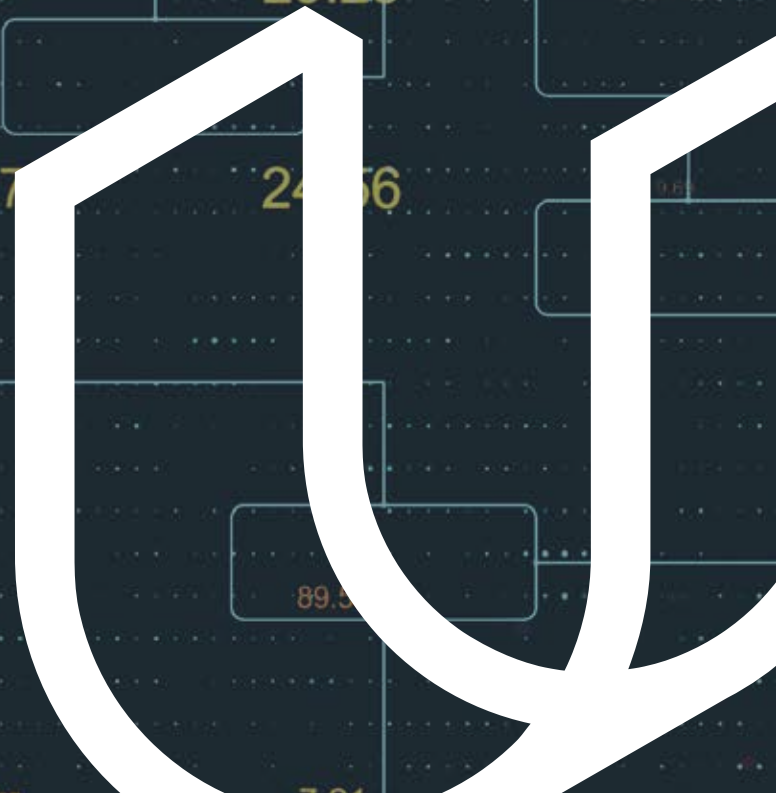




UDACITY  
FOR ENTERPRISE

THE SCHOOL OF PROGRAMMING AND DEVELOPMENT

# Data Structures and Algorithms



NANODEGREE SYLLABUS

# Overview

## Data Structures and Algorithms Nanodegree Degree Program

The Data Structures and Algorithms Nanodegree program will help you excel at solving everything from well-defined problems, like how to calculate the efficiency of a specific algorithm, to more open-ended problems, like building your own private blockchain or writing a web-crawler.

In this program, you will learn data structures and algorithms by solving over 80 practice problems. You will begin each course by learning to solve defined problems related to a particular data structure & algorithm. By the end of each course, you would be able to evaluate and assess different data structures and algorithms for any open-ended problem and implement a solution based on your design choices.

The program is delivered in 1 term spread over 4 months.

### Program Information



#### TIME

4 months  
Study 10 hours/week



#### LEVEL

Practitioner



#### PREREQUISITES

Intermediate Python programming knowledge and basic algebra.



#### HARDWARE/SOFTWARE REQUIRED

Access to the internet and a 64-bit computer and the following software:

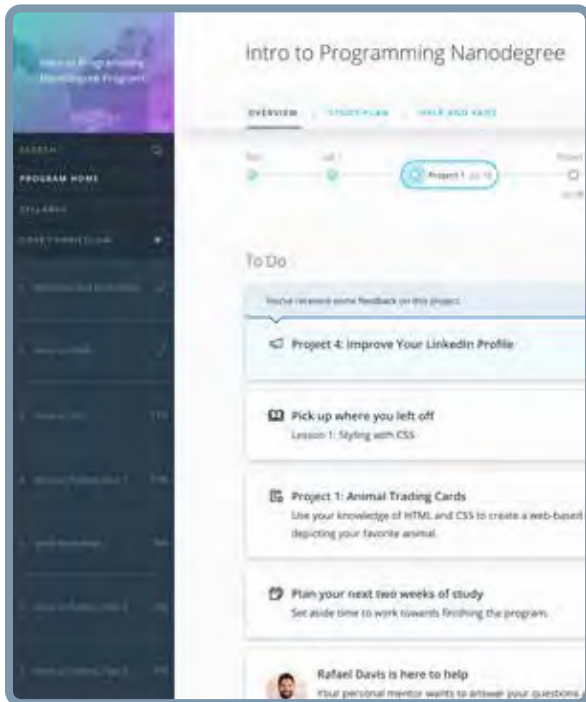
- Python 3
- A code/text editor, such as vim, Sublime Text, Atom, or VSCode
- A web browser
- A command line interface, such as Terminal (on Mac) or Git Bash (on Windows)



#### LEARN MORE ABOUT THIS NANODEGREE

Contact us at [enterpriseNDs@udacity.com](mailto:enterpriseNDs@udacity.com).

# Our Classroom Experience



## REAL-WORLD PROJECTS

Learners build new skills through industry-relevant projects and receive personalized feedback from our network of 900+ project reviewers. Our simple user interface makes it easy to submit projects as often as needed and receive unlimited feedback.

