CMSC 254 - 001 Fall 2022
Introduction to Problem-solving

Catalog listing:	CMSC 254
Course Level:	Undergraduate
Prerequisites:	none
Instructor:	Debra Duke
Office:	Engineering East E4250
Phone:	(804) 828-7135
Email:	s2dmduke@vcu.edu (preferred contact method)
Classroom:	Engineering Building East 4221
Time:	Tuesday & Thursday, 11:00 am - 12:15 pm
	Wednesday Lab, 10:00 am – 11:50 am
Class website:	Canvas
Office Hours:	Friday, 2 – 3:00 pm on Zoom (link in Canvas) or by appointment
October 28:	Last day to withdraw from a course with a mark of "W"
Final Exam:	A cumulative final programming project serves as the course assessment along with an exam on the last day of class.

1.0 – Overview (Catalog Course Description):

Semester course; 3 lecture hours, 3 credits. Introduction to problem solving and implementation of solutions using Python. The course introduces students to concepts and practice of structured programming, problem-solving, top-down design of algorithms, a Python language syntax, control structures, and arrays. The course content also includes instruction in critical thinking and problem-solving skills using contemporary tools. Specific topics include flowcharting, pseudocode, and program control structures, including sequence, selection, repetition, and modularization.

2.0 – Course Structure:

Lecture hours/week – 3

Lab hours/week – 2

3.0 – Course Goals

Upon successful completion of the course, the student will be able to:

1. Demonstrate the use of computer science as a communication and problem-solving tool by developing computational artifacts to solve problems, communicate ideas, and express creativity.
2. Collaborate with others to solve problems and develop computational artifacts in a manner that displays situationally and culturally appropriate demeanor and behavior.
3. Explain the impact computing has on society, economy, and culture.

4. Analyze existing computational artifacts to identify and correct errors; and explain how the artifact functions.
5. Explain how data, information, or knowledge is represented for computational use.
6. Define the fundamentals of computer architecture.
7. Represent real-world objects and processes virtually by identifying properties, behavior, and operations relevant to solving problems on a computer
8. Plan the logic for the program using structured methods.
9. Describe the fundamental organization of computer programs and implement the following control structures in the Python programming language:
    a. Correctly use arithmetic operations,
    b. Various input/output techniques,
    c. Accumulating totals,
    d. Correct comparison and selection programming techniques,
    e. Correct looping programming techniques,
    f. Use and implementation of sub-programs.
10. Write clear and concise documentation for Python programs.

4.0 – Major Topics Covered:

4.1 – Basic concepts of computer systems

- Differentiate computer components by functionality.
- Define basics of computer storage devices.
- Explain the use of computers, and the social impact they have.
- Evaluate the ethical aspects of programming

4.2 Processing Code

- Editors, compilers and/or interpreters; distinguishing source code, object code, and executables.
- Reading and evaluate compilation error messages.
- Executing programs.
- Analyzing and resolving run-time errors.

4.3 Problem analysis and algorithmic modeling

- List and apply the steps involved in problem solving through algorithmic modeling.
- Describe activities related to program modeling and design including algorithm development.
- Solve problems using techniques such as pseudocode, flowcharts, and model development.
- Verify algorithms and identify errors.
- Distinguish between procedural techniques and object-oriented techniques.
- Write programs using good programming practices.

4.4 Use of data

- Compare and contrast data types and values.
- Describe the use of variables.

- Build expressions using variables, literal data, and operators, correctly using rules of operator precedence.

4.5 Decision structures

- Show how conditional operations are used to alter the sequential execution of a program.
- Write Python code using relational and Boolean operators to form logical expressions that evaluate to true or false
- Identify techniques to evaluate selection statements for logic errors.
- Develop programs using sequential and selection operations.

4.6 Programming with Functions

- Apply modularization to manage complexity of programming
- Describe the roles of parameters in a procedure definition.
- Illustrate parameter passing when invoking procedures.
- Define and call new functions as part of solution to a problem.

