

**UNIVERSITY OF GHANA**

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**DEPARTMENT OF COMPUTER SCIENCE**

**SCHOOL OF PHYSICAL AND MATHEMATICAL SCIENCE**

**SEMESTER 2 2023/2024 ACADEMIC YEAR**

**COURSE SYLLABUS**

**Course Code and Title: DCIT 204 – Data Structures and Algorithms 1**

**Credits: 3**

**Lecture Period(s):** Thursday, 1.30pm to 3.20pm

**Tutorial**: Friday, 10.30 to 11.20am

**Lecture Venue:** JQB14

**Lecturer:** Dr Kofi Sarpong Adu-Manu

**Email:** [ksadu-manu@ug.edu.gh](mailto:mamensah@ug.edu.gh)

**COURSE DESCRIPTION**

This course focuses on the fundamentals of computer algorithms, with emphasis on methods useful in practice. Using the Big-O notation, algorithms are classified by their efficiency. We look into basic algorithm strategies and approaches to problem-solving. Some of these approaches include the divide and conquer method, dynamic programming, and greedy programming paradigms. Sorting and searching algorithms are discussed in detail as they form part of a solution to many problems solved using computers. The course also introduces graph theory and graph algorithms, which are also used in many computer-based applications today.

**RATIONALE**

Students investigate the development of efficient algorithms for simple computational tasks and the reasoning behind their correctness. The concept of tractable and intractable problems will be understood through the use of complexity measures.

**COURSE OBJECTIVES**

Upon completion of this course, students will be able to do the following:

* Examine algorithm asymptotic performance.
* Create rigorous proofs of algorithm correctness.
* Show your understanding of significant algorithms and data structures.
* Use fundamental algorithmic design paradigms and analysis techniques.
* Create efficient algorithms in everyday science/engineering design situations.

**RECOMMENDED TEXTBOOK (RT)**

There is one recommended textbook in this course:

Levitin, A. (2012).***Introduction to the Design and Analysis of Algorithms* ( 3rd Edition)**. Harlow: Addison Wesley.

**READING LISTS (RL)**

1. Olds E., Lysecky R., Givargis T., & Lysecky S. (2021). Data Structures Essentials: Pseudocode with Java Examples. Zyante Inc. (zyBooks.com)
2. Cormen, T. H., Leiserson C. E., Rivest R. L., & Stein, C. (2013*). Introduction to Algorithms. Cambridge, Mass*.: The MIT Press.
3. Dasgupta, S., Papadimitriou, C. H., & Vazirani, U*.* (2012). *Algorithms.* Boston: The McGraw-Hill Companies.
4. Goodman, S. E., & Hedetniemi, S. T. (2012). *Introduction to the Design and Analysis of Algorithms*. New York: Mcgraw-Hill College.
5. Aho, A. V., Hopcroft, J. E., & Ullman, J. D. (2010). *The Design and Analysis of Computer Algorithms.* Reading, Mass.: Addison-Wesley.

**GRADING**

The University of Ghana System will award grades for undergraduate students. The Instructor may adjust weighted scores to calculate final grades. Final grades will be based on components as follows:

* Quizzes 10%
* Algorithms and Programming Assignments 10%
* Interim Assessment (IA) 15%
* Group Programming Project 15%
* Final Exam 50%

**QUIZZES**Quizzes will be conducted after each lesson in the semester on Sakai. Missing quizzes will attract a zero (0) point.

**DISCUSSION FORUMS**

Students are required to participate in discussion forums during the week on topics shared by the Instructor. Students may be required to comment on their colleagues' responses as may be deemed fit by the Course Instructor.

**QUIZZES AND ASSIGNMENTS**

Quizzes and assignments will be given, and each will count towards the final grade - there are no "elective" assignments. Each quiz and assignments are to be completed and submitted as particularised by the Instructor. **Assignments may also be in report writing, algorithms, or programming implementation** and submitted before the deadline to the instructor. Quizzes and assignments presented after the deadline attract a “zero” score. **Students will be notified as and when quizzes are scheduled.**

**SEMESTER PROJECT**

Students will be put into groups to implement a project using concepts learnt in class.

**FINAL EXAM**

The concluding exam will be held during the scheduled final exam session and based on topics addressed during the entire course. The final exam will be "On-site physical."

**FINAL GRADE**

Final grades are non-negotiable. Please do not try to bargain with, persuade, intimidate, or otherwise coerce your Instructor to adjust your grade. When you take the course, you agree to the terms of the syllabus. Furthermore, grades are computed using appropriate weightings with the total percentage of 100 the grade equals, and NOT by combining all deliverables and dividing by the raw number of deliverables.

