

## Computer Systems

### **CSC 345 Compiler Construction and Design | 94162 | 3**

Prerequisites/Corequisites: CSC 229 Data Structures and Algorithms I with a grade of C or better and CSC 251 Discrete Structures with a grade of C or better.

Meeting Days and Times: M W 10:50am-12:05pm

Type of Instruction (lab, lecture, clinic, internship, practicum, recitation): Lecture/Lab

Fall 2024

### **Dr. Arthur Hoskey**

hoskeya@farmingdale.edu

Whitman Hall Room 211

(934) 420-2435

### **Office Hours:**

Monday 12:05pm - 1:40pm

Tuesday 8:25am - 9:25am

Wednesday 12:05pm - 1:40pm

### **General Education:**

N/A

### **Catalog Course Description:**

This course builds upon the theoretical and programming foundations introduced in earlier courses to teach students about the structure and function of compilers and compiler components. Compilers are tools that convert high-level languages designed for human readability into low level languages designed for machine execution, and are vital to the democratization of information technology. Students will study aspects of lexical analysis, parsing, semantic analysis, code generation, and execution on a virtual machine.

### **Course Learning Outcomes:**

At the completion of this course, students will be able to:

1. **Explain** the parts of a compiler and the overall process of compilation, the execution of programs and the distinction between interpreted and compiled code.
2. **Define** regular expressions for tokens and **implement** a lexical analyzer using a scanner generator, handwritten code, or a combination of the two.
3. **Explain** the process by which a grammar and a valid expression can be used to build a parse tree or abstract syntax tree.
4. Given a grammar, **design** and **implement** a simple parser using a parser generator tool, handwritten code, or a combination of the two.
5. **Construct** a simple code generator to convert an intermediate code representation into executable code.

### **General Course Requirements** (Recommend textbooks (not required), supplemental material will be given)

Textbooks:

- Engineering a Compiler 2<sup>nd</sup> Edition, 2011, by Keith D. Cooper and Linda Torczon, published by Morgan Kaufman, ISBN 978-0120884780.

### **Grading in this class:**

- 40% of the grade is based on exams.
- 40% of the grade is based on homework assignments.

- 10% of the grade is based on quizzes and in-class activities. This does NOT include labs.
- 10% of the grade is based on labs.

All exams, quizzes, labs, and in-class activities must be done in class to receive credit.

A makeup exam or quiz MAY be granted, though only under mitigating circumstances with supporting documentation.

All homework assignments must be completed and must be turned in by their due dates. Late assignments will be accepted for 1 week after the due date but will have 50% taken off the grade. If, for any reason, you are unable to meet any deadline contact me beforehand. An extension MAY be granted, though only under mitigating circumstances with supporting documentation.

### Farmingdale Grading System

Please see the College Catalog for the current Farmingdale State College Grading System.

### Week by week class outline:

The schedule is tentative and might change due to weather or other events.

Date	Topic	Student Learning Outcomes
<b>Week 1</b>	<ul style="list-style-type: none"> <li>• Course overview</li> <li>• Lexical analysis, finite automata, and regular expressions</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Determine</b> if a string is accepted by a finite automaton.</li> <li>• <b>Determine</b> if a string is accepted by a regular expression.</li> <li>• <b>Determine</b> if a regular expression is equivalent to a finite automaton.</li> <li>• <b>Construct</b> a lexical analyzer.</li> </ul>
<b>Week 2</b> <b>Week 3</b>	<ul style="list-style-type: none"> <li>• Lexical analysis, finite automata, and regular expressions</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Determine</b> if a string is accepted by a finite automaton.</li> <li>• <b>Determine</b> if a string is accepted by a given regular expression.</li> <li>• <b>Determine</b> a regular expression is equivalent to a finite automaton.</li> <li>• <b>Construct</b> a lexical analyzer.</li> </ul>
<b>Week 4</b> <b>Week 5</b>	<ul style="list-style-type: none"> <li>• Context-free Grammars</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Determine</b> if a given program is accepted by a given context-free grammar.</li> <li>• <b>Determine</b> the first and follow sets and for a given grammar.</li> </ul>
<b>Week 6</b> <b>Week 7</b> <b>Week 8</b>	<ul style="list-style-type: none"> <li>• Parsing</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Determine</b> if a program is accepted by a given recursive descent parser.</li> <li>• <b>Construct</b> a recursive descent parser.</li> <li>• <b>Assemble</b> the first part of the front end of a compiler by combining a lexical analyzer and recursive descent parser.</li> </ul>
<b>Week 9</b> <b>Week 10</b>	<ul style="list-style-type: none"> <li>• Abstract Syntax Tree</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Construct</b> an abstract syntax tree.</li> </ul>

Date	Topic	Student Learning Outcomes
		<ul style="list-style-type: none"> <li><b>Assemble</b> most of the front end of a compiler by combining a lexical analyzer, recursive descent parser, and abstract syntax tree.</li> </ul>
<b>Week 11</b>	<ul style="list-style-type: none"> <li>Semantic Analysis</li> </ul>	<ul style="list-style-type: none"> <li><b>Implement</b> basic semantic analysis such as checking for undeclared variables.</li> <li><b>Assemble</b> the whole front end of a compiler by combining a lexical analyzer, recursive descent parser, abstract syntax tree, and semantic analyzer.</li> </ul>
<b>Week 12</b> <b>Week 13</b> <b>Week 14</b>	<ul style="list-style-type: none"> <li>Code generation</li> </ul>	<ul style="list-style-type: none"> <li><b>Determine</b> the code that is generated from a given abstract syntax tree and target assembly language.</li> <li><b>Construct</b> a code generator that uses an abstract syntax tree to generate code for a register-based machine.</li> <li><b>Assemble</b> a compiler by combining a lexical analyzer, recursive descent parser, abstract syntax tree, semantic analyzer, and code generator.</li> </ul>
<b>Week 15</b>	<ul style="list-style-type: none"> <li>Final Exam</li> </ul>	

#### Cancellation of Classes:

Weather and other campus-wide cancellations will be listed on the home page, Facebook and Twitter and you can also sign up for RAVE and SUNY Alert. Go to [www.getrave.com](http://www.getrave.com) and use your Farmingdale user ID and password to enter the site. For SUNY-Alert, please visit the University Police web page at [www.farmingdale.edu/university-police/](http://www.farmingdale.edu/university-police/).

An email will be sent to your Farmingdale email address in the event of cancellation of class in other than weather related instances.

#### Electronic Devices Policy:

It's important that you and your classmates not be distracted from learning. The prohibition of cell phones is covered in Article II of the Student Code of Conduct. Any disruption of teaching, which specifically includes the use of cell phones, pagers, or other electronic devices, is considered a Level 1 violation of Article II of the Student Code of Conduct. Any violation may result in disciplinary action ranging from a warning letter to probation, suspension or dismissal from the College. As such, please turn off and put away these devices prior to your entering the classroom. Laptop computers – if used in class -- are to be used for academic work only, not for recreational means or surfing of the Internet.

#### Classroom Recording:

The recording of classroom instruction is for the sole purpose of supporting the course learning objectives and can only be accessible to FSC faculty, staff, and students. Capturing, copying, and or sharing of recordings is strictly prohibited unless approved by the instructor. Recordings may not be shared on any other learning platform, or internet site, including social media sites. Students not adhering to campus policies would be in violation of the student code of conduct.

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**Attendance Policy:**

Please be courteous and arrive ON TIME for class. Students are required to attend all classes for which they are registered. The student is responsible for fulfilling all course requirements and completion of all course assignments to receive credit for the course. If classes are missed for any reason, the student is not excused for any missed work.

**Religious Absences:**

If you are unable to attend class on certain days due to religious beliefs, please consult with your instructor well in advance of the absence so that appropriate accommodation can be made. Reasonable accommodation in course work may be unavailable if a request results in a significant number of absences or substantially impacts class participation. Please note a significant number of absences is viewed as greater than 5% of class time.

**Use of Email:**

It is College policy that instructors and students use the Farmingdale email system or the Brightspace email system to contact one another.

**Copyright Statement:**

Course material accessed from Brightspace or the Farmingdale website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder, is a violation of the Federal copyright law, as well as a violation of SUNY copyright policy.

