Carleton University

Department of Systems and Computer Engineering

SYSC 4001 Operating Systems Winter 2018-19

Course Outline

Instructor: Shikharesh Majumdar Room: 5203 CB, Tel. 520-5654, Email: majumdar@sce.carleton.ca

TA Information and Office hours: TBD

Calendar Description: Introduction to operating system principles. Processes and threads. CPU scheduling. Managing concurrency: mutual exclusion and synchronization, deadlock and starvation. Managing memory and input/output. Concurrent programming, including interprocess communication in distributed systems.

Prerequisites: SYSC 2006, and (SYSC 2003 or SYSC 3006 or SYSC 3310). Precludes additional credit for SYSC 3001 and COMP 3000. Students who have not satisfied the prerequisites for this course must either a) withdraw from the course, or b) submit a prerequisite waiver online or c) may be deregistered from the course after the last day to register for courses in the term.

Course Objectives:

The objective of this course is to expose the students to the fundamental concepts underlying operating systems. The topics will include the management of both software processes and hard ware devices in a computer system. Students will learn techniques for handling concurrent processes including different synchronization and inter-process communication techniques. Various device management techniques including CPU and I/O scheduling as well as techniques for managing memory including virtual memory systems will be discussed. The course will also include a discussion of different file system management techniques.

Learning Outcomes

The intended learning outcomes of the course are:

1. Understand the basic concepts and techniques underlying concurrent processing
2. Able to write programs with concurrent processes and handle inter-process communication, synchronization and mutual exclusion
3. Understand the various techniques and algorithms for memory management
4. Know the various operating system components (hardware and software) related to virtual memory management
5. Know the popular CPU scheduling policies and be able to understand their performance implications
6. Know various disk I/O scheduling policies and how to evaluate them
7. Understand file system management techniques

Graduate Attributes (GA's)

The learning outcomes listed above are used to develop competencies related to the Canadian Engineering Accreditation Board's (CEAB) Graduate Attributes (GAs). The GAs associated with this course are:

1.4. Programming and Algorithms (activities related to learning outcomes 1 and 2)
1.5. Computer Systems (activities related to learning outcomes 1, 3-7)

Textbook:
Operating System Concepts Essentials, by Silberschatz, Galvin and Gagne, John Wiley & Sons, Inc. (available from the bookstore)

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Reference Book:
Beginning Linux Programming, 4th Edition, by Neil Matthew; Richard Stones, (ebook available from the library)

Approximate Grading Scheme:
To pass the course, a student must pass the final examination (D- or better). For students who will meet this condition, the final grade will be calculated as follows:

Lab Exercises: 7%
Assignments: 18 %
Midterm Exam: 20%
Final Exam: 55%

Assignments: The course will have a number of *assignments*. You will get multiple days to complete any given assignment. The deadline for submission of each assignment will be indicated on the assignment specification (handout). Assignments include programming assignments. The TA will run students' solutions on the lab computer using the lab's compiler and operating system; so make sure that your assignment solutions can be complied and tested on this environment.

Students are allowed to discuss design issues among themselves when solving problems given in the assignments. But they have to do their own design, implement and test their own programs. There is a difference between discussing problems and issues with your colleagues and copying a design or program code (plagiarism). Plagiarism is an instructional offence.

Late assignments are not accepted unless you provide a medical certificate.

Lab Exercises: In addition to assignments there will be lab exercises each of which you are to complete within a single lab period. The specific lab period associated with each exercise will be indicated on the exercise handout. The labs exercises will familiarize you various aspects of the Linux OS.

Laboratory Sessions: The assignments are to be done during **scheduled as well as open lab sessions**. Access to the lab is possible whenever the engineering building is open. Open lab sessions correspond to those timetable slots when the room is NOT reserved for specific courses.

Final Exam: *Is for the evaluation purposes only and will not be returned to the student.* If you want you will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

Students who miss the final exam may be granted permission to write a deferred examination (see the Undergraduate Calendar for regulations on deferred exams).

Tentative week by week outline:

Week 1 – Introduction
Week 2 – Processes and Threads
Week 3 -4– Management of Concurrent Processes
Week 5-6 – CPU Scheduling;
Week 7 – Deadlock Handling;
Week 8-10 – Memory Management
Week **11** – Disk Scheduling
Weeks 12-13 File System Management

General Regulations

Attendance: Students are expected to attend all lectures and lab periods. The University requires students to have a conflict-free timetable. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 1.2, Course Selection and Registration and Section 1.5, Deregistration.*

Health and Safety: Every student should have a copy of our Health and Safety Manual. A PDF copy of this manual is available online: http://sce.carleton.ca/courses/health-and-safety.pdf

Deferred Term Work : Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current *Undergraduate Calendar, Academic Regulations of the University, Section 2.6, Deferred Term Work.*

Appeal of Grades : The processes for dealing with questions or concerns regarding grades assigned during the term and final grades is described in the *Undergraduate Calendar, Academic Regulations of the University, Section 2.7, Informal Appeal of Grade and Section 2.8, Formal Appeal of Grade.*

Academic Integrity: Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: https://carleton.ca/registrar/academic-integrity/. This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

Plagiarism: Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

Academic Accommodation: You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www.carleton.ca/equity/For an accommodation request, the processes are as follows:

- **Pregnancy obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
- **Religious obligation**: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf
- **Academic Accommodations for Students with Disabilities**: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-

class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult https://carleton.ca/pmc/students/dates-and-deadlines/ for the deadline to request accommodations for the formally-scheduled exam (if applicable).

- **Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/sexual-violence-support/.
- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf