# **ECE 309/498 Course Syllabus**

## **Data Structures and Object-Oriented Programming for Electrical and Computer Engineers**

**Section 001**

**Fall 2019**

**3 Credit Hours**

### **Course Description**

Advanced programming topics focusing on Data Structures and Object-oriented design. Common data structures described and implemented, including linked lists, hash tables, trees, balanced trees, heaps, graphs, and B-trees. Object-oriented programming, inheritance, polymorphism, abstract types, and generic types.

### **Learning Outcomes**

* Design and implement data structures and other programs using object-oriented methods.
* Explain the concepts of inheritance and polymorphism, describe a scenario in which they are useful, and interpret the execution of code that uses them.
* Describe common data structures, what they mean, and examples of how they are used in programs. Such data structures include including linked lists, trees, heaps, graphs, and hash tables.
* Describe common algorithms on linked lists, trees, heaps, and graphs, like insertion, removal, and traversal, and analyze their storage and runtime complexity.
* Describe and implement common algorithms on graphs, including shortest path, topological sort, and minimum spanning tree.

### **Course Structure**

There will be two 75 min lectures per week. Homework assignments provide an opportunity to apply concepts and practice program design skills. There are two mid-term exams. Students are also required to complete in-class assignments in TopHat and online activities in the ZyBook.

ECE 498 students have the same requirements as ECE 309 students.

### **Instructors**

**James Tuck** (jtuck) - *Instructor*

**Email:** jtuck@ncsu.edu

**Web Page:** <http://go.ncsu.edu/tuck>

**Phone:** 919-513-0923

**Office Location:** EB2 3066

**Office Hours:** To be announced.

### **Course Meetings**

#### **Lecture**

**Days:** MW

**Time:** 3:00 pm - 4:15 pm

**Campus:** Centennial

**Location:** EB2 1231

*This meeting is required.*

### **Course Materials**

#### **Textbooks**

**ECE 309: Data Structures Essentials and Object Oriented Programming in C++** - *Roman Lysecky, Frank Vahid*

**Edition:** First Edition

**Web Link:** zyBooks.com

**Cost:** $88

*This textbook is* ***required*** *for all students.*

To access:

1. Sign in or create an account at learn.zybooks.com

2. Enter zyBook code: NCSUECE309TuckFall2019

3. Subscribe

**C++ Primer Plus** - *Stephen Prata*

**Edition:** Sixth Edition

**ISBN:** 978-0-13-278114-5

**Cost:** $25 - New on Amazon

*This textbook is optional.*

#### **Expenses**

None.

#### **Materials**

None.

### **Requisites and Restrictions**

#### **Prerequisites**

A C- or better in ECE 209 or knowledge of the C programming language.

#### **Co-requisites**

None.

#### **Restrictions**

None.

### **General Education Program (GEP) Information**

#### **GEP Category**

This course does not fulfill a General Education Program category.

#### **GEP Co-requisites**

This course does not fulfill a General Education Program co-requisite.

### **Transportation**

This course will not require students to provide their own transportation. Non-scheduled class time for field trips or out-of-class activities is NOT required for this class.

### **Safety & Risk Assumptions**

None.

### **Grading**

#### **Grade Components**

|  |  |  |
| --- | --- | --- |
| **Component** | **Weight** | **Details** |
| **Homework** | 25% | Each week there will be a homework assignment, totaling approximately 12 for the semester. These homeworks will often involve writing a small program and submitting it. Some assignments may build on top of each other. Homeworks may involve committing code to github, which will be downloaded and tested by instructors for correctness. |
| **zyBook Assignments** | 7% | Complete assigned zyBook activities by the deadline. |
| **In-class Assignments** | 3% | Lectures will include assignments that must be completed during class on TopHat.  These are primarily online assignments that require the use of either a laptop, tablet, or smartphone running TopHat software.  You may work with friends sitting next to you.  Each question is graded on the following scale: 70% for participation and 30% for correctness. This scale is meant to encourage participation since you earn most of the points just by answering.  Because technical issues inevitably affect everyone, all students will receive a 5% bonus added to their final TopHat average. (This is roughly equivalent to missing one class.) So, if you earn 96% according to the TopHat website, your grade will be rounded up to 100%. If you earn a 76%, I’ll round it to an 81%.  Please do not request that questions be dropped due to technical difficulties. This is already dealt with by way of the 5% bonus added to everyone’s grade.  In-class assignments missed for excused absences will be dropped from your grade at the end of the semester, in accordance with the excused absences policy. |
| **Exams** | 30% | Two exams worth 15% each. These exams will be held during regular class time and cannot be missed. Attendance is mandatory. If you do miss an exam unexpectedly, for example due to illness, speak with the instructor as soon as possible to determine if it is excused and to schedule a make-up. |
| **Final Exam** | 35% | Comprehensive final exam. |

