American Public University System
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CSCI240: Algorithms and Data Structures I

Course Summary

Course:CSCI240 Title: Algorithms and Data Structures I

Length of Course: 16

Prerequisites: CSCI140 or CSCI150 Credit Hours: 3

Description

Course Description: This course strengthens and broadens students' awareness of existing trends in the development of object-oriented programming. Students expand their use of a structured design method to provide systematic analysis of performance and systematic proof of correctness. Students gain a deeper understanding of concepts like implementations of abstract data types and present data structures linked to stacks, queues, and hashes. The course will also address advanced concepts related to algorithms that will include divide-and-conquer and dynamic programming. Students will also learn how to analyze different algorithm development as well as various sorting strategies. (Prerequisites: CSCI140 or CSCI150)

Course Scope: This course will assume you know at least one programming language as you will need that to write code to implement many of the algorithms the course will discuss. You also need some basic mathematical understanding to understand some of the formulas used to express complexity of the different algorithms.

Objectives

By the end of this course, you will be able to:

- CO1: Apply different algorithmic techniques to solve complex problems.
- CO2: Analyze different types of algorithms.
- CO3: Compare different sorting techniques.
- CO4: Explore elementary data structures like stacks, queues, and hashes.
- CO5: Analyze different algorithms related to trees.
- CO6: Compare different standard methods for simplifying the asymptotic analysis of algorithms.

Outline

Week 1: Algorithms and their role in computing

Learning Outcomes

LO1.1: Characterize frameworks for describing and analyzing algorithms.

LO1.2: Develop different types of algorithms.

LO2.1: Compare and contrast the sorting algorithms of insertion sort and merge sort.

LO2.2: Demonstrate the ability to describe algorithms using pseudocode.

LO3.1: Investigate the “divide and conquer” technique within the context of merge sort.

Reading and Resources

Introduction to Algorithms, Third Edition

Chapters 1 & 2

Assignments

- Week 1 Welcome Discussion – For week 1, the discussion is due at the end of the week on Sunday. In subsequent weeks, the initial post is due mid-week.
- Week 1 Discussion: Your First Algorithm
- Week 1 Assignment

Week 2: Growth of Functions

Learning Outcomes

LO6.1: Explain the behavior of functions as they approach their limits, particularly in the context of studying asymptotic efficiency.

LO6.2: Explain the growth patterns of functions.

LO6.3: Identify and emphasize essential aspects by abstracting low-order terms and constant factors from mathematical expressions.

LO6.4: Explore methods for indicating the running times of algorithms.

LO6.5: Compare the relative “sizes” or complexities of different functions.

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 3

Assignments

Week 2 Assignment

Week 3: Divide and Conquer (part 1)

Learning Outcomes

LO2.1: Analyze divide-and-conquer paradigm

LO1.1: Apply recursion to solve problems

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 4

Assignments

Week 3 Discussion

Week 4: Divide and Conquer Part 2

Learning Outcomes

LO2.1: Analyze divide-and-conquer paradigm

LO1.1: Apply recurrences to solve problems

LO3.1: Compare different techniques for solving

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 4

Assignments

Week 4 Assignment

Week 5: Heapsort (Part 1)

Learning Outcomes

LO2.1: Analyze the heapsort algorithm

LO3.1: Build the heap data structure

LO4.1: Introduce priority queue

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 6

Assignments

Week 5 Discussion: Priority Queues

Week 6: Heapsort Part 2

Learning Outcomes

LO2.1: Analyze the heapsort algorithm
LO3.1: Build the heap data structure
LO4.1: Introduce priority queues

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 6

URL:
http://ezproxy.apus.edu/login?url=https://ebookcentral.proquest.com/lib/apus/detail.action?docID=3339142

Assignments

Week 6 Assignment

Week 7: Quicksort Part 1

Learning Outcomes

LO2.1: Analyze the quick sort algorithm
LO3.1: Analyze the complexity of comparison-based algorithms
LO3.2: Analyze linear-time sorting algorithms

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 7 & 8

Assignments

Week 7 Discussion: Quick Sort

Week 8: Quicksort Part 2

Learning Outcomes

LO2.1: Analyze the quick sort algorithm
LO3.1: Analyze the complexity of comparison-based algorithms
LO3.2: Analyze linear-time sorting algorithms

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 7 & 8

Assignments

Week 8 Assignment: Quick Sort

Week 9: Elementary Data Structure

Learning Outcomes

LO4.1: Analyze Stacks and Queue operations
LO2.1: Analyze the constructions and the operations for linked lists
LO4.2: Implement pointers and objects
LO5.1: Represent rooted trees

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 10

Assignments

Week 9 Discussion: Arrays Vs Pointers

Week 10: Elementary Data Structures Part 2

Learning Outcomes

LO4.1: Analyze Stacks and Queue operations
LO2.1: Analyze the constructions and the operations for linked lists
LO4.2: Implement pointers and objects
LO5.1: Represent rooted trees

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 10

Assignments

Week 10 Assignment: Quick Sort

Week 11: Hash Tables Part 1

Learning Outcomes

LO4.1: Analyze the operations of hash tables
LO1.1: Apply different methods to compute hash functions

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 11

Assignments

Week 11 Discussion: Hash Functions

Week 12: Hash Tables Part 2

Learning Outcomes

LO4.1: Analyze the operations of hash tables
LO1.1: Apply different methods to compute hash functions