**Disability Services Center:**

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Disability Services Center, Sinclair Hall, Room 185, or call 934-420-2411, or 420-2607 as soon as possible this semester.

**Campus Mental Health Services**

Occasionally, students may experience problems related to excessive stress, anxiety, depression, and other mental health issues. All registered students at Farmingdale State College have access to Campus Mental Health Services, located in Sinclair Hall. There is no fee for services.

CMHS provides both short and long-term treatment for anxiety, mood disorders, acute and chronic stress disorders, and other emotional or behavioral problems that may adversely impact students' functioning. Additionally, CMHS is available 24/7 for students who may be in crisis. You are encouraged to contact CMHS at (934) 420-2006 or [cmhs@farmingdale.edu](mailto:cmhs@farmingdale.edu) if you are having difficulties in the above areas. We are also available for consultation to help you determine whether or not services may be helpful.

**Academic Integrity Policy**

Because intellectual honesty is a cornerstone of all academic and scholarly work, each member of the Farmingdale State College campus community is expected to maintain academic integrity. Farmingdale State College has developed regulations concerning academic dishonesty and integrity to protect all students and to maintain an ethical academic environment. For more information, click the updated link below:

<https://www.farmingdale.edu/policies/?pid=214095>

It is important for you to understand the concept of plagiarism. Plagiarism is intentionally representing the words, images or ideas of another as one's own in any academic exercise. This includes words, images or ideas in either print or electronic format.

In addition to the general college-wide academic policy linked above, the BCS department has adopted its own academic integrity policy, which supplements the college-wide policy. Students in this class are subject to both the college-wide and the department policy. The department policy is below.

### **Computer Systems Academic Integrity Policy**

Unless specifically indicated as group or team projects, all assignments are considered individual assignments for which the instructor expects original work submitted by each student. All assignments must comply with the following Computer Systems Department academic integrity policy. We will follow the student code of conduct definitions of Academic Dishonesty, as listed in the Farmingdale State College Student Code of Conduct, as follows:

1. Submitting another person's work with or without that person's knowledge.
2. Copying a computer program or programming code from another source.
3. Purchasing and then submitting programming code.

**In addition, the following are also considered to be a breach of the academic integrity policy as it applies to individual assignments:**

4. Exchanging ideas, computer code, and documents electronically.
5. Sharing storage media.
6. Submitting a document file that has been duplicated electronically from another person's work.
7. Collaborating with another person to produce identical or similar work.
8. Intentionally or knowingly helping, attempting to help, or solicit another to commit an act of academic dishonesty.

### **Outside assistance:**

Artificial intelligence (AI) language models, such as ChatGPT, and online assignment help tools, such as Chegg®, are examples of online learning support platforms: they can not be used for course assignments except as explicitly authorized by the instructor. The following actions are prohibited in this course:

- Submitting all or any part of an assignment statement to an online learning support platform;
- Submitting all or any part of an assignment statement to an online learning support platform;
- Incorporating any part of an AI generated response in an assignment;
- Using AI to brainstorm, formulate arguments, or template ideas for assignments;
- Using AI to summarize or contextualize source materials;
- Submitting your own work for this class to an online learning support platform for iteration or improvement.

If you are in doubt as to whether you are using an online learning support platform appropriately in this course, I encourage you to discuss your situation with me.

Any assignment content composed by any resource other than you, regardless of whether that resource is human or digital, must be attributed to the source through proper citation.

Unattributed use of online learning support platforms and unauthorized sharing of instructional property are forms of academic dishonesty and will be treated as such.

### **INSTRUCTOR'S COURSE OF ACTION**

#### ***First Offense:***

- The student (and collaborators, if any) will receive a grade of zero for the assignment and will have his or her final grade reduced by one full letter grade.
- The infraction will be reported to the student's chairperson.

- A letter regarding the infraction will be placed in the student's file.

**Second Offense:**

- The student receives an "F" in the course and may no longer attend or participate in the course.
- The infraction will be reported to the student's chairperson, who will then notify the Dean of Students regarding the infraction.
- A letter regarding the infraction will be placed in the student's file.

