

**Fayetteville State University**  
**College of Arts and Sciences**  
**Department of Mathematics and Computer Science**  
**CSC 431 - 01: Operating Systems I**  
**Fall 2011**

**I. Locator Information:**

Instructor: Sambit Bhattacharya

Course # and Name: CSC 431, Section 01  
Operating Systems I

Semester Credit Hours: 3.00

Day and Time Class Meets: 10:00-10:50 am

Class Location: SBE 211

Total Contact Hours for Class: 46

Office Location: SBE 310

Office hours: MF:- 11:00 am-1:00 pm,

MW:- 2:00 pm -4:00 pm

Office Phone: 910 672 1156

Email address: sbhattac@uncfsu.edu

**FSU Policy on Electronic Mail:** Fayetteville State University provides to each student, free of charge, an electronic mail account ([username@uncfsu.edu](mailto:username@uncfsu.edu)) that is easily accessible via the Internet. The university has established FSU email as the primary mode of correspondence between university officials and enrolled students. Inquiries and requests from students pertaining to academic records, grades, bills, financial aid, and other matters of a confidential nature must be submitted via FSU email. Inquiries or requests from personal email accounts are not assured a response. The university maintains open-use computer laboratories throughout the campus that can be used to access electronic mail.

Rules and regulations governing the use of FSU email may be found at  
<http://www.uncfsu.edu/PDFs/EmailPolicyFinal.pdf>

**II. Course Description:** This course is designed to develop an understanding of the organization and architecture of computer systems at the register-transfer and programming levels of system description. Major concept areas of operating systems principles and the inter-relationships between the operating systems and the architecture of computer systems are taught. Topics include system structure, process concept, CPU scheduling, process synchronization, deadlocks, and memory management. *Prerequisites: CSC 201 and CSC 220.*

**III. Disabled Student Services:** In accordance with Section 504 of the 1973 Rehabilitation Act and the Americans with Disabilities Act (ACA) of 1990, if you have a disability or think you have a disability to please contact the Center for Personal Development in the Spaulding Building, Room 155 (1<sup>st</sup> Floor); 910-672-1203.

**IV. Textbook and other materials:**

1. Required textbook: *Operating System Concepts* by A. Silberschatz, P.B. Galvin, G. Gagne. Publisher: John Wiley & Sons Inc., 8th Edition, ISBN: 978-0-470-12872-5.
2. Free 2<sup>nd</sup> textbook: *The Little Book of Semaphores* by Allen B. Downey. Publisher: Green Tea Press. Available free as online PDF file from <http://www.greenteapress.com/semaphores/>
3. The GCC compilers for the C/C++ languages. They are available on our Linux server fsulinux1.uncfsu.edu (into which you can remote SSH login)
4. Software: These program development environments are available on our Linux server fsulinux1.uncfsu.edu (into which you can remote SSH login) but they can also be installed on a home computer:
  - a. JDK (Java Development Kit) version 5 or 6. Available from <http://java.sun.com/javase/downloads/index.jsp>
  - b. Python available from <http://www.python.org/>

**V. Student Learning Outcomes –**

Upon completion of this course, students will be able to:

1. analyze the tradeoffs inherent in operating system design, evaluate the tradeoffs in terms of memory size (main memory, cache memory, auxiliary memory) and processor speed
2. analyze the various memory portioning techniques including overlays, swapping, and placement and replacement policies

3. explain the different states that a task may pass through
4. discuss data structures needed to support the management of multiple tasks
5. discuss the utility of data structures, such as stacks and queues, in managing concurrency
6. explain conditions that lead to deadlock
7. apply the performance metrics used to determine how a system performs
8. compare and contrast the common algorithms used for both preemptive and non preemptive scheduling of tasks in operating systems, such as priority, performance comparison, and fair share schemes
9. describe how computing resources are used by application software and managed by system software
10. contrast kernel and user mode in an operating system
11. describe reasons for using interrupts, dispatching, and context switching to support concurrency in an operating system
12. differentiate the mechanisms used in interfacing a range of devices to a computer and explain the implications of these for the design of an operating system
13. describe the advantages and disadvantages of direct memory access and discuss the circumstances in which its use is warranted
14. summarize how hardware developments have lead to changes in our priorities for the design and the management of file systems