4.7 Repetition structures

- Describe how repetition structures are used to alter the sequential execution of a program.
- Choose appropriate repetition structures based on the type of application.
- Identify techniques to evaluate repetition statements for logic errors.
- Develop programs using repetition structures.

4.8 Sequential Data Structures (Lists, Dictionaries, and Tuples)

- Define the nature and purpose of an array.
- Use arrays as parameters and returned values in procedures.
- Evaluate programs that use arrays.
- Develop applications using arrays.

5.0 Textbooks and Other Learning Materials:

a) *Python for Everybody – Interactive* from Runestone Academy. There is no fee associated with this ebook. Registration information will be provided during the first week of class.

b) Python-specific computer programming tutorials and other learning materials created by your instructor or available online, such as the W3Schools Python Tutorial.

c) Crossing the River with Dogs: Problem Solving for College Students, 3rd Edition, Ken Johnson, Ted Herr, Judy Kysh. ISBN: 978-1-119-27509-1 https://www.wiley.com/en-us/Crossing+the+River+with+Dogs%3A+Problem+Solving+for+College+Students%2C+3rd+Edition-p-9781119275091

6.0 – Class Schedule of Topics

Week 1: Problem-Solving: Draw a Diagram;
Week 2: Problem-Solving: Make a Systematic List;
Python: Introduction
Week 3: Problem-Solving: Eliminate Possibilities
Python: Arithmetic Expressions
Week 4: Problem-Solving: Use Matrix Logic
Python: Data Types
Week 5: Problem-Solving: Look for a Pattern
Python: Conditions & Logic
Week 6: Problem-Solving: Guess and Check
Python: Loops & Iterations
Week 7: Problem-Solving: Identify Subproblems
Python: Defining Functions
Week 8: Problem-Solving: Analyze the Units
Python: Importing Modules
Week 9: Problem-Solving: Solve an Easier Related Problem
Python: Lists & Strings
Week 10: Problem-Solving: Organize Information in More Ways
Python: Nested Structures
Week 11: Problem-Solving: Work Backwards
Python: Dictionaries
Week 12: Problem-Solving: Convert to Algebra
Week 13: Problem-Solving: Evaluate Finite Differences
Python: File I/O
Week 14: Problem-Solving: Visualize Spatial Relationships
Python: Visualizing Data
Week 15: Problem-Solving: Focus in More Ways
Python: Defining Classes

7.0 Evaluation:

Grading:

Category	% weight
Assigned Reading & Problem Sets	**20**
POGIL & Problem-Solving Classwork	**20**
Lab Assignments	**20**
Python Projects	**30**
Cumulative Exam & Final Project	**10**

Grading scale:

A: >= 90%
B: >= 80% and < 90%
C: >= 70% and < 80%
D: >= 60% and < 70%
F: < 60%

Course Attendance Policy:

This is an cooperative, active learning course therefore your presence in class is essential to your success and the success of your classmates. In class activities (POGIL & Problem-solving classwork) may not be completed independently. You will be excused from a maximum of two class sessions without penalty.

General Instructions:

1. It is expected that you will spend at least 12 hours a week on this class completing readings / related activities, and programming outside of scheduled lab and lectures. For every credit hour it is expected that students are putting in 3-4 hours of work. This is a 4-credit class.
2. In-class activities cannot be made up; you must be present to complete the activity and earn a grade for it. In general, we have activities every class meeting.
3. This class has a dedicated lab time and lab assistance is available **only during this time**. If you choose not to attend the lab, **you are responsible for completing/debugging the lab on your own**. It is recommended that you prepare for labs by reading through the module's assigned readings and lab instructions before the start of lab to make efficient use of the time.
4. All programming assignments must be uploaded to Gradescope on or before the due date specified. Only files submitted on or before the due date will be considered for grading unless an extension was granted prior to the due date. *In all circumstances, an assignment will not be accepted after it has been reviewed and a solution presented in class.*
5. Requests to re-grade any assignment or assessment must be made within one week from the date the project grade is posted in Canvas, requests after this time will be denied.
6. No assignments will be accepted late unless special permission has been given prior to the due date. *In all circumstances, an assignment will not be accepted after it has been reviewed and a solution presented in class.*
7. No makeup exams or quizzes will be given unless special permission has been given prior to the date of the test. Be prepared to provide documentation for the reason you are requesting the makeup exam, or permission may not be granted.
8. Request to adjust scores or re-grade tests must be made within one week after the test results are released, requests after this time will be denied.
9. All programming projects are to be individual efforts. **Plagiarism applies to source code as with any other intellectual property. Plagiarized code is a form of cheating and will be treated as such.** Instances of plagiarism and other violations of the VCU Honor Code will be reported to the VCU Honor Council.

