Jackson State University
Department of Computer Science
CSC 323 – 01   Algorithm Design and Analysis
Fall 2019

Instructor: Dr. Natarajan Meghanathan   **Class Room:** ENB 162
Office: ENB 275   **Class Time:** TR 2.30 PM to 3.50 PM
Phone: 601-979-3661   **Office Hours:** TR 4 PM to 5.30 PM
Email: natarajan.meghanathan@jsums.edu

Catalog Description
CSC 323 (3) Algorithm Design and Analysis; Prerequisites: CSC 228 and CSCL 228. Introduces students to various techniques to design and analyze algorithms. Topics include examples of computational problems, basic issues related to algorithms, efficiency comparison, and the design and analysis of brute force, divide-and-conquer, decrease-and-conquer, and transform-and-conquer algorithm design strategies. (F, S).

Course Outcomes
Each student who successfully completes this course should be able to:
   CO-1: Analyze the time complexity of iterative and recursive algorithms with respect to the asymptotic order of growth
   CO-2: Prove or justify the correctness of algorithms and their properties through formal or informal analysis
   CO-3: Design and analyze algorithms to solve optimization problems using classical design strategies such as brute force, divide and conquer, transform and conquer, etc
   CO-4: Reduce one NP-complete problem to another NP-complete problem in polynomial-time as well as design and analyze polynomial-time heuristics to approximate solutions for NP-complete problems
   CO-5: Discuss efficient algorithms for various graph theory problems (like shortest paths and minimum spanning trees) based on different design techniques
   CO-6: Design and analyze algorithms to solve combinatorial problems using advanced techniques such as dynamic programming and greedy strategies
   CO-7: Develop and evaluate efficient implementations of algorithms, based on the different design techniques, and their associated run-time complexity through experimental analysis

Textbook
R. Neapolitan, "Foundations of Algorithms," 5th Edition, Jones & Bartlett Learning, 2015, ISBN: 1284049191.

Course Website
http://www.jsums.edu/nmeghanathan/csc323-fall2019/
Students are required to attend every class and frequently check the course website for latest updates regarding the course. All announcements, lecture materials for all chapters, lab projects, reading assignments, sample questions and quiz solutions will be posted in the course website. Note that the course website can also be accessed by visiting the link http://www.jsums.edu/nmeghanathan and clicking on the CSC 323 Course link in the list of courses for Fall 2019.

Canvas
Students are required to check the Canvas site for the course. Some of the quizzes and exams would need to be answered through Canvas. All the project submissions should be done through Canvas. NO LATE SUBMISSIONS will be accepted for any reason.

Evaluation

Exams – 39% (3 Exams; 13% for each Exam)

Quizzes – 21% (7 Quizzes; 3% for each Quiz): All the quizzes will be required/considered for the final grade. The syllabus for each Quiz will be announced at least a class before the quiz.

Projects – 40% (8 Projects; 5% per Project): All projects will be programming projects (individual).

Quiz, Projects and Exam Calendar: Unless otherwise notified, we will stick on to the following dates for the quizzes and exams. A Quiz could be conducted any time during the class. So, students need to be present on-time at the beginning of the class and stay till the end of the class.

	Tuesday	Thursday
Week 1	08/20	08/22
Week 2	08/27	08/29
Week 3	09/03	09/05
Week 4	09/10	09/12
Week 5	09/17, PROJECT 1	09/19, QUIZ 1
Week 6	09/24,	09/26, EXAM 1
Week 7	10/01, PROJECT 2	10/03, QUIZ 2
Week 8	10/08, PROJECT 3	10/10, QUIZ 3
Week 9	10/15, PROJECT 4	10/17, QUIZ 4
Week 10	10/22, PROJECT 5	10/24, EXAM 2
Week 11	10/29, PROJECT 6	10/31, QUIZ 5
Week 12	11/05, PROJECT 7	11/07, QUIZ 6
Week 13	11/12, PROJECT 8	11/14, QUIZ 7
Week 14	11/19	11/21, EXAM 3
Week 15	11/27, Thanksgiving Break	11/29, Thanksgiving Break

Project Report Submissions: All project reports should be submitted through Canvas. The project report should include all the programs and the submission items stated in the project description. For some projects, you will probably have to record a video of your presentation to demonstrate the working of the project and submit the video through GoogleDrive (using your JSU student account) or through Canvas.