## VI. Course Requirements and Evaluation Criteria -

### a. Grading Scale -

Grade	Total point range	Credit Hours	Quality Points	Meaning
A	90% – 100%	Hours attempted and earned	4 per credit hour;	Exceptionally high
B	80% – 89.99%	Hours attempted and earned	3 per credit hour	Good
C	65% – 79.99%	Hours attempted and earned	2 per credit hour	Satisfactory
D	55% – 64.99%	Hours attempted and earned	1 per credit hour	Marginally passing
F	below 55%	Hours attempted – Not earned	0 per credit hour	Failing
FN		Hours attempted – Not earned	0 per credit hour	Failing due to non-attendance. (Student registered, but <u>never</u> attended.)
W		Hours attempted – Not earned	No impact on GPA	Class withdrawal prior to deadline (see Academic Calendar)
P		Hours attempted and earned	No impact on GPA	Satisfactory - Assigned only in classes specified as Pass/Fail
WU		Hours attempted – Not earned	No impact on GPA	Withdrawal from all classes for semester or term
AU		Hours attempted – Not earned	No impact on GPA	Auditing

- b. Attendance Requirements – **Note: the following requirements are for regular face to face classes and while they do not apply directly to an online course such as this one, students are required to follow them in spirit; lack of participation in discussion boards, late submission of projects etc. will be equivalent to classroom absence in our online course.** Students are expected to attend all class meetings, laboratories, and other instructional sessions for this course. Students are also expected to arrive to class on time and remain in class for the entire scheduled period. When students must miss class(es) for unavoidable reasons, i.e., illness, family emergencies, or participation in official university sponsored activities – they are responsible for informing faculty of the reasons for the absences, in advance if possible. Missed assignments, labs, quizzes and exams can only be made up for by explicit permission from the instructor. In order to receive this permission the student has to provide convincing evidence (e.g. doctor’s note) that the absence was due to an unavoidable reason. During the first half of the semester/term, faculty will assign an interim grade of “EA,” Excessive Absences, for students whose class absences exceed 10% of the total contact hours for the class. Students who receive EA interim grades must either withdraw from the class or resume attendance. Students who resume attendance must consult with the instructor about completion of missed

assignments. The EA is not a final grade, so students who are assigned an interim grade of EA, but do not withdraw from the class, will receive a final grade based on the evaluation criteria for the class. **Note: in case FSU must close for an emergency during the semester, instruction will continue using Blackboard.**

- c. Graded Assignments and Value of Each Assignment -
  - i. Two tests worth 10% each for a total of 20%
  - ii. Final test worth 30%
  - iii. 4 projects worth 10% each for a total of 40%
  - iv. Quizzes, class participation and discussion boards (total of 10%):

**Discussion Board Grading Policy:**

The Discussion Board will allow each student the opportunity to interact with other students in the course and offer their insights on a variety of topics that relate to the lecture material. Each student can receive a maximum of 16 points for participation in the discussion board. There will be 10 discussion boards including the FAQ during the semester. So a maximum of 160 points (which will be normalized to 10) can be earned in the Course Participation through Discussion Boards category. Each topic will be posted on Monday and discussed for three days. The asynchronous Discussion Board will close on Friday of every week. Transcripts of the discussion board will be reviewed by the professor to assess the level of participation by each student. Failure to participate during Discussion Board in the designated time [Monday – Friday] will result in a grade of zero (0) for the week. Refer to Grading Rubric for Discussion Postings below to determine the point breakdown and student expectations regarding the Discussion Board. Discussion Board topics will be announced and their discussion boards will be added by the instructor as the semester progresses.

**VII. Grading Rubric for Discussion Postings**

	<b>4 (Excellent)</b>	<b>3 (Good)</b>	<b>2 (Fair)</b>	<b>1 (Poor)</b>
<b>Contribution to the Classroom</b>	Posting is insightful, thorough, and interesting.	Posting is thorough and interesting.	Posting is interesting but lacks insight and depth.	Posting is uninteresting and/or too brief for the assignment.
<b>Inspires Reply Postings from Other Students</b>	A serious effort is made to frame the discussion posting in such a way as to encourage others to reply. Posting generates questions and opens up new avenues for discussion.	A serious effort is made to frame the discussion posting in such a way as to encourage others to reply.	Some effort is made to frame the discussion posting in such a way as to encourage others to reply.	No effort is made to frame the discussion posting in such a way as to encourage others to reply.
<b>Demonstrated Understanding of the Reading Assignment</b>	Posting demonstrates a thorough understanding of the reading assignment and is substantiated by several examples from the textbook and/or companion website.	Posting demonstrates an understanding of the reading assignment and is substantiated by at least one example from the textbook and/or companion website.	Posting demonstrates an understanding of the reading assignment but is not substantiated by examples from the textbook and/or companion website.	Posting demonstrates very little understanding of the reading assignment.