10. Personal computers/laptops/cell phone may be used in class only with the instructor's permission.
11. Use of any electronic device is prohibited during exams. **Students may not leave the exam room once testing begins for any reason.** Violations of these class rules will result in a grade of zero (0) for the exam.

Course Standards for Cheating and Plagiarism

It is important that the work you hand in is your own. It is fairly easy to copy someone else's program (especially as the due date approaches). For you to learn the material in order to perform well on the tests and subsequent programs and courses, it is imperative that you understand everything that is in your program.

Obtaining verbal assistance on assignments is allowed. This means that you may discuss algorithms. **You may not view or discuss written algorithms or code with anyone other than your instructor or course teaching assistants.**

Remember, programming is a learn-by-doing skill. The programming assignments are key tools for learning the material in the course. *Doing the programming projects as "group projects" is strictly prohibited, an honor code violation, and will invariably lead to you performing poorly in the course.*

Just make sure that the work you hand in is truly yours. Three simple guidelines to insure this are:

1. The "form of expression" must be original.
2. Understand everything in your program.
3. Never copy files from someone else, never give files to someone else, never examine someone else's code, never debug someone else's code, never show someone else your code.

The internet is a great resource for finding alternate explanations or examples for programming concepts that may help you better understand the material and you are allowed and encouraged to utilize it. However, asking for specific help that is targeted towards a homework assignment or programming project on "homework help" sites, tutoring sites, blogs, or forums is considered cheating and will be reported to the VCU Honor Council for investigation. The TAs and the instructor are much better sources of assistance.

Code that is obtained from outside sources, such as the internet, and used in a homework submission MUST be approved by your instructor and properly cited in the code comments or it will be considered plagiarism.

The TAs and I will be using Gradescope's software and Stanford University's Moss (for Measure of Software Similarity) program to detect software plagiarism along with the measure of similarity provided by Gradescope.

You are reminded that all homework is pledged to be your own work as described above and it is an honor code violation to misrepresent work that is not yours. Programs that violate these standards will be immediately referred to the Honor System for action.

Technology Requirements

- Participants need access to a personal computer (Mac or Windows) and the Internet for major amounts of time for this course.
- Browser that is compatible with Canvas. To see if your browser is compatible with Canvas, visit the Canvas Browser Checker webpage.
- Your computer will need speakers to hear sound for videos and audio files.
- You will need access to word processing software such as Microsoft Word or Google Docs. Please note that any software that you use must be able to save files as Microsoft files (example *.doc or *.docx) or PDF.
- Adobe Acrobat Reader or an equivalent PDF reader.
- A webcam and microphone on your computer. A cell phone camera and microphone may suffice depending on the quality of the cell phone. It is your responsibility to ensure the divide can allow for real time video conferencing and video and audio recording.
- Python and an integrated development environment is needed to write Python programs.

Technology Skills Required

- It is expected that you can use and check your official VCU email address daily.
- You should be able to upload documents to Canvas.
- You should be able to use word processing software.
- You will be expected to interact with me and your peers using Canvas tools. Instruction for the use of each tool will be given when the tool is introduced.
- You will be required to download and install Python and an Integrated Development Environment(IDE) to write programs. Tutorials on how to install both applications will be provided during the first week of class.

Please consult external resources for VCU policies regarding academic honesty, students with disabilities, student conduct in the classroom, withdrawal from classes, and others.

