

# uCertify

## Course Outline

### Data Structures and Algorithms in Python



04 Aug 2025

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Here's what you get

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Here's what you get

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## 1. Course Objective

Use the Data Structures and Algorithms in Python course and lab to master all the concepts associated with Data Structures algorithms. The lab is cloud-based, device-enabled, and can easily be integrated with an LMS. With this course, you will learn common data structures and algorithms in Python and gain skills on topics like object-oriented programming, algorithm analysis, graph algorithms, array-based sequences, memory management, text processing, linked lists, and recursions.

## 2. Pre-Assessment

Pre-Assessment lets you identify the areas for improvement before you start your prep. It determines what students know about a topic before it is taught and identifies areas for improvement with question assessment before beginning the course.

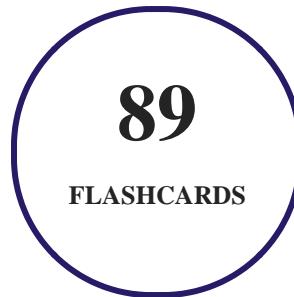
## 3. Quiz

Quizzes test your knowledge on the topics of the exam when you go through the course material. There is no limit to the number of times you can attempt it.



## 4. flashcards

Flashcards are effective memory-aiding tools that help you learn complex topics easily. The flashcard will help you in memorizing definitions, terminologies, key concepts, and more. There is no limit to the number of times learners can attempt these. Flashcards help master the key concepts.



## 5. **Glossary of terms**

uCertify provides detailed explanations of concepts relevant to the course through Glossary. It contains a list of frequently used terminologies along with its detailed explanation. Glossary defines the key terms.



## 6. **Expert Instructor-Led Training**

uCertify uses the content from the finest publishers and only the IT industry's finest instructors. They have a minimum of 15 years real-world experience and are subject matter experts in their fields. Unlike a live class, you can study at your own pace. This creates a personal learning experience and gives you all the benefit of hands-on training with the flexibility of doing it around your schedule 24/7.

## 7. **ADA Compliant & JAWS Compatible Platform**

uCertify course and labs are ADA (Americans with Disability Act) compliant. It is now more accessible to students with features such as:

- Change the font, size, and color of the content of the course
- Text-to-speech, reads the text into spoken words
- Interactive videos, how-tos videos come with transcripts and voice-over
- Interactive transcripts, each word is clickable. Students can clip a specific part of the video by clicking on a word or a portion of the text.

JAWS (Job Access with Speech) is a computer screen reader program for Microsoft Windows that reads the screen either with a text-to-speech output or by a Refreshable Braille display. Student can easily navigate uCertify course using JAWS shortcut keys.

## 8. State of the Art Educator Tools

uCertify knows the importance of instructors and provide tools to help them do their job effectively. Instructors are able to clone and customize course. Do ability grouping. Create sections. Design grade scale and grade formula. Create and schedule assessments. Educators can also move a student from self-paced to mentor-guided to instructor-led mode in three clicks.

## 9. Award Winning Learning Platform (LMS)

uCertify has developed an award winning, highly interactive yet simple to use platform. The SIIA CODiE Awards is the only peer-reviewed program to showcase business and education technology's finest products and services. Since 1986, thousands of products, services and solutions have been recognized for achieving excellence. uCertify has won CODiE awards consecutively for last 7 years:

- **2014**

1. Best Postsecondary Learning Solution

- **2015**

1. Best Education Solution

2. Best Virtual Learning Solution
3. Best Student Assessment Solution
4. Best Postsecondary Learning Solution
5. Best Career and Workforce Readiness Solution
6. Best Instructional Solution in Other Curriculum Areas
7. Best Corporate Learning/Workforce Development Solution

- **2016**

1. Best Virtual Learning Solution
2. Best Education Cloud-based Solution
3. Best College and Career Readiness Solution
4. Best Corporate / Workforce Learning Solution
5. Best Postsecondary Learning Content Solution
6. Best Postsecondary LMS or Learning Platform
7. Best Learning Relationship Management Solution

- **2017**

1. Best Overall Education Solution
2. Best Student Assessment Solution
3. Best Corporate/Workforce Learning Solution
4. Best Higher Education LMS or Learning Platform

- **2018**

1. Best Higher Education LMS or Learning Platform
2. Best Instructional Solution in Other Curriculum Areas
3. Best Learning Relationship Management Solution

- **2019**

1. Best Virtual Learning Solution
2. Best Content Authoring Development or Curation Solution
3. Best Higher Education Learning Management Solution (LMS)

- **2020**

1. Best College and Career Readiness Solution
2. Best Cross-Curricular Solution
3. Best Virtual Learning Solution

## 10. Chapter & Lessons

uCertify brings these textbooks to life. It is full of interactive activities that keeps the learner engaged. uCertify brings all available learning resources for a topic in one place so that the learner can efficiently learn without going to multiple places. Challenge questions are also embedded in the chapters so learners can attempt those while they are learning about that particular topic. This helps them grasp the concepts better because they can go over it again right away which improves learning.

Learners can do Flashcards, Exercises, Quizzes and Labs related to each chapter. At the end of every lesson, uCertify courses guide the learners on the path they should follow.