## KNOWLEDGE

Answers to most questions can be found with Knowledge, our proprietary wiki. Learners can search questions asked by others and discover in real-time how to solve challenges.

## LEARNER HUB

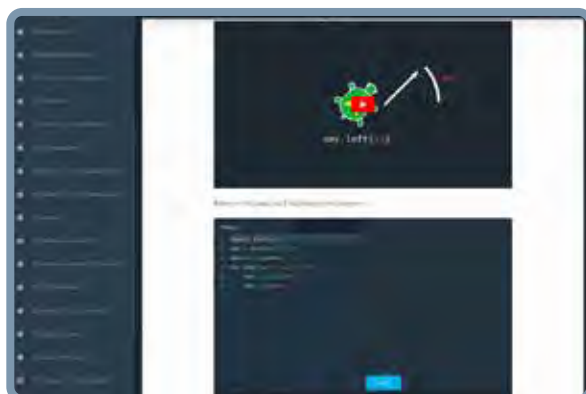
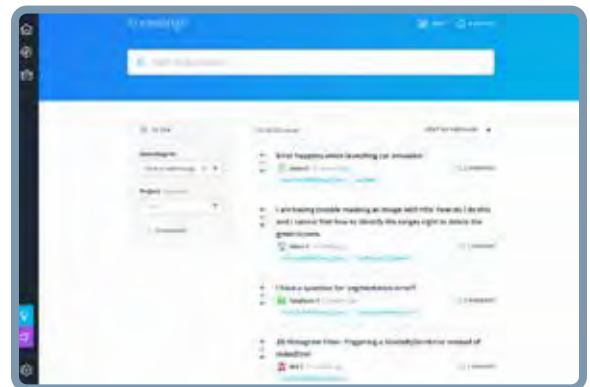
Learners leverage the power of community through a simple, yet powerful chat interface built within the classroom. Learner Hub connects learners with their technical mentor and fellow learners.

## WORKSPACES

Learners can check the output and quality of their code by testing it on interactive workspaces that are integrated into the classroom.

## QUIZZES

Understanding concepts learned during lessons is made simple with auto-graded quizzes. Learners can easily go back and brush up on concepts at anytime during the course.



## CUSTOM STUDY PLANS

Mentors create a custom study plan tailored to learners' needs. This plan keeps track of progress toward learner goals.

## PROGRESS TRACKER

Personalized milestone reminders help learners stay on track and focused as they work to complete their Nanodegree program.

# Learn with the Best



**Brynn Claypoole**

INSTRUCTOR

Brynn is a former Udacity employee who worked as Lead Data Analyst at Udacity before joining Facebook as a Data Engineer. Currently, she is working as a software engineer with 10x Genomics.



**Abe Feinberg**

CONTENT DEVELOPER

Abe is a Content Developer at Udacity and previously taught university courses in psychology and computer science. He loves both learning and teaching, and has a particular passion for breaking down difficult concepts and making them easier to master.



**Kyle Stewart-Franz**

CONTENT DEVELOPER

Kyle has developed projects for a variety of Udacity's Nanodegree programs, such as Self-Driving Car Engineer, Robotics, and Blockchain. Kyle, a self-taught developer, is always striving towards creating great learning experience for students.



## Course 1: Introduction

Get an overview of your program. Meet your instructors, and refresh your python skills. Learn the framework to deconstruct any open-ended problem and then understand the concepts of time and space complexity, essential tools for evaluating different data structure & algorithms.

### Project

### Unscramble Computer Science Problems

Deconstruct a series of open-ended problems into smaller components (e.g, inputs, outputs, series of functions).

LESSON TITLE

INTRODUCTION

PYTHON REFRESHER

HOW TO SOLVE PROBLEMS

BIG O NOTATION

# Nanodegree Program Overview

## Course 2: Data Structures

Learn different data structures that can be used to store data. Implement different methods used to manipulate these data structures and examine the efficiency. Understand the advantages and applications of different data structures. Learn how to approach open ended problems (either in interviews or in real-world scenarios) and select appropriate data structures based on requirements.

### Project

### Show Me the Data Structures

Solve a series of open-ended practice problems such as LRU Cache, Private Blockchain, File Recursion and many more. Hone your skills to identify and implement appropriate data structures and corresponding methods which meet given constraints.

#### LESSON TITLE

#### SAMPLE PRACTICE PROBLEMS

**COLLECTION DATA STRUCTURES** (lists, arrays, linked lists, queues, stack)

**RECURSION**

**TREES**

**MAPS AND HASHING**

- Reverse Strings
- Hamming Distance
- Reverse a Linked List
- Linked List Loop Detection,
- Balancing Brackets
- Building Queue using Stacks
- Tree Traversals
- Checking Binary Search Tree
- String Key Hash table



## Course 3: Basic Algorithms

Learn and implement basic algorithms such as searching and sorting on different data structures and examine the efficiency of these algorithms. Use recursion to implement these algorithms and then learn how some of these algorithms can be implemented without recursion. Practice selecting and modifying these algorithms for a variety of interview problems.