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 11

Assignments

Week 12 Assignment: Hashing

Week 13: Quicksort Part 1

Learning Outcomes

LO1.1: Define binary search trees

LO5.1: Apply different operations related to binary search trees

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 12

Assignments

Week 13 Discussion: Quick Sort

Week 14: Binary Search Trees Part 2

Learning Outcomes

LO1.1: Define binary search trees

LO5.1: Apply different operations related to binary search trees

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 12

Assignments

Week 14 Assignment: Quick Sort

Week 15: Red-Black Trees Part 1

Learning Outcomes

LO1.1: Define red-black trees

LO5.1: Perform different operations for red-black trees

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 13

Assignments

Week 15 Discussion: Red-Black Trees

Week 16: Red-Black Trees Part 2

Learning Outcomes

LO1.1: Define red-black trees

LO5.1: Perform different operations for red-black trees

Reading and Resources

Introduction to Algorithms, Third Edition

Chapter 13

Assignments

Week 16 Assignment: Red-Black Trees

Evaluation

Grading

Name	*Grade %*
Discussions	**40%**
Assignments	**60%**

Materials

Book Title: Various resources from Trefry Library and/or the Open Web are used. Links provided inside the classroom.

All required readings are located in the Reading and Resources tab under the Lessons tab.

Course Guidelines

Writing Expectations

All activities completed in this course are to follow the stated instructions (inside the classroom). Always check the grading rubrics to see what your instructor will be on the lookout for when grading your work. Also, be sure you have read the APUS Plagiarism Policy (the entire Academic Dishonesty section) before submitting work in this or in any other course. See the above Course Outline or the Policies section on this Syllabus for links.

Citation and Reference Style

Attention: You will follow the citation style that is common to your discipline. Instructions regarding citation styles are included in the classroom.

Late Assignments

Students are expected to submit assignments by the due dates listed in the classroom. Late assignments, including but not limited to Assignments, Discussions, posts and responses, quizzes, and exams, may or may not be accepted after the course end date. Submitting an assignment after the due date may result in a penalty of up to 10% of the grade per day late, not to exceed a maximum 50% of the grade. The amount of the penalty is at the faculty member's discretion. Faculty recognize that students have limited time and maybe more flexible if potential delays are communicated ahead of time.*

*Doctoral and Programs with specialty accreditation may have different late policies.

**Students with DSA accommodations may have different late policies applied. For more information regarding our DSA services, please contact DSA@apus.edu.

Also, completing all Assignments (under the Assignments tab) is paramount to your success in this course.

Netiquette

Online universities promote the advancement of knowledge through positive and constructive debate, both inside and outside the classroom. Forums on the Internet, however, can occasionally degenerate into needless insults and flaming. Such activity and the loss of good manners are not acceptable in a university setting. Basic academic rules of good behavior and proper Netiquette must persist. Remember that you are in a place for the rewards and excitement of learning, which does not include descent to personal attacks orstudent attempts to stifle the learning of others.

- Humor Note: Despite the best of intentions, jokes and especially satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add emoticons to help alert your readers: ;-), :), .

Disclaimer Statement

Course content may vary from the outline to meet the needs of this particular group.

Communications

Student Communication

To reach the instructor, please communicate through the MyClassroom email function accessible from the Classlist of the Course Tools menu, where the instructor and students email addresses are listed, or via the Office 365 tool on the Course homepage.

- In emails to instructors, it's important to note the specific course in which you are enrolled. The name of the course is at the top center of all pages.
- Students and instructors communicate in Discussion posts and other learning activities.
- All interactions should follow APUS guidelines, as noted in the Student Handbook, and maintain a professional, courteous tone.
- Students should review writing for spelling and grammar.
- Tips on Using the Office 365 Email Tool

Instructor Communication

The instructor will post announcements on communications preferences involving email and Instant Messaging and any changes in the class schedule or activities.

- Instructors will periodically post information on the expectations of students and will provide feedback on assignments, Discussion posts, quizzes, and exams.
- Instructors will generally acknowledge student communications within 24 hours and respond within 48hours, except in unusual circumstances (e.g., illness).
- The APUS standard for grading of all assessments (assignments, Discussions, quizzes, exams) is five days or fewer from the due date.
- Final course grades are submitted by faculty no later than seven days after the end date of the course or the end of the extension period.

University Policies

Consult the Student Handbook for processes and policies at APUS. Notable policies:

- Drop/Withdrawal Policy
- Extension Requests
- Academic Probation
- Appeals
- Academic Dishonesty / Plagiarism
- Disability Accommodations
- Student Deadlines
- Video Conference Policy

Mission

The mission of American Public University System is to provide high-quality higher education with emphasis on educating the nation's military and public service communities by offering respected, relevant, accessible, affordable, and student-focused online programs that prepare students for service and leadership in a diverse, global society.

Minimum Technology Requirements

- Please consult the catalog for the minimum hardware and software required for undergraduate and graduate courses.
- Although students are encouraged to use the Pulse mobile app with any course, please note that not all course work can be completed via a mobile device.

Disclaimers

- Please note that course content – and, thus, the syllabus – may change between when a student registers for a course and when the course starts.
- Course content may vary from the syllabus' schedule to meet the needs of a particular group.