## Syllabus

### Chapter 1: Python Primer

- Python Overview
- Objects in Python
- Expressions, Operators, and Precedence
- Control Flow
- Functions
- Simple Input and Output
- Exception Handling

- Iterators and Generators
- Additional Python Conveniences
- Scopes and Namespaces
- Modules and the Import Statement
- Exercises

## Chapter 2: Object-Oriented Programming

- Goals, Principles, and Patterns
- Software Development
- Class Definitions
- Inheritance
- Namespaces and Object-Orientation
- Shallow and Deep Copying
- Exercises

## Chapter 3: Algorithm Analysis

- Experimental Studies
- The Seven Functions Used in This Course
- Asymptotic Analysis

- Simple Justification Techniques
- Exercises

## Chapter 4: Recursion

- Illustrative Examples
- Analyzing Recursive Algorithms
- Recursion Run Amok
- Further Examples of Recursion
- Designing Recursive Algorithms
- Eliminating Tail Recursion
- Exercises

## Chapter 5: Array-Based Sequences

- Python's Sequence Types
- Low-Level Arrays
- Dynamic Arrays and Amortization
- Efficiency of Python's Sequence Types
- Using Array-Based Sequences

- Multidimensional Data Sets
- Exercises

## Chapter 6: Stacks, Queues, and Deques

- Stacks
- Queues
- Double-Ended Queues
- Exercises

## Chapter 7: Linked Lists

- Singly Linked Lists
- Circularly Linked Lists
- Doubly Linked Lists
- The Positional List ADT
- Sorting a Positional List
- Case Study: Maintaining Access Frequencies
- Link-Based vs. Array-Based Sequences
- Exercises

## Chapter 8: Trees

- General Trees
- Binary Trees
- Implementing Trees
- Tree Traversal Algorithms
- Case Study: An Expression Tree
- Exercises

## Chapter 9: Priority Queues

- The Priority Queue Abstract Data Type
- Implementing a Priority Queue
- Heaps
- Sorting with a Priority Queue
- Adaptable Priority Queues
- Exercises

## Chapter 10: Maps, Hash Tables, and Skip Lists

- Maps and Dictionaries

- Hash Tables
- Sorted Maps
- Skip Lists
- Sets, Multisets, and Multimaps
- Exercises

## Chapter 11: Search Trees

- Binary Search Trees
- Balanced Search Trees
- AVL Trees
- Splay Trees
- (2,4) Trees
- Red-Black Trees
- Exercises

## Chapter 12: Sorting and Selection

- Why Study Sorting Algorithms?
- Merge-Sort
- Quick-Sort

- Studying Sorting through an Algorithmic Lens
- Comparing Sorting Algorithms
- Python's Built-In Sorting Functions
- Selection
- Exercises

## Chapter 13: Text Processing

- Abundance of Digitized Text
- Pattern-Matching Algorithms
- Dynamic Programming
- Text Compression and the Greedy Method
- Tries
- Exercises

## Chapter 14: Graph Algorithms

- Graphs
- Data Structures for Graphs
- Graph Traversals

- Transitive Closure
- Directed Acyclic Graphs
- Shortest Paths
- Minimum Spanning Trees
- Exercises

## Chapter 15: Memory Management and B-Trees

- Memory Management
- Memory Hierarchies and Caching
- External Searching and B-Trees
- External-Memory Sorting
- Exercises

## Chapter 16: Appendix A: Character Strings in Python

## Chapter 17: Appendix B: Useful Mathematical Facts

# 11. Practice Test

**Here's what you get**

75

PRE-ASSESSMENTS QUESTIONS

75

POST-ASSESSMENTS QUESTIONS

## Features

Each question comes with detailed remediation explaining not only why an answer option is correct but also why it is incorrect.

### Unlimited Practice

Each test can be taken unlimited number of times until the learner feels they are prepared. Learner can review the test and read detailed remediation. Detailed test history is also available.

Each test set comes with learn, test and review modes. In learn mode, learners will attempt a question and will get immediate feedback and complete remediation as they move on to the next question. In test mode, learners can take a timed test simulating the actual exam conditions. In review mode, learners can read through one item at a time without attempting it.

## 12. Performance Based Labs

uCertify's performance-based labs are simulators that provides virtual environment. Labs deliver hands on experience with minimal risk and thus replace expensive physical labs. uCertify Labs are cloud-based, device-enabled and can be easily integrated with an LMS. Features of uCertify labs:

- Provide hands-on experience in a safe, online environment
- Labs simulate real world, hardware, software & CLI environment
- Flexible and inexpensive alternative to physical Labs
- Comes with well-organized component library for every task
- Highly interactive - learn by doing
- Explanations and remediation available
- Videos on how to perform

## Lab Tasks

- Using the Bitwise Operator
- Using the Equality Operator and the list Class
- Using Arithmetic Operators
- Performing Bitwise Operations
- Using the Comparison Operator
- Using the if-elif-else Statement - Part 1
- Using the if-elif-else Statement - Part 2
- Using the if-else Statement
- Determining the Armstrong Number
- Rectifying Errors
- Finding LCM of Two Numbers
- Creating a Function with its Default Value
- Handling Exception
- Using the dir Function
- Using the math Module
- Understanding the init Method
- Understanding Numeric Progressions
- Calculating the Product of Two Positive Integers
- Finding the Minimum Element
- Using the getsizeof Function
- Implementing a Dynamic Array
- Adding Elements to a List
- Using the extend Method
- Removing Elements from a List
- Constructing the Caesar Cipher Algorithm
- Using Stack Abstract Data Type Method
- Implementing a Stack
- Implementing a Queue
- Implementing a Queue with a Circular Linked List
- Implementing a Deque with a Doubly Linked List
- Adding Elements to a Set

- Performing Set Operations
- Using a Sorting Function
- Using the `len()` Built-In Function
- Performing Pattern Matching

## Here's what you get



## 13. Post-Assessment

After completion of the uCertify course Post-Assessments are given to students and often used in conjunction with a Pre-Assessment to measure their achievement and the effectiveness of the exam.

You can't stay away! Get

 3187 Independence Drive  +1-415-763-6300  support@ucertify.com  www.ucertify.com