Use VCU Libraries to find and access library resources, spaces, technology and services that support and enhance all learning opportunities at the university. (https://www.library.vcu.edu/)

Students should visit http://go.vcu.edu/syllabus and review all syllabus statement information. The full university syllabus statement includes information on safety, registration, the VCU Honor Code, student conduct, withdrawal and more.

Campus emergency information

What to know and do to be prepared for emergencies at VCU:

- Sign up to receive VCU text messaging alerts. Keep your information up-to-date. Within the classroom, the professor will keep his or her phone on to receive any emergency transmissions.

- Know the safe evacuation route from each of your classrooms. Emergency evacuation routes are posted in on-campus classrooms.
- Listen for and follow instructions from VCU or other designated authorities. Within the classroom, follow your professor's instructions.
- Know where to go for additional emergency information.
- Know the emergency phone number for the VCU Police (828-1234).
- Report suspicious activities and objects.
- Keep your permanent address and emergency contact information current in eServices.

Class registration required for attendance

Students may attend only those classes for which they have registered. Faculty may not add students to class rosters or Canvas. Therefore, if students are attending a class for which they have not registered, they must stop attending.

Honor System: upholding academic integrity

The VCU Honor System policy describes the responsibilities of students, faculty and administration in upholding academic integrity, while at the same time respecting the rights of individuals to the due process offered by administrative hearings and appeals. According to this policy, "Members of the academic community are required to conduct themselves in accordance with the highest standards of academic honesty, ethics and integrity at all times." In addition, “To support a commitment to the Honor System, all members of the VCU community are required to:

- Adhere to the Honor System policy and its procedures;
- Report any suspicion or knowledge of possible violations of the Honor System;
- Answer truthfully when called upon to do so regarding Honor System matters;
- Maintain appropriate confidentiality regarding related to Honor System matters." More information can be found at in the VCU policy library.

Managing stress

Students may experience situations or challenges that can interfere with learning and interpersonal functioning including stress, anxiety, depression, alcohol and/or other drug use, concern for a friend or family member, loss, sleep difficulties, feeling hopeless or relationship problems. There are numerous campus resources available to students including University Counseling Services (804-828-6200 MPC Campus, 804-828-3964 MCV Campus), University Student Health Services (MPC 804 828-8828, MCV Campus 804 828-9220) and the Wellness Resource Center (804-828-9355). 24-hour emergency mental health support is available by calling 828-1234 and asking to speak to the on-call therapist or utilizing the National Suicide Prevention Lifeline (1-800-784-2433).

Student conduct in the classroom

According to the Faculty Guide to Student Conduct in Instructional Settings, "The university is a community of learners. Students, as well as faculty, have a

responsibility for creating and maintaining an environment that supports effective instruction. In order for faculty members (including graduate teaching assistants) to provide and students to receive effective instruction in classrooms, laboratories, studios, online courses, and other learning areas, the university expects students to conduct themselves in an orderly and cooperative manner." Among other things, cell phones should be turned off while in the classroom. The Student Code of Conduct also prohibits the possession of or carrying of any weapon. For more information see http://register.dls.virginia.gov/details.aspx?id=3436.

Student email policy

Email is considered an official method for communication at VCU because it delivers information in a convenient, timely, cost-effective, and environmentally aware manner. Students are expected to check their official VCU email on a frequent and consistent basis in order to remain informed of university-related communications. The university recommends checking email daily. Students are responsible for the consequences of not reading, in a timely fashion, university-related communications sent to their official VCU student email account. This policy ensures that all students have access to this important form of communication. It ensures students can be reached through a standardized channel by faculty and other staff of the university as needed. Mail sent to the VCU email address may include notification of university-related actions, including disciplinary action. Please read the policy in its entirety at the VCU Policy Library.