Program Outcomes
Each student who graduates from the Undergraduate program in Computer Science will be able to:
(1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
(2) Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
(3) Communicate effectively in a variety of professional contexts.
(4) Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
(5) Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
(6) Apply computer science theory and software development fundamentals to produce computing-based solutions.

Mapping of CSC 323 Course Outcomes to Program Outcomes

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
(1)	X	X		X			
(2)							X
(6)			X		X	X	

Course Outline (Tentative)

Week #	Topics to be Covered	Course Outcomes
Week 1	Module 1: Analyzing the Efficiency of Algorithms: Best, Worst and Average-case analysis; Order of growth; Asymptotic notations; Analysis of iterative algorithms	CO-1
Week 2	Module 1: Analysis of recursive algorithms and solving recurrence relations (including Master Theorem)	CO-1
Week 3	Module 2: Divide and Conquer: Merge sort and its complexity analysis; Applications of divide and conquer strategy	CO-2 CO-3
Week 4	Module 2: Applications of Binary Search (incl. two-dimensional data)	CO-6
Week 5	Module 3: Greedy strategy: Fractional Knapsack problem; Huffman encoding: tree construction algorithm	CO-6
Week 6	Module 4: Dynamic Programming and Space-time tradeoff: Binomial Coefficient; Coin collecting problem; Hash table and its applications	CO-6
Week 7	Module 4: Dynamic Programming: Integer Knapsack problem; Longest Common Subsequence (LCS) Problem	CO-6
Week 8	Module 5: Graph Algorithms: Review of Breadth First Search and Depth First Search Algorithms and their Applications; Topological Sort of a DAG; Proof of Correctness of DAG properties	CO-2 CO-5
Week 9	Module 5: Graph Algorithms: Computation of Betweeness Centrality using Breadth First Search; Shortest Path Algorithm; Proof of Correctness	CO-2 CO-5
Week 10	Module 5: Graph Algorithms: Kruskal's algorithm for minimum spanning trees and proof of correctness; Properties of Minimum Spanning Trees	CO-2 CO-5
Week 11	Module 5: Graph Algorithms: Floyd-Warshall algorithm; Counting the Number of Walks in a graph	CO-5
Week 12	Module 6 – Limitations of P, NP, and NP-complete problems; Polynomial time reductions of NP-complete problems	CO-4
Week 13	Module 6 – Approximation algorithms for the Traveling salesman problem: Multi-fragment heuristic, 2-Change heuristic	CO-4
Week 14	Module 6 - Heuristics for the Connected Dominating Set problem; Review for Exam 3	CO-4
Week 15	Thanksgiving Break	

Grading Scale

90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
Below 60	F

Reference Books

No.	Book Title/ Edition, Year	Authors	Publisher	ISBN
1	Introduction to Algorithms, 3rd Edition, 2009	T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein	MIT Press	0262033844
2	Algorithms, 4th Edition, 2011	R. Sedgewick and K. Wayne	Addison-Wesley	032157351X
3	The Algorithm Design Manual, 2nd Edition, 2008	S. S. Skiena	Springer	1848000693
4	Algorithms, 1st Edition, 2006	S. Dasgupta, C. Papadimitriou and U. Vazirani	McGraw-Hill Science	0073523402
5	Algorithm Design: Foundations, Analysis and Internet Examples, 1st Edition, 2001	M. T. Goodrich and R. Tamassia	Wiley	0471383651
6	Data Structure and Algorithm Analysis in Java, 3rd Edition, 2011	M. A. Weiss	Addison-Wesley	0132576279
7	Data Structures & Problem Solving using Java, 4th Edition, 2009	M. A. Weiss	Addison-Wesley	0321541405
8	Advanced Concepts in Operating Systems, 1994	M. Singhal and N. Shivaratri	McGraw Hill	007057572X
9	Algorithm Design, 1st Edition, 2005	J. Kleinberg and E. Tardos	Addison-Wesley	0321295358
10	Data Structures, Algorithms, and Applications in Java, 2nd Edition, 2004	Sartaj Sahni	Silicon Press	0929306333

ADA Statement

Compliance with the Americans with Disabilities Act: "It is the university policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Students with disabilities are encouraged to contact their instructors to discuss their individual needs for accommodations."

