UPR: Mayagüez
Department of Electrical and Computer Engineering

Syllabus for ICOM 5007 – Operating Systems – Fall 2013

Faculty
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General Description
The goal in this course is for students to learn the fundamental principles of operating systems, which are essential to understand the problems addressed by such systems, and study the strategies and fundamental algorithms or schemes followed to solve them. We will also have hands-on experience with implementation of some parts of an operating system; in particular, the course activities include some programming assignments using the educational-oriented operating system known as MINIX 3, Linux, and/or the Java Virtual Machine (JVM). The particular topics to cover include:

• General operating system concepts
• Processes and scheduling
• Memory management
• File systems
• Management of input/output
• Deadlocks
• Protection and security
• Distributed processing

Throughout the course we may use examples from real modern operating systems to illustrate concepts covered in class and how they are addressed in particular systems. The course counts for 4 credits.

Pre-requisites
ICOM4035 (or equivalent) and INEL4206. Students must also have sufficient computer programming skills and basic knowledge of Linux-like OS. Most of the programming to be done in this course will be using C language (and perhaps C++) language and Java. Some general discussion about C language will be offered during lab hours. It is expected that experience with other programming languages (such as Java) and in software development in general allow you to quickly grasp the essentials of that language. Most of the code examples to be discussed are written in C/C++ & Java.

¹ To meet at an hour different from the ones listed here you need to make an appointment.
Time and Place

<table>
<thead>
<tr>
<th>Section</th>
<th>Lecture</th>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>T,Th 5:00-6:15 PM @ S113</td>
<td>M 4:30-7:20 PM @ S121</td>
</tr>
<tr>
<td>116</td>
<td>T,Th 5:00-6:15 PM @ S113</td>
<td>W 4:30-7:20 PM @ S121</td>
</tr>
</tbody>
</table>

Textbook and References

**Required:**

<table>
<thead>
<tr>
<th>Title</th>
<th>Operating System Design and Implementation (3rd Edition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors</td>
<td>Andrew Tanenbaum, Albert S. Woodhull</td>
</tr>
<tr>
<td>Publisher</td>
<td>Pearson © 2006</td>
</tr>
</tbody>
</table>

**Recommended References:**

- Get used to surf the Web to look for tutorials about each of the topics covered. For example, use Google to search for OS topics such as “minix 3” or “virtual memory tutorial” and you will get access to online resources and tutorials about them. These are excellent resources to complement what is seen in class, in the laboratory or in the textbook.
- In addition, you can rely on other web sources, such as YouTube, to watch lectures on any of the topics of the course.
- Access the Web page for the textbook. You will find the necessary information in the book itself.

Grading

Your grade will be based **exclusively** on the scores that you obtain in the class projects, exams, laboratory assignments, and attendance. The curve to be used to assign a grade to your final grade is the following:

<table>
<thead>
<tr>
<th>Final Score</th>
<th>Grade</th>
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<tbody>
<tr>
<td>100 – 90</td>
<td>A</td>
</tr>
<tr>
<td>89 – 80</td>
<td>B</td>
</tr>
<tr>
<td>79 – 70</td>
<td>C</td>
</tr>
<tr>
<td>69 – 55</td>
<td>D</td>
</tr>
<tr>
<td>54 – 0</td>
<td>F</td>
</tr>
</tbody>
</table>
Your final score will be computed as a weighted average of your individual scores in: class attendance, programming projects, exams, and laboratory activities. The weights assigned to each of these categories are as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Attendance and Participation</td>
<td>2%</td>
</tr>
<tr>
<td>Midterm Exams (3)</td>
<td>53%</td>
</tr>
<tr>
<td>Final Exam (Comprehensive)</td>
<td>20%</td>
</tr>
<tr>
<td>Laboratory Work and Projects</td>
<td>25%</td>
</tr>
</tbody>
</table>

In addition, we have to enforce the following rule. **In order to pass this course you must have a final average score in partial exams of not less than 50 as well as a minimum final score of 50 in the lab and no laboratory or exam with a score of 0.**

There will be no special project, no special homework, no special exam, nor any other kind of “special work” to improve grades. However, each exam might have an extra credit problem that you can use to help improve your score on that category.