<b>Grammar, Mechanics, Spelling, and Sentence Structure</b>	Posting is highly polished; no grammar or spelling errors.	Posting is polished; maximum of one grammar or spelling error.	Posting is adequate; maximum of two grammar or spelling errors.	Inadequate posting; more than two spelling or grammar errors.
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- a. Policy on Missed or Late Assignments - tests and quizzes missed due to an unavoidable reason can be made up only with the instructor's permission. In order to receive this permission the student has to provide convincing evidence (e.g. doctor's note) that the absence was due to an unavoidable reason. There is a penalty of 5% for each day a project is overdue. Project submissions that are more than a week overdue will not be accepted for grading.
- b. Policy on email format –
  - i. Course name CSC431 must be written in the subject box:
  - ii. Include your first and last names after your email message
  - iii. Email that does not follow the communication policy and procedure will not receive a response.
  - iv. Email without the course name CSC431 in the subject box will not be opened.
  - v. Email without a first and last name will not receive a response.
- c. Communication policy –
  - i. Post your question to the Frequently Asked Questions (FAQ) forum in the Discussion Board in Blackboard
  - ii. Each student is expected to check and respond to the FAQ's in between class sessions. If you have not received an answer at this point, email your instructor (be sure to follow the email policy below)
  - iii. Discussion boards pertaining to particular topics will be added by the instructor as the semester progresses. The instructor will notify students of such additions and student participation is also required in those additional discussion boards.
  - iv. The purpose of this procedure is to work and learn together.
  - v. Discussion boards will be used as communication vehicles as well as course requirements. The purposes of the discussion boards are: to ask and answer each other's questions about course information, technical issues and course material such as lecture and textbook contents.
  - vi. Participation in discussion boards counts towards a significant part of your grade. Refer to "Method of Evaluation" below for more details.
- d. Assignment policy –
  - i. Assignments are posted in Blackboard under "Assignments" and must be submitted on or before the due date. On-line assignments for each week must be submitted by Sunday at 5:00 p.m. EST unless otherwise stated. There are no exceptions for this deadline.
  - ii. All assignments must be submitted online via the View/Complete link found in each assignment.
  - iii. Assignments submitted online via the View/Complete link must be turned in as a file attachment.
  - iv. Do not email assignments to your instructor.
  - v. Do not submit assignments to the Digital Drop Box.
  - vi. Assignments submitted via email to the instructor or the digital drop box will not be accepted.

Five percent (5%) of the total points will be deducted from each school day a programming assignment is overdue.
- e. Dishonesty in academic affairs – Acts of dishonesty in any work constitute academic misconduct. Such acts include cheating, plagiarism, misrepresentation, fabrication of information, and abetting any of the above. Plagiarism in particular presents pitfalls to be avoided: failure to document any words, ideas, or other contributions that do not originate with the author constitutes plagiarism. Widespread use of the World Wide Web (Internet) requires particular attention to proper documentation practices. Individual course syllabi offer additional clarification about requirements for proper documentation. Actions outlined in the Fayetteville State University Student Handbook under Disciplinary System and Procedures will be followed for incidents of academic misconduct. The handbook may be obtained from the Office of Student Affairs located in the

Collins Administration Building. Non-disclosure or misrepresentation on applications and other university records will make students liable for disciplinary action, including possible expulsion from the university.

**Please note: If these evaluation criteria must be revised because of extraordinary circumstances, the instructor will distribute a written amendment to the syllabus.**

### **FSU Policy on Disruptive Behavior in the Classroom**

The *Code of the University of North Carolina* (of which FSU is a constituent institution) and the *FSU Code of Student Conduct* affirm that all students have the right to receive instruction without interference from other students who disrupt classes.

