HARRISBURG UNIVERSITY
OF SCIENCE AND TECHNOLOGY

CISC 610 (Section 90)
Data Structures and Algorithms

Instructor: Renata Rand McFadden, PhD
Email: RMcFadden@HarrisburgU.edu

Meetings: Wednesdays 7:00 - 8:00 PM EST (recording available)
Office Hours: Email

Course Overview

This course introduces the basic concepts of Algorithms and the data structures associated with them. Topics include: Introduction to Algorithms, Sorting, data structures, search, graphs and strings. This course requires writing programming assignments. Students are free to use any of the following programming languages: Java, C++, C#, or Python. **Prerequisite: CISC 120, CISC 233**

Course Objectives

- The primary objective of this course is to:
- Provide an introduction to the principles of Algorithms and data structures.
- Help clarify basic concepts through the use of Programming assignments.
- Help the students understand and implement some algorithms.
- Open up new avenues for students to design algorithms.
- Understand the application of algorithms.

The emphasis of the course is on teaching the fundamentals, and not on providing a mastery of specific algorithms that are commercially available. In short, this course is about understanding data structures and algorithms and implementing them to solve different problems.

Upon successful completion of the course, students will have an understanding of the basics of

Algorithms including problem solving, creativity, critical thinking, and team-work. Students will also be able to implement different algorithms of moderate complexity and evaluate their performance.

Prerequisite:

A bachelor's degree (BA / BS / BE) in computer science or a related technical field (e.g., electrical and computer engineering, information science, operations research) typically suffices. Applicants who have majored in other fields are absolutely encouraged to apply provided they have demonstrated knowledge of the following subjects:

- **Programming in a high-level language and introduction to computer science (CISC 120, CISC 233).** Topics include program structure and organization, object-oriented programming (classes, objects, types, sub-typing), graphical user interfaces, algorithm analysis (asymptotic complexity, big "O" notation), recursion, data structures (lists, trees, stacks, queues, heaps, search trees, hash tables, graphs), simple graph algorithms.
- **Discrete Mathematical Structures (e.g., Math 210).** Covers the mathematics that underlies most of computer science. Topics include mathematical induction; logical proof; propositional and predicate calculus; combinatorics and discrete mathematics; some basic elements of basic probability theory; basic number theory; sets, functions, and relations; graphs; and finite-state machines. These topics are discussed in the context of applications to many areas of computer science, such as the RSA cryptosystem and web searching.
- **Linear Algebra (e.g., Math 120)** Topics include properties of real numbers, problem-solving using equations and inequalities, algebraic functions, graphing, systems of equations and inequalities, polynomial functions and graphs, exponents and radicals, the binomial theorem, zeros of polynomials, inverse functions, and applications and graphs. Free on-line graphing and calculating utilities are used in lieu of a graphing calculator.

Course Textbook and References

- **Richard Neapolitan** "Foundations of Algorithms 5th Edition."
  ISBN-10: 1284049191. Jones & Bartlett Learning, March 19, 2014
- **Harry Hariom Choudhary** "Data Structures And Algorithms.: Made Easy"
  ISBN-10: 149599600X. CreateSpace Independent Publishing Platform. February 18, 2014
- **Papers**, **programs**, or **online references** will be made available to supplement the text.

Class Schedule

This list represents the initial plan for CS 601. Please note that it is a ***plan*** so there may be a change as needed. Changes will be posted on the course's **Moodle announcements**.

	Topics	Read/Watch	Assignments
1	**Introduction**	CHOUDHARY CH 1 Tools.pdf Class meeting/recording	Post Introduction in Discussions forum Install and setup compiler/IDE Install and/or setup video tool
2	**Linked Lists and Arrays**	CHOUDHARY CHs 2, 3, & 7 Review Project Instructions Supplemental materials Example-Video.mp4 Class meeting/recording	A1 Video Test program due Friday 5/18
3	**Stacks and Queues**	CHOUDHARY CHs 5 & 6 Class meeting/recording	
4	**Sorting**	CHOUDHARY CH 4 Class meeting/recording	A2 due Friday 6/1
5	**Trees**	CHOUDHARY CH 8 Class meeting/recording Supplemental materials	
6	**Graphs**	CHOUDHARY CH 9 Class meeting/recording Supplemental materials	A3 due Friday 6/15
7	**Divide and Conquer**	NEAPOLITAN CH 1 and 2 Class meeting/recording	**Project proposal due 6/22 (send in email to instructor)**
8	**Dynamic Programming**	NEAPOLITAN CH 3 Class meeting/recording	A4 due Friday 6/29
9	**Greedy Approach**	NEAPOLITAN CH 4 Class meeting/recording	
10	**Backtracking**	NEAPOLITAN CH 5 Class meeting/recording	A5 due Friday 7/13
11	**Branch and Bound**	NEAPOLITAN CH 6 Class meeting/recording Supplemental materials	
12	**Computational Complexity: Sorting**	NEAPOLITAN CH 7 Class meeting/recording	A6 due Friday 7/27

13	**Computational Complexity: Searching**	NEAPOLITAN CH 8 Class meeting/recording	**Project due Friday 8/3**
14	**Theory of NP**	NEAPOLITAN CH 9 Class meeting/recording	A7 due Friday 8/10

Participation
Attending or watching weekly session (Thursdays 7-8PM EST) is worth 14% of the grade. If student cannot make the live session, he/she must watch the recording by **Sunday midnight EST** the same calendar week.

