IT 342 Operating Systems Fundamentals
Fall 2014 Syllabus

Tuesday 7:20 to 10:00 Bull Run Hall Room 258

James F. Holdener, P.E.
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Email: jholdene@gmu.edu
Email is the best method to get hold of me. Put IT342 in the subject line to alert me.
Office Hours: By Appointment Occoquan Room 228, phone, or online

Teaching Assistant: We had one and now we don’t – am working to get another. Will post contact and office hours once it’s been announced.

Prerequisites: To be eligible to take IT342, students must have already completed, earning at least a grade of C in each, these courses

- IT 101 Introduction to Information Technology
- IT 106 Introduction to IT Problem Solving using Computer Programming (or CS 112)
- IT 212 Computer Hardware Fundamentals

If you do not understand the material from these courses, you will have problems in this class.

Catalog Description: Fall 2014: Practices and procedures for installing and configuring modern operating systems, including user accounts, file, print, and terminal servers, mobile computing, and disaster recovery. Through practical lab sessions, students receive real-world experiences with multiple operating systems

Prior: Fundamentals of modern operating system design and issues. The relationship of Operating Systems to the core business including user accounts, file, print, and terminal servers, mobile computing, and disaster recovery. Practical lab sessions with multiple operating systems.

Grading: The final grade for this course is computed from:

1. 10% Homework (Go/No Go)
2. 10% In class Quiz (Toss lowest two)
3. 10% Laboratories
4. 10% Current Event Presentation
5. 20% Paper
6. 20% Midterm Examination
7. 20% Final Examination

- >96% A+
- >93 to 96 A
- >90 to 93 A-
- >88 to 90 B+
- >83 to 88 B
- >80 to 83 B-
- >78 to 80 C+
- >73 to 78 C
- >70 to 73 C-
- >60 to 70 D
- 60 and below F

Final Examination
December 16, 2014
7:30 – 10:15

Class Format
Admin 10 minutes
Lecture 60 minutes (7:30-8:30)
Quiz 10 minutes (8:30 – 8:40)
Break (8:40 – 8:45)
Lecture 60 minutes (8:45 – 9:45)
Questions 15 minutes (9:45 – 10:00)


Supplementary Material may be found at: http://williamstallings.com/OperatingSystems/

Optional Texts: Are listed on blackboard. You will need access to material on Linux and how to work with its structure.
Course Policies:

You are expected to attend every class. **If you miss a class, you will miss important material.** Classes will be lecture, small group discussions, and student presentations of material. It is **your** responsibility to find out what happened in the class and obtain the information. I will respond to questions about the material but **NOT** about what was presented. It is your responsibility to find out what was covered. I recommend having one or more buddies in the class to share what was presented. **Homework and/or reading assignments can be expected for most classes.** Remember to put your name on your work. I encourage you to use the method of study you find best for yourself. I have found that active reading\(^1\), outlining, and taking notes **by hand** continue to help me in my studies. **You should take a lot of notes.** This is because you are intelligent, capable and I will lecture extensively outside the text. **The syllabus is a guide for the lectures and topics discussion.** We may drift from it in a given week. You are in an upper level class and this means, you will take a lot of notes. **Discussion and participation can also enhance your overall understanding of the material (and as a side effect, your grade).** The discussions are meant to be informative and helpful. It is not meant to be degrading or condescending. **You must come to class prepared to participate in discussion of the lecture material and any handouts.** Missed exams must be arranged with the instructor **before** the exam date. **Assignments (of any type) presented late will receive a 50% penalty.** Assignments will not be accepted more than 1 week late.

While students are encouraged to discuss solutions to problems, **students must submit their own, original, work.** All students are expected to abide by the **George Mason University Honor System and Code** (http://mason.gmu.edu/~montecin/plagiarism.htm) (which contains a definition of plagiarism, amongst other things). Further related information is available from **IEEE** (http://www.ieee.org/portal/pages/iportals/aboutus/ethics/code.html) and **ACM** (http://www.acm.org/about/code-of-ethics). I reserve the right to submit student work for automated testing against other submitted work to confirm a submission’s originality.