**Class Attendance**

Class attendance is required by university rules. Attendance will be verified on every lecture. The final grade corresponding to class attendance (which has a weight of 2% in the final grade) will be assigned using the following formula: \( \text{max}(0, 100 - x \times 20) \), where \( x \) is the number of lectures in which the student is not present. Any late arrival to the class will be considered as an absence, unless the student presents a reasonable excuse as interpreted by the instructor. **Moreover, any student with 7 or more lectures missed with no reasonable excuses will automatically get an F grade in the course.**

Once the class has started, if you need to get out of the room before the class ends, you are required to present a reasonable excuse at the end of the class (without having to offer details); otherwise, you may be considered as absent for that lecture.

Under no circumstance, we will accept as an excuse to be absent from lectures your need to take an exam or to comply with some requirement from another course that has been scheduled for an hour overlapping the official periods of this course. No professor of any of your courses can force you to miss another class, or activity officially scheduled in advanced, for the reason of scheduling his/her exams out of the regular hours of the particular course you might be taking with him/her. I need to apply that rule to myself too; therefore, if you have some other official academic activity (course, exam, etc), which is already scheduled, and in conflict with any of the dates that I have reserved for this course (see below), you need to report it immediately.

**OTHER IMPORTANT RULES TO FOLLOW:**

- No use of cellular phones is allowed inside the room during the lectures. Turn-off your phone before entering the room, or set it to vibrating mode, or silent, …
- No use of computers of any kind will be allowed inside the room during the lectures.

**Exams**

In this course, there will be three midterm exams and a comprehensive final exam. Unless otherwise indicated, all exams will be taken with closed books and closed notes. The midterm
Exams will be administered outside the regular class time. The date and time for each midterm exam will be as follows:

<table>
<thead>
<tr>
<th>Exam Number</th>
<th>Date</th>
<th>Time</th>
<th>Room</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Thursday, Feb 13, 2013</td>
<td>7:00 PM – 9:00 PM</td>
<td>TBD</td>
</tr>
<tr>
<td>II</td>
<td>Thursday, Mar 13, 2013</td>
<td>7:00 PM – 9:00 PM</td>
<td>TBD</td>
</tr>
<tr>
<td>III</td>
<td>Tuesday, Apr 24, 2013</td>
<td>7:00 PM – 9:00 PM</td>
<td>TBD</td>
</tr>
</tbody>
</table>

If an exam for some other course, or some other official academic activity, has already been scheduled in one of the dates and hours given, you must notify it immediately, so that such exam can be rescheduled for you, the same day at an earlier hour. **No excuse about conflicts will be accepted if reported after the day of the first session of your corresponding section.** Each exam lasts 1.5 hours.

The exams are offered out of regular hours of lectures in order for you to be able to have more time available to work on them. **If for any reason (storm, bad weather conditions, etc.) we cannot offer a particular exam on the given date, unless otherwise established, that particular exam will be automatically rescheduled for the first day of classes that we are able to meet afterward at regular lecture hours of the respective section.** The final exam will be administered in accordance with the schedule specified by the Registrar of the University of Puerto Rico, Mayagüez Campus.

**Exam Reposition Policy:** There shall be no repositions for missed midterm exams unless a reasonable\(^2\) excuse is notified in advance (not later than the day of the exam) and it is accepted as such.

**Laboratory and Programming Projects**

This course includes a weekly 3-hour laboratory session in which concepts discussed in class are put in practice. In each session, some practical activity will be specified, and you are expected to develop programming code to comply with the specifications given. In addition to the coding activities, there might be others requiring you to answer questions based upon experimentation with code that is provided or developed during the lab session. All of the lab activities are based upon fundamental topics that must have been previously discussed in lectures.

As part of your grade, you are expected to work some programming projects that are designed with the following objectives requiring more work than the weekly work assigned in lab sessions. These are projects related to some of the topics covered in the course. They may include modifications to some part of a real operating system or in which some relevant topic is put in practice, such as: multithreaded programming, distributed computation, process scheduling, etc.