Neither students nor instructors are perfect and seldom do mistakes in grading occur. In such situations, students must inform their lecturers as soon as probable to recheck grades. Lecturers have 24 hours to get back to you concerning any observed or real grading issue.

**COURSE DELIVERY PLAN**

* The course will be delivered through live sessions and video lectures published on Sakai.
* Weekly virtual tutorial sessions will be organised, and session schedules will be duly communicated.
* Assignments will help students connect and take the perspective of the theoretical concept and knowledge, of course.
* Group projects may be given.

**COURSE SCHEDULE:**

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| --- | --- | --- |
| **Sessions** | **Contents** | **Activity Description** |
| **1** | Introduction to Data Structures and Algorithms | **Activity 1:** Read this article for an overview of the importance of algorithms and a listing of some of the critical algorithm areas.  [Click <http://web.archive.org/web/20140916113120/http:/community.topcoder.com/tc?module=Static&d1=tutorials&d2=importance_of_algorithms> link to open resource.] |
|  | | |
| 2 | Fundamentals of the Analysis of Algorithm Efficiency | **Activity 2:** Read the Prologue of S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani's book *Algorithms* [Click [https://web.archive.org/web/20120308144150/http://www.cs.berkeley.edu/~vazirani/algorithms/chap0.pdf](https://web.archive.org/web/20120308144150/http:/www.cs.berkeley.edu/~vazirani/algorithms/chap0.pdf) link to open resource.] |
|  | **Reading Assignment [Write a 2-page report on Activities 1 and 2 for discussion in class]** |
|  | | |
| 3 and 4 | Searching and Algorithm Analysis | **Activity 3:** Read this page to get an introduction to algorithms.  [Click <https://en.wikibooks.org/wiki/Algorithms/Introduction> link to open resource.] |
| Sorting Algorithms | **Assignment [Code implementation of Algorithms]** |
|  | | |
| 5 | Divide and Conquer | **Activity 4:** Read Chapter 2 of S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani's book *Algorithms*.  [Click [https://web.archive.org/web/20120308140658/http://www.cs.berkeley.edu/~vazirani/algorithms/chap2.pdf](https://web.archive.org/web/20120308140658/http:/www.cs.berkeley.edu/~vazirani/algorithms/chap2.pdf) link to open resource.] |
| 6 and 7 | Greedy Algorithm | **Activity 5:** Read Chapter 5 of S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani's book *Algorithms*.  [Click [https://web.archive.org/web/20120308140110/http://www.cs.berkeley.edu/~vazirani/algorithms/chap5.pdf](https://web.archive.org/web/20120308140110/http:/www.cs.berkeley.edu/~vazirani/algorithms/chap5.pdf) link to open resource.] |
|  |  | **Reading Assignment [Write a 2-page report on Activities 3 and 4 for discussion in class]** |
|  | | |
| 8 | Dynamic Programming | **Activity 5:** Read Chapter 6 of S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani's book *Algorithms*. [Click [https://web.archive.org/web/20120308142842/http://www.cs.berkeley.edu/~vazirani/algorithms/chap6.pdf](https://web.archive.org/web/20120308142842/http:/www.cs.berkeley.edu/~vazirani/algorithms/chap6.pdf) link to open resource.] |
| 9 and 10 | Graph Theory and Algorithms | **Activity 6:** Read this chapter for an introduction to graph theory. [Click <https://s3.amazonaws.com/saylordotorg-resources/wwwresources/site/wp-content/uploads/2011/09/CS202-Graph-Theory-GT-Edward-Bender.pdf> link to open resource.] |
|  | **Reading Assignment [Write a 2-page report on Activities 5 and 6 for discussion in class]** |
|  | **Group Project Presentation** |  |
|  | | |

***This Schedule is subject to revision before and throughout the course. Registered students should see Sakai for the latest class schedule.***

If a session is cancelled or put off:

* In consultation with class representatives, the lecturer may arrange for a Make-Up Day, in which case the cancelled session will be held on that day. Please note that the Make-Up Day may be a different day of the week from the regular class day.
* After giving students advance notice, the lecturer will reserve the prerogative to schedule an ad hoc make-up session (after giving students advance notice). All sessions will be online – students will need internet access and a compatible browser to participate in real-time. Online schedules will be arranged using the Microsoft Calendar on Teams platform; hence, students should note and get acquainted ahead of time.

**ATTENDANCE POLICY**

**Class attendance is compulsory.** Students are expected to attend every session, complete any required preparatory work (including assigned reading – see Schedule above), and participate actively in sessions, discussions, and assignments. All students are to contribute regardless of their proficiency with the topics.

Students are to make prior arrangements with Instructor if they know that they will miss any session and consult with the Instructor as soon as possible if they miss any session without prior notice.