I am very straightforward about how I deal with plagiarists. **NO MERCY.** I will fail you. I will ask for your expulsion. Do not find yourself in this situation.

**No student who fails the midterm or final exam will receive a grade higher than C.** Assignments (of any type) presented late will receive a 50% penalty. Assignments will not be accepted more than 1 week late.

I will be accepting work via Blackboard and in class this term depending on the assignment. **Read the assignments carefully to understand how to submit them.** Please be sure to put your name on the assignment even if submitted electronically. **No name = no credit.** For file names use the convention Last Name, First Name, Assignment – example is HoldenerJamesHW1. Spaces, dashes, and underscores are optional. If a particular assignment cannot be turned in via blackboard because of its format please contact me.

**CELL PHONES, SMART PHONES, BLACKBERRIES, etc.** Please turn off your communication devices during class. If it goes off, I will take it. You can have it after class. If you are an emergency responder or you have a possibly critical situation, please let me know.

If you text or even so much as look at your cell phone, email, text, etc. during an exam or a quiz, you will be asked to turn in your work in and it will not be graded. I prefer **NOT** to have laptops in the classroom except during lab or project time. They are a distraction rather than an aid in this sort of learning environment. If this is an issue with you then come speak with me.

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\(^1\) See Mortimer Adler and Charles Van Doren’s *How to Read a Book*
Campus Services:
A number of services are available to students, and you are encouraged to make use of them as you may need:

Writing Center
A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu

Office of Disability Services:
If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu and be arranged before any accommodation is needed.

Counseling and Psychological Services (CAPS):
(703) 993-2380; http://caps.gmu.edu
University Policy: The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/. All members of the university community are responsible for knowing and following established policies.

Religious Holidays and Sports
There are a large number of religious holidays that the university recognizes and many more that they may not be familiar with. Some of you may have obligations to one or more of Mason’s sports teams or to an employer as well. I will try to accommodate reasonable requests for conflicts of these types. It is your responsibility to bring it to my attention and to help craft a solution to the conflict.

Course Objective:
The purpose of IT 342 is to give students an understanding of the central concepts that make contemporary operating systems work. Knowing the how and why behind OS will allow you to plan a better fit for system management and overall resource or project management. It is not the intent of the course to provide details on what particular commands are used in a given OS to perform a particular function; rather, given an understanding of the OS functions, you can always look up the needed command. The course presents these underlying OS concepts, and illustrates many of them in class using a popular proprietary OS (Microsoft Windows) and a popular open source OS (Linux).
By taking this course, students will:
• Understand the role of Operating Systems to the end business
• Be able to access Operating system choices in a given environment
• Be able to discuss OS concepts and determine issues related to the proposed environment
• Be able to think critically about the OS trade offs

NOTE:
An average student should expect to spend about 10 hours each week on this class. In class you will spend 3 ½ hours. The remaining time will be outside of class. Budget your time accordingly to complete the reading, outline the chapter (recommended), complete the questions and homework and just to spend time each week reviewing.
## Schedule:

<table>
<thead>
<tr>
<th>Class</th>
<th>Date</th>
<th>In Class</th>
<th>Reading</th>
<th>Assignments Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/26</td>
<td>Course Introduction</td>
<td>Chapter 1</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Computer System Overview</td>
<td></td>
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<tr>
<td>2</td>
<td>9/2</td>
<td>Operating System Overview</td>
<td>Chapter 2</td>
<td>Review Baseline Exam</td>
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<td>Email Trouble Areas to Instructor</td>
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<td>Decide on date for Presentation</td>
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<td></td>
<td>Familiarize yourself with text</td>
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<tr>
<td>3</td>
<td>9/9</td>
<td>Processes</td>
<td>Chapter 3</td>
<td>HW1</td>
</tr>
<tr>
<td>4</td>
<td>9/16</td>
<td>Threads</td>
<td>Chapter 4</td>
<td>HW2</td>
</tr>
<tr>
<td>5</td>
<td>9/23</td>
<td>Concurrency</td>
<td>Chapter 5</td>
<td>HW3</td>
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<td></td>
<td></td>
<td>Concurrency</td>
<td>Chapter 6</td>
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<td>6</td>
<td>9/26</td>
<td>Drop Date</td>
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<td>7</td>
<td>9/30</td>
<td>Memory Management</td>
<td>Chapter 7</td>
<td>HW4</td>
</tr>
<tr>
<td>8</td>
<td>10/7</td>
<td>Virtual Memory</td>
<td>Chapter 8</td>
<td>HW5</td>
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<td></td>
<td>10/14</td>
<td>Columbus Day Break</td>
<td></td>
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<tr>
<td>9</td>
<td>10/21</td>
<td>Midterm</td>
<td></td>
<td>HW6</td>
</tr>
<tr>
<td>10</td>
<td>10/28</td>
<td>Uniprocessor Scheduling</td>
<td>Chapter 9</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11/4</td>
<td>Multiprocessor and Real-Time</td>
<td>Chapter 10</td>
<td>HW7</td>
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<tr>
<td></td>
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<td>Scheduling</td>
<td></td>
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<tr>
<td>12</td>
<td>11/11</td>
<td>I/O Management and Disk</td>
<td>Chapter 11</td>
<td>HW8</td>
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<tr>
<td></td>
<td></td>
<td>Scheduling</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>File Management</td>
<td>Chapter 12</td>
<td></td>
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<tr>
<td>13</td>
<td>11/18</td>
<td>Embedded OS</td>
<td>Chapter 13</td>
<td>HW9</td>
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<tr>
<td>14</td>
<td>11/25</td>
<td>Multimedia Systems</td>
<td>To be provided</td>
<td>HW10</td>
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<td>Computer Security</td>
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<td>Skim Chapters 14 &amp; 15</td>
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<tr>
<td>15</td>
<td>12/2</td>
<td>Distributed Processing</td>
<td>Chapter 16</td>
<td>HW11</td>
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<tr>
<td>16</td>
<td>12/9</td>
<td>Reading Period</td>
<td></td>
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<tr>
<td>17</td>
<td>12/16</td>
<td>Final Exam</td>
<td></td>
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</tbody>
</table>

\(^2\) Currently from Seventh Edition
Suggested Linux Books


Gerard Beekmans, Linux From Scratch (LFS) 7.1, 2012

Matthias Kalle Dalheimer and Matt Welsh, *Running Linux*,
Homework:
There are a total of 11 homework assignments this semester with one due roughly each week.

These will be graded as completed or not completed. A late assignment will be given ½ credit per our syllabus. I will not grade the work but only look that you completed it.

The solutions for the homework will be posted on blackboard. These have been provided by our text’s author with the stipulation we do not disseminate it past our class. Please abide by his wishes despite much of the material has already been posted to the web.

The questions refer to the text. I may post other questions below for your use or to turn it. A blank here means I haven’t decided yet. The blank will change one week before the due date to a No or a Yes. The extra problems are below the table with the submission tab. You should work as many questions as you feel you have time for. The more you work the more you will learn. There are some questions I consider out of scope for our class and have done you the service of listing them here.

These currently refer to the Seventh Edition. Please refer to my discussion in class.

For Q&A you must complete one question and its answer each week. The questions should come from material found in the chapter or from the lecture given the prior week. The table below shows the chapters for each assignment.

Over the course of the term you must have at least 2 essay and 2 calculation questions. The answer should take about ½ page.

The remaining questions may be essay, calculation, short answer (about a sentence to answer), fill in the blank, matching, or distractor type questions.

