CISC 610-51
Data Structures and Algorithms
Summer 2016

Instructor: **Mohammad Nayeem Teli, Ph.D.**
Email: **mteli@harrisburgu.edu**
Office Hours: **e-mail**

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 trees. **This course requires writing programming assignments**. Students are free to use any of the following programming languages: Java, C, C++, or Python. *Prerequisite: Undergraduate level course in data structures and/or algorithms or equivalent.*

CISC 610-51 is a graduate level course in the field of data structures and Algorithms. It covers basic elements of Algorithms, such as data structures, and analysis of algorithms, sorting, searching, and runtimes.

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.

Note students with disabilities: Harrisburg University's policy is not to discriminate against qualified students with documented disabilities. It is also our 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 me 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.

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. These are demonstrated by the student's ability to
- Identify and clarify the problem,
- Gather information,
- Evaluate the evidence and approach,
- 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 programming.

TEXTBOOK and REFERENCES

○ "**Essential Algorithms: A practical approach to computer algorithms**", by Rod Stephens, (1st Ed.), 2013.

○ "**Introduction to Algorithms**", by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, (3rd Ed.), MIT Press, 2009.

○ "**Algorithms**", by Robert Sedgewick, and Kevin Wayne, (4th Ed.), Addison-Wesley, 2011

ASSIGNMENT, EXAM, and QUIZ DESCRIPTIONS

There are points for quizzes/ class participation, a mid-term exam, programming assignments, and a final exam. Please consult the schedule to see when the quizzes and exams are scheduled. Here is a brief description of each:

Four (4) Assignments - Each student is responsible for completing the assignments in accordance with the specifications given by the instructor. Each assignment is worth a maximum of ten **(10)** points for a total of forty **(40)** points.

Quiz / Class participation - There will be ten **(10)** points for quiz / class participation.

Mid-term Examination - This examination will cover the class material up to the midpoint of the semester (2**5** points).

Final Examination - This will be a comprehensive examination that covers all the course material (**25** points).

COURSE CONDUCT

A few rules will help us to get the most of our investment in CISC 610-51: Classes will start on time and end as scheduled. Please log on to Adobe Connect prior to the start of class.

You will attend each class and actively participate in the discussions during class. If you are uncomfortable with public speaking, or if English is not your native language, please talk to the

instructor in the first two weeks of the course to establish ways to make you more comfortable in speaking and interacting with other students (your peers).

For every class, I anticipate that you will need to budget about 4 hours of out-of-class time. This implies that you need to budget about 120 hours of out-of-class time over the course of the semester. This time estimate is a guide and **you may need to budget more**. For example, if the material is new to you or difficult to comprehend, it will require more of your time.

You are responsible for all the readings, even if the material is not explicitly covered in class. You should read the class materials prior to class and be prepared to discuss and ask questions about the readings and quiz materials. You should also re-read the material after class as not every topic will be covered during class 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.

All work must be completed and turned in on or before the assigned date. **No late work will be accepted**. Late means after the due date and time. Note that a computer's failure is not an excuse (it represents poor planning on your part). However, you will get two chances to submit your assignment late, each time by two days, during the course of the semester, for whatever reasons you may choose to do that.

All written work must be done using a word processor. Carefully proofread your work since mistakes which include spelling errors, grammatical errors, and typos will affect your grade. Your work should be properly referenced and adhere to standards of both academic integrity and proper form. Generally, I prefer the IEEE paper writing style.

All class credit-related electronic mail must be done using Harrisburg's electronic mail service and the student's assigned Harrisburg University ID. Students are welcome to use Gmail, Yahoo mail, Hotmail or any other service for their private non-class-related use. By 'credit-related' I mean all work to be evaluated for credit. Any work submitted through a different mail system will not be accepted.

When individual work is assigned it should be done by you, alone. Students who participate in University-sanctioned events (such as athletics) must make prior arrangements and give the instructor ample notice. Missing class for practice is not advised.

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*.

Course Outline:

Week	Topic
1	**Campus Visit** **Introduction to the Course and to Algorithms** Introduction to the course material, grading, assignments, due dates, and other logistics related to the course. Introduction to Algorithms.
2	**Asymptotic Analysis of Algorithms** Big O, Big Omega and Big Theta
3	**Sorting** Merge sort, Quick sort
4	**Sorting Contd.** Priority queues, heap sort, radix sort, bucket sort
5	**Searching** Elementary Data Structures like stacks and queues, linked lists, hash tables
6	**Search Trees** Binary search trees, Red-Black trees.
7	**Graphs** Undirected graphs, directed graphs.
8	**Graphs Contd.** Minimum spanning trees, shortest paths.
9	**Strings** String sorts, Tries, substring search.
10	**Strings Contd.** Regular expressions, data compression.

12	**Matrix Operations and Linear Programming** Solving systems of linear equations, inverting matrices, formulating programs as linear programs.
13	**Polynomials and FFT** Representing polynomials, the DFT and FFT, Efficient FFT implementation.
14	**NP completeness** Polynomial time, polynomial-time verification, NP-completeness and reducibility, NP-completeness proofs, NP complete problems.