Student responsibilities

(Source: One VCU: Responsible Together available at: https://together.vcu.edu/students/)
When we return, things will look and feel different as we take necessary steps to protect the well-being of our community. Here is what is expected of you:

1. Monitor your health daily. Testing will occur according to protocols.
2. Wear a face covering or mask in common areas, including class.
3. Apply physical distance guidelines to all settings.
4. Clean and disinfect personal and shared spaces before and after use.
5. Cleaning supplies will be available in numerous locations.
6. Report symptoms associated with COVID-19 to VCU Student Health
7. A call center hotline will be available later in the summer.
8. Not sharing is caring during this unique pandemic. Please do not share
9. calculators, tools, lab supplies, etc.

Following rules regarding face coverings or masks, cleaning and disinfecting, and physical distancing is required. Students will receive reminders for daily health monitoring. Staff in the Dean of Students office will be notified after incidents of non-compliance. Refusal to comply with rules can include progressive disciplinary action up to and including suspension, based on the VCU Student Code of Conduct.

Requesting accommodations

The university recognizes that some students who previously did not need Section 504 Academic Accommodations, and who have a qualifying condition or disability, may need support or assistance during the return to campus process. A modified approach for the temporary and more permanent need for accommodation has been developed and implemented to provide students with full access to programs and activities related to their

academic majors. Because every case is different, student requests are evaluated on a case-by-case basis. Please share your need for an accommodation with the Student Accessibility and Education Office , or for MCV Campus students, the Division for Academic Success , after you have worked directly with your faculty member.

Health and Well-being

Navigating the anticipated stressors of daily life can often be challenging enough. When unexpected stressors emerge or when we are faced with uncertainty, it can be tough to know how to cope. Try out some of these tips and resources for health and wellness to see if they are a right fit for you.

Symptoms or Diagnosis: If an on-campus student identifies symptoms, has tested positive for COVID-19, or has come into contact with someone diagnosed with COVID-19, that student should contact University Student Health Services . At that point, isolation should begin and contact tracing will be performed by Student Health Services. Symptoms will be monitored, and the student should refer to a medical provider if symptoms worsen or be released from isolation after 14 days if symptom-free.

Nondiscrimination policy

VCU is committed to providing a safe, equitable and inclusive environment for all its employees, patients, and students. Discrimination or discriminatory harassment is not only unlawful, but also harmful to the well-being of our university community. Our university's core values, specifically those related to diversity and inclusion, have withstood many difficult situations and trying times, and they will not falter now.

Reports of discrimination, bullying, harassment and/or stereotyping of persons of color or those impacted by COVID-19 or otherwise, will not be tolerated. Be assured that VCU will make every effort to address and prevent the occurrence of unlawful discrimination and, if necessary, take prompt and appropriate action to remedy and prevent its reoccurrence.

Every member of our community is asked to:

- Become familiar with the university's policies on Preventing and Responding to Discrimination and Duty to Report and Protection from Retaliation in the VCU Policy Library.
- Consult with Equity and Access Services or VCU Human Resources for additional guidance on how to file a report of discrimination.
- Contact the Office of Institutional Equity, Effectiveness and Success (IES) on how to address and maintain a culture of inclusion.
- Encourage individuals who may need an ADA accommodation for a known or newly acquired disability, to contact the ADA/504 Coordinator in ADA Services.
- Bookmark and share information on university or community agencies that offer support or services, such as VCU's Counseling Services or Ombudsperson.
- Explore training and educational opportunities on diversity and inclusion at IExcel Education and through the Office of Institutional Equity, Effectiveness and Success .
- Offer nonjudgmental support and empathy to those affected by current events and this health crisis.

Message from your Instructor

I am grateful for your presence and input in this online course. I appreciate and welcome you regardless of your immigration status, country of origin and/or citizenship, race, ethnicity, religious affiliation, gender/sex, gender identity, sexual orientation, age, or dis/ability. Thank you for enriching our world, sharing your vital experience, and

contributing to the diversity that makes our intellectual community vibrant and evermore creative.