The questions must be machine readable. The answers may be completed by hand the scanned and provided separately for each question. The answers may be machine readable.

<table>
<thead>
<tr>
<th>Home Work</th>
<th>Review Questions</th>
<th>Problems</th>
<th>Q&amp;A</th>
<th>Extras?</th>
<th>Out of Scope (Problems)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.1, 1.3, 1.8</td>
<td>1.1, 1.3</td>
<td>Chapter 2</td>
<td>No</td>
<td>None</td>
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<td>2.1, 2.5, 2.7</td>
<td>2.1, 2.6</td>
<td>Chapter 3</td>
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<td>3</td>
<td>3.2, 3.12, 4.4, 4.5</td>
<td>3.2, 4.5</td>
<td>Chapter 4</td>
<td>Yes</td>
<td>4.7, 4.8, 4.9, 4.10, 4.11</td>
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<td>4</td>
<td>5.1, 5.3, 5.7, 6.2, 6.7</td>
<td>5.5, 6.2</td>
<td>Chapter 5 &amp; 6</td>
<td></td>
<td>5.2, 5.3, 5.4, 5.6, 5.7, 5.8, 5.9, 5.10, 5.12, 5.13, 5.14, 5.15, 5.16, 5.17, 5.20, 5.21, 5.22, 5.24, 5.25, 6.9, 6.10, 6.21, 6.22</td>
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<td>5</td>
<td>7.6, 7.8, 8.2, 8.3</td>
<td>7.6, 8.1, 8.4</td>
<td>Chapter 7</td>
<td>Yes</td>
<td>8.16, 8.17,</td>
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</tbody>
</table>
HW 3 Extra:
Consider a system that has two CPUs and each CPU has two threads (hyperthreading). Suppose three programs, P0, P1, and P2, are started with run times of 5, 10, and 20 msecs, respectively. How long will it take to complete the execution of these programs? Assume that all three programs are 100% CPU bound, do not block during execution, and do not change CPUs once assigned.

**HW5 Extra**
A. Consider a computer system that has cache memory, main memory (RAM) and disk, and the operating system uses virtual memory. It takes 2 nsec to access a word from the cache, 10 nsec to access a word from the RAM, and 10 msec to access a word from the disk. If the cache hit rate is 95% and main memory hit rate (after a cache miss) is 99%, what is the average time to access a word?

B. A swapping system eliminates holes by compaction. Assuming a random distribution of many holes and many data segments and a time to read or write a 32-bit memory word of 10 nsec, about how long does it take to compact 128MB? For simplicity, assume that word 0 is part of a hole and that the highest word in memory contains valid data. Why are these assumptions germane to this problem?

C. How long does it take to load a 64-KB program from a disk whose average seek time is 10 msec, whose rotation time is 10 msec, and whose tracks hold 32 KB
(a) for a 2-KB page size?
(b) for a 4-KB page size?

**Quizzes**
There will be a short quiz each week in class. I will throw out the lowest two scores.

**Labs:**
There will be a few opportunities for labs to enhance the understanding. More on this later.

**Current Event**
You will need to spend some time looking at trade rags. In each class following the midterm, each of you will make a presentation to the class on what you have learned (10-15 minutes). I will pass examples of typical articles. In the first half of the semester you should read enough to collect about 6 articles. If you can find six that following a thread that would make this assignment easier but is not required. You will need to make a case for how the article relates to operating systems. I will grade primarily your written work here. You should summarize what you read, how it relates to IT and specifically Operating Systems, and how you might be able to use the articles. Be sure to reference the material and justify your position. All references are to be annotated and evaluated. This means you
need to provide a sentence of what the article is about and your evaluation of its truth or believability in your bibliographic reference.

**Paper**
You will write a research paper on a topic of your choice and approved by me. Here are some example topic areas.

- Linux Optimization
- Embedded OS
- Main Frame OS
- Semi-Smart Desktop Environment

I will post a paper fully describing the last one of these.