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and ADA Coordinator (as early as possible in the term) located in the Jacob L. Reddix Building (old student union), rooms 101 and 102. The office hours are: 8:00 a. m. to 5:00 p.m., Monday through Friday. The telephone number is (601) 979-3704 or (601) 979-6919 (TTY) and the facsimile number is (601) 979-6918. The mailing address is: Office of Support Services for Students and Employees with Disabilities, P.O. Box 17156, Jackson State University, Jackson MS 39217.

Diversity Statement

Jackson State University is committed to creating a community that affirms and welcomes persons from diverse backgrounds and experiences and support the realization of their potential. We recognize that there are differences among groups of people and individuals based on ethnicity, race, socioeconomic status, gender, exceptionalities, language religion, sexual orientation, and geographical area. All persons are encouraged to respect the individual difference of others.

Collegiate Code of Conduct

Jackson State University students are expected to dress in a manner representative of higher education institution. More information on Dress Code; Verbal and/or Physical Harassment; Indecent, Obscene, Immoral Behavior and/or Profanity is available in the JSU Student Handbook. The JSU Student Handbook is available at http://www.jsums.edu/~studentlife/handbook.pdf

Dropping a course

The last day to drop a course with no grade: August 30, 2019
The last day to drop a course with "W" grade: October 25, 2019

Course Policies

Note: The course policies will be strictly adhered to. Students are expected to be aware of the course policies throughout the semester.

Exam/ Quiz Dates

- Unless otherwise notified, we will stick on to dates for the quizzes and exams listed in Page 2 of this syllabus. A Quiz could be conducted any time during the class. So, students need to be present on-time at the beginning of the class and stay till the end of the class.

Programming Projects

- **Late submission of projects will not be accepted.**
- It is the responsibility of the student to make sure he/she can print the project reports before the due date /time. No excuse will be given for lack of computer access, printers to print the document.

Make-up Quizzes and Exams

- No Make-up Quizzes will be given. If a student misses a quiz for ANY reason, the student gets a score of 'zero' for the quiz and no make-up quiz will be given.
- **No make-up examinations will be given except for emergencies such as death in the family or serious illness. The instructor must be informed, through e-mail or a written request, BEFORE the time of the examination that is to be missed.** The instructor will make a decision on the make-up examination after verifying the appropriate written documentation. Failure to furnish, written, verifiable documentation will result in a grade of zero for the missed examination.
- **Any make-up exam for a missed exam has to be taken before the next class meeting time.**
- **A make-up exam will be different and will be relatively tough compared to the actual missed exam.**
- **NO MAKE-UP EXAM WILL BE GIVEN FOR THE FINAL EXAM. Students are required to take the final exam during the date and time specified by the university.**

Contesting Grades

- Grades for a particular exam or quiz can be contested only within a week after the grades for that exam/quiz are announced.
- Grades for the final exam will have to be contested within two days after the exam.
- The grade for the overall course will have to be also contested within two days after the final exam. Any change of grade requested by the student 48 hours after the completion of the final exam will not be considered.

Maintaining Registration Status

- It is the duty of the student to make sure that he/she stays registered in the course throughout the semester. If a student sees he/she is dropped from the course without his/her knowledge, the student should notify the instructor before the next meeting of the class.
- A student cannot attend a class or take an exam/quiz if the student is not registered for the course at that point of time.

Dropping the Course

- The last date to drop the course without any grade is August 30, 2019. The last date to drop the course with a "W" grade is October 25, 2019.
- The instructor will not assist in any way to get the student dropped with no grade or "W" grade after the above dates.