Tips for Success:

- When taking online and hybrid courses, your self-motivation and self-pacing are absolutely critical. For this course, you should plan to work about 9 hours per course module as we move through the materials. Be sure to plan your time accordingly.
- Make yourself a calendar with all of your due dates across ALL of your courses. Plan for when you will work on each one for completion in advance of the due dates.
- Make sure you note any "online" course that still have a required meeting time (such as a Google Meet or Zoom session).
- Avoid the common assumption that online courses are easier or should be easier. That is a MYTH!!
- Plan Ahead!! Study as you go instead of at the last minute!

Where to post questions

Questions of general interest should first be posted to the discussion board (only if they have not already been answered) so that other students can benefit from the response or have an opportunity to respond to your question.

Only questions of a private nature should be communicated to me through email. When sending a message to me, please allow a minimum of 24 hours for a response . Most of the time I will respond much faster, but sometimes meetings and other courses take over my schedule.

Netiquette Guidelines

Netiquette is a set of rules for behaving properly online. Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea but you are not to attack an individual. Working as a community of learners, we can build a polite and respectful course community.

The following netiquette tips will enhance the learning experience for everyone in the course:

- Do not dominate any discussion.
- Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Popular emoticons such as ☺ can be helpful to convey your tone but do not overdo or overuse them.
- Never make fun of someone's ability to read or write.
- Share tips with other students.
- Keep an "open-mind" and be willing to express even your academically informed opinion.
- Think and edit before you push the "Send" button.
- Do not hesitate to ask for feedback.
- Using humor is acceptable

(Adapted from UWSP)

Be Proactive in Communication

If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that we can help you find a solution. (Adapted from UWSP)

VCU Honor System

VCU recognizes that honesty, truth, and integrity are values central to its mission to advance knowledge and student success both in the world VCU students will enter, or return to once they have graduated and in the university community as a microcosm of that world. In a community devoted to learning, a foundation of honor must exist if that community is to thrive with respect and harmony. Therefore, all members of the university community must conduct themselves in accordance with the highest standards of academic honesty, ethics, and integrity at all times.(from https://conduct.students.vcu.edu/vcu-honor-system/)

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- Know the safe evacuation route from each of your Emergency evacuation routes are posted in on-campus classrooms.
- Listen for and follow instructions from VCU or other designated Within the classroom, follow your professor's instructions.
- Know where to go for additional emergency information.
- Know the emergency phone number for the VCU Police (828-1234).
- Report suspicious activities and
- Keep your permanent address and emergency contact information current in

Important dates

You can view important dates for the semester in the academic calendar.

Attendance Policy

Attendance can be gauged in an online or hybrid course. Regular participation in the discussion forums, the timely submission of required assignments, and the prompt notification of problems in the course all constitute “class attendance” online. Students are expected to participate in all class activities, submit all assignments, and complete all tests and examinations in accordance with the class syllabus and outline. Students who cannot participate in or complete assigned class activities, assignments, tests, and examinations by the designated deadlines owing to circumstances should contact the instructor prior to any incidences or immediately following all unforeseen emergencies. Simply logging into the Canvas course does not constitute attendance. Maintaining communication with the instructor via phone or email is a must when absences occur. Please note that it is your responsibility to understand and complete the course assignments. You are expected to read all the material posted in Canvas or disbursed through email. If you do not ask questions, it will be assumed that you understand the assignments.

Discussions

Most weeks we will be discussing a chapter/topic from the textbooks in the course. You are expected to contribute to the forum discussions during the week listed in the Course Schedule. Discussion Forums will be monitored through the entire semester. All forum contributions must be written in a business professional fashion, using correct spelling, complete sentences, and appropriate grammar. Forum contributions not following this format will not be graded.
For each forum, students will be required to read all other students forums and comment on at least two other forum contributions. These comments are a requirement for full credit for the forum contributions.

Military short-term training or deployment

If military students receive orders for short-term training or for deployment/mobilization, they should inform and present their orders to Military. Student Services and to their professor(s). For further information on policies and procedures contact Military Student Services at 828-5993 or access the corresponding policies.

Please visit http://go.vcu.edu/syllabus and review all syllabus statement information. The full university syllabus statement includes information on safety, registration, the VCU Honor Code, student conduct, withdrawal and more.