Assignments
There will be seven **individual** assignments due. The first assignment will be a **test video** worth 4% of the grade. The other six **programming assignments** are worth 10% each for a total of 60% of the final grade. Assignments are due on **Fridays at midnight EST** on the dates indicated above.

You can use Python, Java, C#, or C++ for the assignments but once you select a programming language you need to submit **all** assignments using the same programming language. Your solutions must use Object Oriented design approach (you may **not** have all the code in the same class or main method).

Exams
There will be no exams in this course.

Project
You will design and implement an application that uses some of the data structures and algorithms you learned this semester. You will implement two separate algorithms (e.g. search or sort) and compare for efficiency and runtime. You may implement the system in Python, Java, C#, or C++ using Object Oriented design and implementation. If the project is large, it may be tackled by a group (maximum 3 members). This project is worth 22% of the grade in the course

Project is due by **Friday July 3** at midnight EST

Final Grades will be determined using points earned for the assignments and project based on the following scale:

Points	Letter Grade	GPA
93-100	A	4.00
90-92	A-	3.67
87-89	B+	3.33
83-86	B	3.00
80-82	B-	2.67
76-79	C+	2.33
70-75	C	2.00
0-69	F	0.0

Collaboration Policy
All the assignments for this class must be done **individually**
Project can be done individually or as a group up to 3 individuals. You may work on the code and write-up together but then must prepare your presentation individually.

Note to students with disabilities: It is Harrisburg University's policy not to discriminate against qualified students with documented disabilities. It is also your instructor's policy to try and help students learn by whatever reasonable means necessary. If you have a disability related need that requires a modification in your testing situation, please notify your instructor a week before the first test or quiz so that your need can be accommodated. You may be asked to present documentation that describes the nature of your disability and the recommended remedy.

Course Conduct and Expectations
A few rules will help us to get the most of our investment in CISC 610:

- You are expected to check the **Moodle class announcements** regularly, at minimum every 2-3 days
- **Class meetings will start on time** and end as scheduled. Please be there on time. A recording will be available for students who cannot make the meeting. Attending the meeting is not mandatory but watching the recording is and will count as participation credit
- **You are responsible for all the readings**, even if the material is not explicitly covered in class. You should read the class materials and watch any provided videos prior to class meeting so you are already familiar with the topics. You should also re-read the material after class meeting as not every topic will be covered during class meeting time. Many passages in the text may need to be read several times to gain clarity. Also, taking notes on the material you are reading and reflecting on the reading and these notes will help you better understand the issues, concepts and techniques that are being presented. The meeting time is meant to only highlight some of the main concepts for that week
- All work must be completed and **turned in through Moodle**, on or before the assigned date. I allow an extension of up to 2 days maximum when needed but no more than for two assignments. ***Other than that, no late work will be accepted***. Note that a computer's or internet's failure is not an excuse (it represents poor planning on your part).
- You may send me email at any time at RMcFadden@HarrisburgU.edu to ask questions and I will usually **respond within 48 hours**. For general questions you may also post in the weekly Discussions forum.
- It is your responsibility to make sure that submitted files are readable and virus-free and have all the required files for that assignment or project. You must archive the code source files and not submit them individually. Check assignment instructions on how you should submit the files for that assignment

HU CORE COMPETENCIES
At the conclusion of this course a student will have met the following core competencies that reflect HU's mission:

- Critical Thinking and Problem Solving skills are demonstrated by the student's ability to:
  — Identify and clarify the problem**,**
  — Gather information,
  — Evaluate the evidence,
  — Consider alternative solutions,
  — Choose and implement the best alternative.
- Communication - The core communication skills are demonstrated by the student's ability to:
  — Express ideas and facts to others effectively in a variety of formats, particularly written, oral, and visual formats,
  — Communicate effectively by making use of information resources and technology.
- Teamwork and Collaboration - The students will be working with others to increase involvement in learning and by sharing one's own ideas and responding to others' reactions to sharpen thinking and deepen understanding.
- Information Technology - The students will be making effective use of the .NET information resources and technology.

Statement on Academic Integrity

According to the University's Student Handbook: Academic integrity is the pursuit of scholarly activity free from fraud and deception, and is the educational objective of this institution. Academic dishonesty includes, but is not limited to cheating, plagiarism, fabrication of information or citations, facilitating acts of academic dishonesty by others, unauthorized possession of examinations, submitting work of another person, or work previously used without informing the instructor, or tampering with the academic work of other students. Any violation of academic integrity will be thoroughly investigated, and where warranted, punitive action will be taken.

Students should be aware that standards for documentation and intellectual contribution may depend on the course content and method of teaching, and should consult the instructor for guidance in this area.

Honor Code - We as members of Harrisburg University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work. As a Community of Learners, we honor and uphold the ***HU Honor Code***.