Anticipated Leave

- If a student is anticipating any medical emergency (like surgery, pregnancy, etc.), conference participation, game participation, etc. during the course of the semester, the student should furnish the appropriate medical documents, conference registration receipt, letter from the coach, etc, and discuss with the instructor within the first two weeks of the course on how to make up for the classes/exams/assignments that will be missed.
- The instructor will make a decision on the make-up examination after verifying the appropriate written documentation. Failure to furnish, written, verifiable documentation will result in a grade of zero for the missed examination.
- The instructor will give a different set of assignments, projects and make-up exams than the ones given in class.
- **<u>The student is responsible for the materials covered in a class that he/she misses.</u>**

Other Course Policies

- If a student leaves the classroom during a quiz or exam for any reason, the student's exam paper will be collected, and thus he/she will not be able to resume the testing after coming back to the room. Inform the instructor if any health problem prevents you from remaining in the classroom until you complete the quiz or exam.
- Students should not use cell phone and/or laptop during lecture time for purposes other than those related to the course.
- Students found to be disturbing the class during lecture time could be asked to leave the class for the remaining lecture time of the day.

Cheating

- Student(s) found to have involved in cheating (e.g., copying work) for even one question in an exam/quiz/project will get a ZERO for the entire exam/quiz/project. All the students involved (i.e., those who copied the work of others as well as those who did the work and shared with others) in copying will get a ZERO for the entire exam/quiz/project.

Explaining the Submitted Work/Code

- Student(s) should be able to explain their work/code any time (after submission) when the instructor questions them. Failure to adequately explain the submitted work/code will result in a ZERO for the corresponding exam/quiz/project.

Student Conduct and Class Attendance Policy

Students at Jackson State University must fully commit themselves to their program of study. One hundred percent (100%) punctual class attendance is expected from each student for all the scheduled classes and activities. The instructor will be maintaining the attendance record and any absence of a student without providing any written official excuse, is counted as an unexcused absence. Irrespective of the type of excuse (i.e., official or unofficial), the student is responsible for the work required during their absences.

The instructor will call the roll at the beginning of the class. Also, the instructor will pass an attendance sign-up sheet to each student. Students coming late to the class by more than 10 minutes will be marked "Absent".

Students may be officially excused from class for attendance at University approved functions provided the sponsor properly executes a Student Affairs Leave Form. The instructor shall accept such excuses. The Dean of the School or the Vice President for Academic Affairs may also officially excuse students for certain campus activities. Students must submit written documentation to Student Affairs to obtain official excuses for absences due to illness or other emergency situations. Students who willfully miss class face serious consequences. After being absent four times in a 80-minute class, one time immediately before or after a scheduled recess/holiday, the instructor shall report the next unexcused absence to the Dean of University College for freshmen and sophomores and to the School Dean and Department Chair for Juniors and Seniors. The Dean/Chair or designee will counsel with the student and in concert with the instructor, may require the student complete complimentary course assignments. If a student does not respond well to the counsel or with the assignments, the instructor may impose a grade penalty on the student. Unexcused absences that exceed the equivalency of four 80-minute sessions may lead to an "F" for the course.

Academic Honesty

All acts of academic dishonesty (e.g., cheating on exams, plagiarizing – presenting another person's work as one's own, having another person write one's paper, making up research data, presenting excuses which are untrue for failing to meet academic and professional standards) are a violation of engineering values, ethics, and University policy, which will entail appropriate penalties.

Policy Regarding Course Incompleteness

Incomplete is the designation used to indicate failure to complete assignments or other course work including final or other examinations, by the end of the term in which the student is enrolled. The grade of incomplete "I" is recorded when the student has not completed the course due to some unavoidable reason that is acceptable by the instructor. An incomplete grade "I" is to be considered only when the majority of the course requirements and the assignments have been successfully completed and there is a documented crisis situation of illness, accident, or other occurrence which prevents a student from completing the remaining requirements before the school term ends. The incomplete grade "I" is not a substitute for the failure grade "F".

The instructor is required to indicate on the grade sheet the grade the student should receive if the incomplete is not removed within the prescribed time. If the student fails to complete the course requirements satisfactorily within the specified time, the alternate grade will be recorded as the grade of record.