FSU Core Curriculum Learning Outcome under Ethics and Civic Engagement (6.03): All students will “prepare themselves for responsible citizenship by fulfilling roles and responsibilities associated with membership in various organizations.” Each classroom is a mini-community. Students learn and demonstrate responsible citizenship by abiding by the rules of classroom behavior and respecting the rights all members of the class.

The FSU Policy on Disruptive Behavior (see FSU website for complete policy) identifies the following behaviors as disruptive:

1. Failure to respect the rights of other students to express their viewpoints by behaviors such as repeatedly interrupting others while they speak, using profanity and/or disrespectful names or labels for others, ridiculing others for their viewpoints, and other similar behaviors;
2. Excessive talking to other students while the faculty member or other students are presenting information or expressing their viewpoints.
3. Use of cell phones and other electronic devices
4. Overt inattentiveness (sleeping, reading newspapers)
5. Eating in class (except as permitted by the faculty member)
6. Threats or statements that jeopardize the safety of the student and others
7. Failure to follow reasonable requests of faculty members
8. Entering class late or leaving class early on regular basis
9. Others as specified by the instructor.

The instructor may take the following actions in response to disruptive behavior. Students should recognize that refusing to comply with reasonable requests from the faculty member is another incidence of disruptive behavior.

1. Direct student to cease disruptive behavior.
2. Direct student to change seating locations.
3. Require student to have individual conference with faculty member. At his meeting the faculty member will explain the consequences of continued disruptive behavior.
4. Dismiss class for the remainder of the period. (Must be reported to department chair.)
5. Lower the student’s final exam by a maximum of one-letter grade.
6. File a complaint with the Dean of Students for more severe disciplinary action.

Students who believe the faculty member has unfairly applied the policy to them may make an appeal with the faculty member’s department chair.

**VII. Academic Support Resources** – This course uses FSU Blackboard for online dissemination. Students will find most materials online within the Blackboard module for this course. Project submissions and most tests will be implemented through Blackboard so students are required to check the Blackboard course website and their email at least once a day.

**VIII. Course Outline and Assignment Schedule -**

WEEK	LECTURE TOPICS & ACTIVITIES
FIRST DATES: 08/18 – 08/19	COURSE ORIENTATION CHAPTER 1
SECOND DATES: 08/22 – 08/26	CHAPTERS 2 & 3
THIRD DATES: 08/29 - 09/02	CHAPTERS 3 & 4
FOURTH DATES: 09/05 - 09/09	CHAPTER 5 Labor day, 09/05
FIFTH DATES: 09/12 - 09/16	CHAPTER 6
SIXTH DATES: 09/19 - 09/23	CHAPTER 7
SEVENTH DATES: 09/26 - 09/30	CHAPTER 7
EIGHTTH DATES: 10/03 - 10/07	CHAPTER 8 Midterm tests 10/06 – 10/12
NINTH DATES: 10/10 - 10/14	Midterm tests 10/06 – 10/12
TENTH DATES: 10/17 - 10/21	CHAPTER 9 Midterm break, 10/17 & 10/18
ELEVENTH DATES: 10/24 - 10/28	CHAPTER 10
TWELFTH DATES: 10/31 - 11/04	CHAPTER 11
THIRTEENTH DATES: 11/07 – 11/11	CHAPTER 12 Veteran’s day, 11/11
FOURTEENTH DATES: 11/14 – 11/18	CHAPTER 13
FIFTEENTH DATES: 11/21 – 11/25	EXTRA TOPICS Thanksgiving break, 11/24 & 11/25
SIXTEENTH DATES: 11/28 – 12/02	REVIEW
<p align="center"><b>FINAL EXAM FOR THIS CLASS IS FRIDAY 12/09, 10 AM</b>            Final exam for graduating seniors 11/28 – 12/03            Last day of classes is 12/02            Final exam for seniors (not graduating) 12/03 – 12/09</p>	

**IX. Teaching Strategies** – The primary teaching strategies for this course will be lectures and discussion. You are strongly encouraged to participate in any discussion. Programs in Java and Python will be used to demonstrate how operating systems are built. In addition to solving tests and homework problems students will complete short programming projects in this course.