### Project

### Problems vs. Algorithms

A series of real-world open ended problems such as request routing for web server, search-term auto-completion and Fibonacci heap which train you to apply suitable data structures and algorithms under different context.

#### LESSON TITLE

#### SAMPLE PRACTICE PROBLEMS

#### BINARY SEARCH

#### SORTING ALGORITHMS

#### DIVIDE & CONQUER ALGORITHMS

- Randomized Binary Search
- K-smallest elements using Heaps
- Build Red-Black Tree
- Bubble sort, merge sort, quick sort, sorting strings
- Linear-time median finding

# Nanodegree Program Overview

## Course 4: Advanced Algorithms

Build on your algorithm skills by learning more advanced algorithms such as brute-force greedy algorithms, graph algorithms, and dynamic programming, which optimizes recursion by storing results to sub problems.

### Project

### Route Planner

In this project, you will build a route-planning algorithm like the one used in Google Maps to calculate the shortest path between two points on a map. You will first select and implement appropriate data-structure to represent points on a map and then implement the A\* algorithm to find shortest path.

#### LESSON TITLE

#### SAMPLE PRACTICE PROBLEMS

#### GREEDY ALGORITHMS

#### GRAPH ALGORITHMS

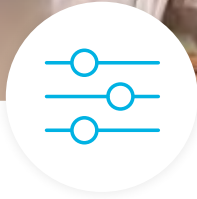
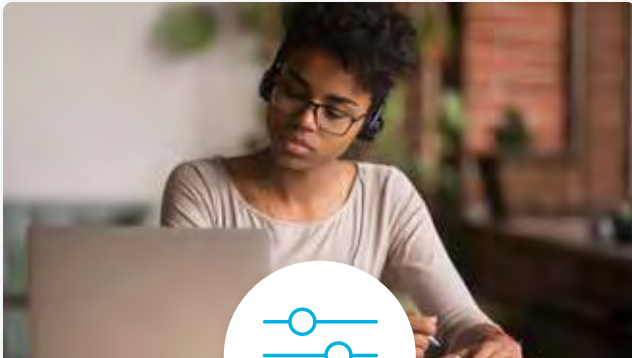
#### DYNAMIC PROGRAMMING

#### LINEAR PROGRAMMING

- Graph Traversals
- Dijkstra's Algorithm
- Shortest Hops
- A\* Search
- Longest Palindromic subsequence
- Web crawler



# Our Nanodegree Programs Include:



## Pre-Assessments

Our in-depth workforce assessments identify your team's current level of knowledge in key areas. Results are used to generate custom learning paths designed to equip your workforce with the most applicable skill sets.



## Dashboard & Progress Reports

Our interactive dashboard (enterprise management console) allows administrators to manage employee onboarding, track course progress, perform bulk enrollments and more.



## Industry Validation & Reviews

Learners' progress and subject knowledge is tested and validated by industry experts and leaders from our advisory board. These in-depth reviews ensure your teams have achieved competency.



## Real World Hands-on Projects


Through a series of rigorous, real-world projects, your employees learn and apply new techniques, analyze results, and produce actionable insights. Project portfolios demonstrate learners' growing proficiency and subject mastery.

# Our Review Process

## Real-life Reviewers for Real-life Projects

Real-world projects are at the core of our Nanodegree programs because hands-on learning is the best way to master a new skill. Receiving relevant feedback from an industry expert is a critical part of that learning process, and infinitely more useful than that from peers or automated grading systems. Udacity has a network of over 900 experienced project reviewers who provide personalized and timely feedback to help all learners succeed.


## All Learners Benefit From:




Line-by-line feedback for coding projects



Industry tips and best practices



Advice on additional resources to research



Unlimited submissions and feedback loops


### How it Works

Real-world projects are integrated within the classroom experience, making for a seamless review process flow.


- Go through the lessons and work on the projects that follow
- Get help from your technical mentor, if needed
- Submit your project work
- Receive personalized feedback from the reviewer
- If the submission is not satisfactory, resubmit your project
- Continue submitting and receiving feedback from the reviewer until you successfully complete your project

## About our Project Reviewers


Our expert project reviewers are evaluated against the highest standards and graded based on learners' progress. Here's how they measure up to ensure your success.




**Expert Project Reviewers**  
Are hand-picked to provide detailed feedback on your project submissions.



**Projects Reviewed**  
Our reviewers have extensive experience in guiding learners through their course projects.



**Hours Average Turnaround**  
You can resubmit your project on the same day for additional feedback.



**Average Reviewer Rating**  
Our learners love the quality of the feedback they receive from our experienced reviewers.



**Vaibhav**  
UDACITY LEARNER

*"I never felt overwhelmed while pursuing the Nanodegree program due to the valuable support of the reviewers, and now I am more confident in converting my ideas to reality."*

now at  
**CODING VISIONS INFOTECH**



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