#### **Letter Grades**

**This Course uses Standard NCSU Letter Grading:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 97 | ≤ | **A+** | ≤ | 100 |
| 93 | ≤ | **A** | < | 97 |
| 90 | ≤ | **A-** | < | 93 |
| 87 | ≤ | **B+** | < | 90 |
| 83 | ≤ | **B** | < | 87 |
| 80 | ≤ | **B-** | < | 83 |
| 77 | ≤ | **C+** | < | 80 |
| 73 | ≤ | **C** | < | 77 |
| 70 | ≤ | **C-** | < | 73 |
| 67 | ≤ | **D+** | < | 70 |
| 63 | ≤ | **D** | < | 67 |
| 60 | ≤ | **D-** | < | 63 |
| 0 | ≤ | **F** | < | 60 |

#### **Requirements for Credit-Only (S/U) Grading**

In order to receive a grade of S, students are required to take all exams and quizzes, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <http://policies.ncsu.edu/regulation/reg-02-20-15>.

#### **Requirements for Auditors (AU)**

Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-20-04>.

#### **Policies on Incomplete Grades**

If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <http://policies.ncsu.edu/regulation/reg-02-50-3>.

#### **Late Assignments**

All assignments are due at the specified date and time on the assignment. Exams may not be submitted late. TopHat and ZyBook do not support late submissions. Therefore, these assignments must be submitted on time to receive points.

Written homework assignments that are submitted electronically to Moodle may be submitted up to 10 hours late with no penalty and with a small penalty assessed per hour after that. The formula is as follows:

Grade = MarkedGrade  \* (1 -  .0125 \* Max(0, Hours Late - 10))

This policy is meant to provide tolerance against common technical problems, like a dead laptop battery, failed hard drive, or a bad internet connection that prevent you from submitting on time. If you have trouble submitting by the deadline, do not email me. All you need to do is make every effort to submit to Moodle as soon as you possibly can early the next day.

### **Attendance Policy**

For complete attendance and excused absence policies, please see <http://policies.ncsu.edu/regulation/reg-02-20-03>

#### **Attendance Policy**

Students are expected to attend class.

#### **Absences Policy**

Absences may be excused at the discretion of the instructor provided they are consistent with university policy and the instructor’s policies.

Request for an excused absence and any extension of assignment due dates that may arise as a result of the absence must be **submitted in writing** to the instructor along with any supporting material (e.g. doctor’s note or letter from a school official). The instructor will evaluate absences on a case-by-case basis and decide whether they are excused. Most decisions will fall in line with the university policy, but the instructor reserves the right to deviate from that policy when necessary.

Frivolous requests will be declined. For example, requests to attend the career fair will not be treated as excused absences, however, the instructor does encourage you to attend the career fair outside of class time.

As a convenience to you, you may submit requests for an excused absence at any time using [an online form](https://forms.gle/wknmk1MaL262fmmU9). Please note, requests to be excused long after the fact for absences other than unexpected medical or family emergencies will most likely be declined.

Preliminary decisions regarding the excused absence will be returned within 24 hours. Please be aware that the preliminary decision may include a request for additional information.

#### **Makeup Work Policy**

If work is missed due to an excused absence, students are expected to make up the work within a reasonable amount of time on their return to health/campus. The instructor will work with the student to identify and set reasonable deadlines.

#### **Additional Excuses Policy**

None.

### **Academic Integrity**

#### **Academic Integrity**

Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at <http://policies.ncsu.edu/policy/pol-11-35-01>

None.

#### **Academic Honesty**

See <http://policies.ncsu.edu/policy/pol-11-35-01> for a detailed explanation of academic honesty.