**X. Bibliography** -

1. Linux Kernel Development, R. Love, Novell Press, 2<sup>nd</sup> edition, 2005, ISBN 0672327201.
2. Computer Systems: A Programmer's Perspective (CS:APP), R.E. Bryant, D.R. O'Hallaron, Prentice Hall, 2003, ISBN 013034074X.
3. Website for Computer Systems (above) text: <http://csapp.cs.cmu.edu/>
4. The Linux documentation project (free): <http://www.tldp.org/LDP/lkmpg/>
5. Operating systems resources: <http://www.nondot.org/sabre/os/articles>
6. More resources: [http://www.cl.cam.ac.uk/users/maw48/os\\_stuff/](http://www.cl.cam.ac.uk/users/maw48/os_stuff/)
7. Programming from the Ground Up (freely available online textbook):  
<http://download.savannah.gnu.org/releases/pgubook/ProgrammingGroundUp-1-0-booksize.pdf>
8. Operating Systems, Harvey M. Deitel, Paul J. Deitel, and David R. Choffnes, 3rd ed. Prentice Hall, 2004. ISBN: 0-13-182827-4.
9. Operating Systems: Internals and Design Principles, William Stallings, 5th ed. Upper Saddle River, NJ: Prentice Hall, 2005. ISBN 0-13-147954-7.
10. Modern Operating Systems, Andrew S. Tanenbaum, 2nd ed. Upper Saddle River, NJ: Prentice Hall, 2001, ISBN 0-13-031358-0.
11. Understanding Operating Systems, 3<sup>rd</sup> edition, Ida M. Flynn and Ann McIver-McHoes, Course Technology, 2000, ISBN: 0534376665
12. Operating Systems, 3<sup>rd</sup> edition, Gary Nutt, Addison Wesley, 2003, ISBN: 0201773449.
13. Guide to Operating Systems, 3<sup>rd</sup> edition, Michael Palmer and Michael Walters, Course Technology, 2004, ISBN: 0619213477.
14. Advanced Concepts In Operating Systems, Mukesh Singhal and Niranjana Shivaratri, McGraw-Hill Science/Engineering/Math, 1994, ISBN: 007057572X.
15. Distributed Systems: Concepts and Design, 3<sup>rd</sup> edition, George Coulouris, Jean Dollimore and Tim Kindberg, Addison Wesley, 2000, ISBN: 0201619180
16. Distributed Systems: Principles and Paradigms, Andrew S. Tanenbaum and Maarten van Steen, Prentice Hall, 2002, ISBN: 0130888931.
17. Distributed Algorithms (The Morgan Kaufmann Series in Data Management Systems), Nancy A. Lynch, Morgan Kaufmann, 1997, ISBN: 1558603484.
18. Guide to Parallel Operating Systems with Microsoft Windows XP and Linux, Ron Carswell, Heidi Webb and Terrill Freese, Course Technology, 2006, ISBN: 1418837253.
19. The Design and Implementation of the FreeBSD Operating System, Marshall Kirk McKusick and George V. Neville-Neil, Addison-Wesley Professional, 2004, ISBN: 0201702452.
20. Communications in Linux: The Nooks and Crannies, John Gray, Prentice Hall, 2003, ISBN: 0130460427.
21. Operating Systems Fundamentals, D. Irtegov, Charles River Media, 2002, ISBN: 1-58450-274-6.
22. Beginning Linux Programming, 3rd Edition, Neil Matthew, Richard Stones and Alan Cox, Wrox Press, 2004, ISBN: 0-7645-4497-7.
23. Linux Programming by Example: The Fundamentals (Paperback), Arnold Robbins, Prentice Hall PTR, 2004, ISBN: 0131429647.
24. GNU/Linux Application Programming, M. Tim Jones, Charles River Media, 2005, ISBN: 1584503718.
25. Linux Application Development, 2nd Edition, Michael K. Johnson and Erik W. Troan, Addison-Wesley Professional, 2004, ISBN: 0321219147.
26. 2Linux Device Drivers, 3rd Edition, Jonathan Corbet, Alessandro Rubini and Greg Kroah-Hartman, O'Reilly Media, 2005, ISBN: 0596005903.
27. Understanding the Linux Kernel, Daniel Pierre Bovet and Marco Cesati, O'Reilly Media, 2005, ISBN: 0596005652.
28. Design of the UNIX Operating System (Prentice Hall Software Series), Maurice J. Bach, Prentice Hall PTR, 1986, ISBN: 0132017997.