**ONLINE SESSION CONDUCT**

Students are to conduct themselves in a conducive to learning, as directed by the Instructor. Any student who negatively impacts other students' learning opportunities may be asked to leave a live online session or remove the Instructor.

All mics must be muted during a presentation from the lecturer. Students who cannot speak have no right to turn on their microphones during an ongoing session. Gestures such as **raised hands** are allowed to draw the instructors attention when required.

Students must partake in live online sessions using a computer with suitable cameras to allow for demonstrations. Students who may have the privilege of making periodic presentations may earn bonus marks leading to their final grade.

**During a live online session, all participants are required to turn on their laptop/pc cameras and are also required to assume proper body postures.**

**COMMUNICATIONS**

Registered students will be given access to a Sakai section for this course. Sakai will be used as the primary mechanism (outside of lectures) to disseminate course information, including announcements, lecture slides, assignments and other assignments, and scores for assignments. Some notifications may be sent via Sakai to students' UG email accounts.

Communication with the Instructor on issues relating to the individual student should only be conducted using UG email, telephone, or in-person - not in the public "Discussions" forums on Sakai. To protect student privacy, any communication related to a student's status must be conducted using secure UG systems – if you use email to communicate with the Instructor, you ***MUST*** send messages from your UG email account. Students must activate and monitor their UG email accounts to receive relevant information from the University, including messages related to this class.

Course materials (including assignment specifications, etc.) are published on Sakai in Adobe® Portable Document Format (PDF). This allows users of most computing platforms to view and print these files. Microsoft® Word (or a compatible word processing application) is required for preparing assignments – it is available on computers in the UG open labs across the campus.

Online sections will use several tools through the Sakai course management system. Students are responsible for obtaining Internet access and a compatible platform. Appropriate computers are available on campus in open labs across the University.

**PRIVACY**

Instructors respect and protect the confidentiality of information related to individual students. As described above, an individual student's issues will be discussed via email, telephone or in-person. Instructors will not discuss issues relating to an individual student with other students (or anyone without a need to know) without prior permission of the student. Assignments, quizzes, mid-term exams and other assessable work will be returned to individual students directly by the Instructor (or by a faculty member, staff member, or Teaching Assistant designated by the Instructor, or via another secure method). Under no circumstances will a student's graded work be returned to another student.

Instructors, staff, and Teaching Assistants will take care to protect the privacy of each student's scores and grades.

**ACADEMIC INTEGRITY**

All members of the UG community are expected to uphold the principles of scholarly ethics.

On admission to UG, students agree to comply with the requirements of the University. Any use of the words or ideas of another person(s) without explicit attribution that identifies the material used and its source appropriately is **plagiarism** and will not be tolerated.

The Instructor reserves the right to use manual and automated means (including such services as Turnitin) to detect plagiarism in any work submitted by students for this course and direct Teaching Assistants and other faculty and staff members to do likewise in support of this course.

For this course, the following requirements are specified:

* All assessable work is to be prepared by the individual student unless the Instructor explicitly directs otherwise.
* All work must be newly created by the individual student for this course for this semester. Any usage of work developed for another course, or this course in a prior semester, is strictly prohibited without the instructor's prior approval.
* No digital reproduction of any part of an exam or quiz. No posting quiz questions to online test outlets or social media sites. Electronic reproduction of any assessable work in this course is PROHIBITED unless authorised by the course coordinator (not the section instructor).
* Usage of electronic devices is STRICTLY PROHIBITED during any period when there is assessable work in the students' possession – this includes exams, quizzes, and any other type of assessable work.
* Students MUST put their cell phones away during exams and quizzes, with volume or ringers turned off.

Students may seek assistance with assigned work (and are encouraged to do so if they feel the need), *provided*:

* The directions for the assigned work do not prohibit such assistance.
* Such assistance is explicitly acknowledged in the submitted work, clearly identifying the person(s) giving assistance and the nature of the assistance provided.
* Any work to be submitted is prepared entirely and exclusively by the student submitting it. Students are expressly prohibited from sharing any assessable work for this course in any manner with other students (except students assigned as Teaching Assistants or Academic supervisors to this course and the student's section) unless all students involved have had their work graded and returned by the Instructor, or the Instructor has explicitly approved such sharing.

Another aspect of academic integrity is the free exchange of ideas. Vigorous discussion and debate are encouraged in this course. The firm expects all aspects of the class to be conducted with civility and respect for differing ideas, perspectives, and traditions.

Students are encouraged to clarify any academic integrity issues and seek guidance from the Instructor, other faculty members, academic advisors, or the Head of the Department's Office.

**NOTE: Plagiarism test results must be obtained from Turnitin, and they must be less than 20% for submitting the reading reports, reviews, and assignments. Otherwise, it will not be accepted.**