Once assigned, you will be given at least **one week** to complete each programming project. You might discuss with your peers general aspects about the project and/or programming

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\(^2\) What is “reasonable” will be decided based on the instructor’s judgment of the particular evidence shown.
environment. However, you cannot share your code with any student, nor use code written by someone else, unless explicitly allowed by the project’s specifications. Failure to comply with this requirement will be considered as an act of academic dishonesty and you may receive a grade of F in the class (read section below titled Academic Integrity).

For each project, you will have access to such document explaining the tasks to be completed for the programming project. That document contains the detailed specification of the programming project. In some cases, you may have access to a set of files containing partial implementations of the particular programming project. **It is your job in these cases to extend the given code that executes the tasks these methods are designed to perform.**

The **grading process** consists of compiling the project that you submit and executing it to verify that it complies with specifications. If your program is not submitted as specified, or does not compile, you will receive a score of 0. On those cases, no further check of your code will be done. In general, we verify: compilation, complying with specifications, program documentation, and clarity of your code. Again, you will receive further instructions on how to submit your project electronically.

**Late Project Policy:**

Each project will have a due date composed of an hour, month and day (such as 11:59 PM-February 12). A project will be considered late if it is submitted for grading one minute after its due date. For example, if the due date for a project is 11:59 PM-October 30, then a project submitted at 12:00 AM-PM-October 31 is considered as one day late. Any late project will receive a penalty as established in the specifications document for the particular project. Usually, two dates are established as deadlines to submit a working implementation. The first date established is the “no penalty deadline”, the real deadline. The second date, which is usually two or three days after the first one, establishes a grace period during which you can submit your (late) working project but with a penalty (your maximum score will be 75 out of 100). Any project submitted after the second deadline is considered as not submitted.

**Any project that is not submitted for grading on time according to its submission rules will automatically receive a score of 0.**

**NOTE:** We will not debug your code via e-mail. We shall only look at your program source code listings, or login to see your code files during the allotted office hours.

**Incomplete Grade Policy**

A student will receive an incomplete grade if and only if the student misses the final exam, has a valid excuse, and if with the reposition of that exam (assuming the largest possible grade) the student has a chance to obtain a final passing grade in the course. Such excuse must be one of the following:

- Medical certificate indicating illness.
- Legal certificate indicating an appointment to attend a Court of Law.
• Certificate from a hospital or a physician indicating the death of either: parent, child, husband, wife or sibling.

Academic Integrity

Each student is expected to work individually on all projects, exams and laboratory assignments. You may not share your answers to the laboratory assignments. You may not use code from another student, or code that you find on the Internet or any similar resources (unless explicitly allowed). You may not share your code with another student. Failure to comply with these requirements will result in a grade of F in the course for the student(s) violating these rules. Unauthorized group efforts, particularly during exams, will be considered academic dishonesty and the students involved will receive an F in the course. You should read the “Reglamento General de Estudiantes de la Universidad de Puerto Rico” to learn more about the possible sanctions that you might experience if caught in an act of academic dishonesty.
List of Topics
The following is a list of the course topics in the order in which they will be presented. This list is subject to change and it will vary depending on the pace of the lectures. More details will be given during the first weeks of the semester. These shall include specifics about sections in the textbook, suggested exercises, the expected agenda, and content of each exam.

Outline of Topics to be Covered:

Part 1 - General Overview

Topic 1. Introduction
Topic 2. Operating-System Structures

Part 2 - Process Management

Topic 3. Processes
Topic 4. Threads
Topic 5. CPU Scheduling
Topic 6. Process Synchronization
Topic 7. Deadlocks

Part 3 - Memory Management

Topic 8. Main Memory
Topic 9. Virtual Memory

Part 4 - Storage Management

Topic 10. File-System Interface
Topic 11. File-System Implementation
Topic 12. Mass-Storage Structure
Topic 13. I/O Systems

Part 5 - Protection and Security

Topic 14. Protection
Topic 15. Security

This syllabus is a guide for the instruction of the course during this semester, it is subject to changes that will be notified by the instructor in regular class hours or by other means. Changes should be available online at the course website in UPRM Portal Colegial.