topics:

Unit	Chapter	Duration
1. Overview		
a. Introduction	1	
b. Operating System Structures	2	1 week
2. Process Management		
a. Processes	3	
b. Threads	4	
c. CPU Scheduling	5	2 Weeks
d. Interrupt mechanism		
e. Process Synchronization	6	
f. Deadlocks	7	2 Weeks
3. Memory Management		
a. Main Memory	8	
b. Virtual Memory	9	3 Weeks
4. Storage Management		
a. File System Interface	10	
b. File-system Implementation	11	
c. Mass Storage Structure	12	
d. I/O Systems	13	2 Weeks

5. **Overview of Protection And Security**
   a. Protection 14
   b. Security 15 2 Weeks

6. **Case Studies** (Will be covered in **one non-programming Assignment**)
   a. Comparative Study of the latest operating systems **(Team Project) or**
   b. Windows NT, 95, 98, 2000, ME, XP, Vista, 7
   c. Research Paper presentation

Syllabus - Lab Topics :

Lab Topic	Tool	Duration
Processes Ps, kill etc.	UNIX	2 hr
IPC Introduction to threads	Java	4 Hrs
Concurrency Control Monitors, Semaphores and locks	Java	4 Hrs
Security features Permissions, sharing etc.	Unix/Windows	2 Hrs

ACM / IEEE Knowledge Area Coverage

Knowledge Areas that contain topics and learning outcomes covered in the course

Knowledge Area	**Total Hours of Coverage**
Overview of OS	3
Operating System Principles	3
Concurrency	6
Scheduling and Dispatch	4
Memory Management	4
Virtual Machines	4
File Systems	4
Device Management	4
Security and Protection	4

Body of Knowledge coverage

KA	**Knowledge Unit**	**Topics Covered**	**T1 hours**	**T2 hours**	**Elective hours**
	Overview	[Core-Tier1] • Role and purpose of OS	3	0	0

		• Functionality of a typical OS • Mechanism to support client/server model, hand-held devices • Design Issues • Influence of security, networking, multimedia, windowing systems			
	Operating System Principles	[Core-Tier1] • Structuring methods • Abstraction, processes and resources • API's, System calls • Interrupts : methods and implementations • Threads • Kernel/User mode • Device Organization	3	0	0
	Concurrency	***Topics:*** • States and state diagrams • Process structures • Dispatching and context switching • The role of interrupts • Managing atomic access to OS Objects • Implementing synchronization primitives • Multiprocessor issues (spin-lock, re-entrancy)	6	0	0
	Scheduling and Dispatch	[Core-Tier2] • Pre-emptive and non-preemptive scheduling • Scheduler and policies • Processes and threads • Deadlines and real-time issues	0	4	0
	Memory Management	[Core-Tier2] • Review of physical memory and memory management hardware • Working sets and thrashing • Caching/	1	3	0
	Virtual Memory	• Types of Virtualization • Paging abd Virtual memory • Virtual File System • Hypervisors •Portable Virtualizations • Cost of Virtualization		4	0

	File System	• Files : Data, metadata, sequential, random • Directories : Content and structure •File System : Structure, mount/unmount •Standard implementing techniques •memory mapped files •naming, searching, access, backups •journaling and log-structured file system	0	4	0
	Device Management	• Serial and parallel devices • Abstracting device differences • Buffering strategies • Direct Memory Access • Recovery from Failure		4	
	Security and Protection	• Overview of system security •Policy/mechanism separation •Security methods and devices • protection, access control and authentication Backups		4	