None.

#### **Honor Pledge**

Your signature on any test or assignment indicates "I have neither given nor received unauthorized aid on this test or assignment."

### **Electronically-Hosted Course Components**

Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

**Electronically-hosted Components:** This course will use ZyBooks, Google Docs, Moodle, Piazza, TopHat, GitHub and Travis-CI.

### **Accommodations for Disabilities**

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Suite 304, University College Commons, Campus Box 7509, 919-515-7653. For more information on NC State’s policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.01) (<https://policies.ncsu.edu/regulation/reg-02-20-01/>).

### **Non-Discrimination Policy**

NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/policy/pol-04-25-05> or [http://www.ncsu.edu/equal\_op/.](http://www.ncsu.edu/equal_op/) Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

## **Course Schedule**

**NOTE:** The course schedule is subject to change.

### **Lecture MW 3:00 pm - 4:15 pm — Lecture — 08/21/2019 - 12/17/2019**

This schedule is tentative. Check the [Google Drive](https://drive.google.com/open?id=1jYDvukmVahJYElvZaO2-FbIozIjZDFAd) shared folder for an up to date detailed calendar.

|  |  |  |  |
| --- | --- | --- | --- |
| **Date** | **No.** | **Lecture Topic** | **Assignment**  **(Due at midnight)** |
| 8/21/2019 | Wed | Introduction to C++ and Object-Oriented Programming, Tools: git, compilers, testing |  |
| 8/26/2019 | Mon | Basics of Classes; Members; Constructors; Destructors; new/delete | Z1 |
| 8/28/2019 | Wed | Linked lists in C and C++; objects as nodes | Z2, HW1 |
| 9/2/2019 | Mon | **Labor Day** |  |
| 9/4/2019 | Wed | Linked list traversal; iterators; insertAfter, removeAfter | Z3 |
| 9/9/2019 | Mon | Doubly linked list |  |
| 9/11/2019 | Wed | Queue and Stack ADT in C++ (Video) | Z4, HW2 |
| 9/16/2019 | Mon | Inheritance, Is-A; Polymorphism; Virtual Functions |  |
| 9/18/2019 | Wed | Abstract Classes; Friend Classes/Functions, Has-A | Z5, HW3 |
| 9/23/2019 | Mon | Namespaces; Generics |  |
| 9/25/2019 | Wed | Hash Table; Chaining | Z6, HW4 |
| 9/30/2019 | Mon | **Exam 1** |  |
| 10/2/2019 | Wed | Hash Functions; | Z7, HW5 |
| 10/7/2019 | Mon | Binary Trees |  |
| 10/9/2019 | Wed | Binary Search Trees; Insert algorithm | Z8, HW6 |
| 10/14/2019 | Mon | BST: Remove algorithm, in-order traversal |  |
| 10/16/2019 | Wed | Heap; | Z9, HW7 |
| 10/21/2019 | Mon | Treap |  |
| 10/23/2019 | Wed | Balanced Trees; AVL, Red-Black Trees | Z10, HW8 |
| 10/28/2019 | Mon | (Cont) Algorithms on balanced Trees |  |
| 10/30/2019 | Wed | Graphs; Representations; Algorithms on graphs | Z11, HW9 |
| 11/4/2019 | Mon | Depth-First Search; Breadth-First Search |  |
| 11/6/2019 | Wed | Directed Graphs, Weighted Graphs; Shortest Path | Z12, HW10 |
| 11/11/2019 | Mon | **Exam 2** |  |
| 11/13/2019 | Wed | Topological sort; Minimal Spanning Tree | Z13, HW11 |
| 11/18/2019 | Mon | B-Tree |  |
| 11/20/2019 | Wed | B-Tree (cont): insert, rotations, fusion,removal | Z14, HW12 |
| 11/25/2019 | Mon | Generic Types in C++ | Z15 |
| 11/27/2019 | Wed | Thanksgiving Holiday |  |
| 12/2/2019 | Mon | Standard Template Library for common data structures |  |
| 12/4/2019 | Wed | **Review** |  |
| 12/13/2019 | Fri | **Final Exam, 1-4 pm (normal class room)** |  |

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