A second offense can occur in the same course or in different courses in the same or different semesters. Student dishonesty on exams and/or a capstone project will **automatically be treated as a second offense**.

If you are unclear about or have any questions regarding the academic integrity policy, it is the student's responsibility to ask the professor for clarification of the policy.

**Note:** If you have a question about an assignment submission or evaluation, or if you have a question about an exam or a quiz grade, you must raise those questions within one week after the assignment evaluation or the exam or quiz was graded or returned.

**Diversity Equity & Inclusion:**

Farmingdale State College embraces the belief that our intellectual community is enriched and enhanced by the opportunity to learn from and appreciate diversity. We strive to have a curriculum and learning environment which respects, honors and incorporates the contributions of a diverse and inclusive teaching and learning community. Your person (identity) and voice are welcomed in this classroom environment because of your value as a member of FSC's inclusive and diverse culture. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class.

**Student Code of Conduct**

The President of the College and the Vice President for Student Affairs recognize the rights of designees including University Police, to enforce all regulations, policies, license agreements, laws and codes on campus. If any individual allegedly violates the laws, Student Code of Conduct or campus policies, a President's designee will institute proceedings against the offender (s). For more information on the student code of conduct, see the Code of Conduct section in the current Student Handbook which can be found at this link, <https://www.farmingdale.edu/dean/policies.shtml>

**Basic Needs Insecurity:**

Your well-being is crucial to your academic success at Farmingdale State College. If you are dealing with basic needs insecurity, please communicate with the Office of the Dean of Students at (934)420-2104. We are here to ensure that your well-being is prioritized. Resources are available to support you if you face challenges such as unstable housing, insufficient food, financial difficulties or other personal hardships.

*Food Security*

- **Campus food Pantry** –The Food Pantry provides free groceries to students in need. More information and hours of operation are available at [Food Pantry](#)
- **Supplemental Nutrition Assistance Program (SNAP)**: Many students are eligible for SNAP benefits, which provides funds for purchasing food. For more information and assistance with applying, please contact Jamie Hawkins, Health & Wellness Center, [hawkinjk@farmingdale.edu](mailto:hawkinjk@farmingdale.edu), or call 934-420-2690. You can apply online at [Supplemental Nutritional Assistance Program \(SNAP\)](#). [Health and Welfare Counsel of Long Island](#) is available to help you complete the application.

*Housing Assistance*



- **Homeless Liaison:** Jamie Hawkins, your Campus Homeless Liaison, offers confidential support to students experience housing instability. They will connect you with campus and community resources.
- **Emergency Housing:** If you are experiencing housing instability or homelessness, the Residence Life Office (RLO) can assist with temporary housing solutions. Contact them at (934)420-2010.
- **Affordable Housing Resources:** For long-term housing support, the RLO can connect you with affordable housing options in the community. Visit [the RLO webpage](#) for more details.

#### *Financial Assistance*

- **Emergency Grants:** Your campus offers emergency financial grants to assist students faculty unexpected financial hardships. To apply, visit <https://www.farmingdale.edu/scholarships/>
- **Financial Aid:** Ensure that you have applied for all available financial aid, including scholarships, grants, and loans. Visit the [Financial Aid Office](#) or contact them (934)420-2578 for personalized assistance

#### *Additional Support Services*

- **Mental Health Services:** All registered students at Farmingdale State College have access to Campus Mental Health Services (CMHS), located in Dewy Hall, room 91. There is no fee for services. CMHS provides both short and long-term treatment for anxiety, mood disorders, acute and chronic stress disorders, and other emotional or behavioral problems that may adversely impact students' functioning. Additionally, CMHS is available 24/7 for students who may be in crisis. You are encouraged to contact CMHS at (934) 420-2006 or [cmhs@farmingdale.edu](mailto:cmhs@farmingdale.edu) if you are having difficulties in the above areas or are seeking a consultation.
- **Disability Services:** If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Disability Services Center, Whitman Hall, room 186D, or call 934-420-2411, or 420-2607 as soon as possible this semester.
- **Health and Wellness Center:** For health-related concerns, visit the [Health and Wellness Center](#)
- **Academic Support:** For academic assistance, contact [Center for Academic Success & Tutoring](#)

**University Police**  
934-420-2111