UDACITY
FOR ENTERPRISE

THE SCHOOL OF DATA SCIENCE

Programming for Data Science with R

NANODEGREE SYLLABUS

Overview

This Nanodegree Degree Program is Built in Collaboration with

MODE

The Programming for Data Science with R Nanodegree program offers you the opportunity to learn the most important programming languages used by data scientists today: the foundational data science programming tools (R, SQL, Git).

Graduates of this program will be proficient in the programming skills used in many data analysis and data science roles, including R, SQL, Terminal, and Git, and will emerge prepared to tackle real world data analysis problems.

The Programming for Python with R Nanodegree program is comprised of content and curriculum to support three (3) projects.

Program Information

TIME
3 months
Study 10 hours/week

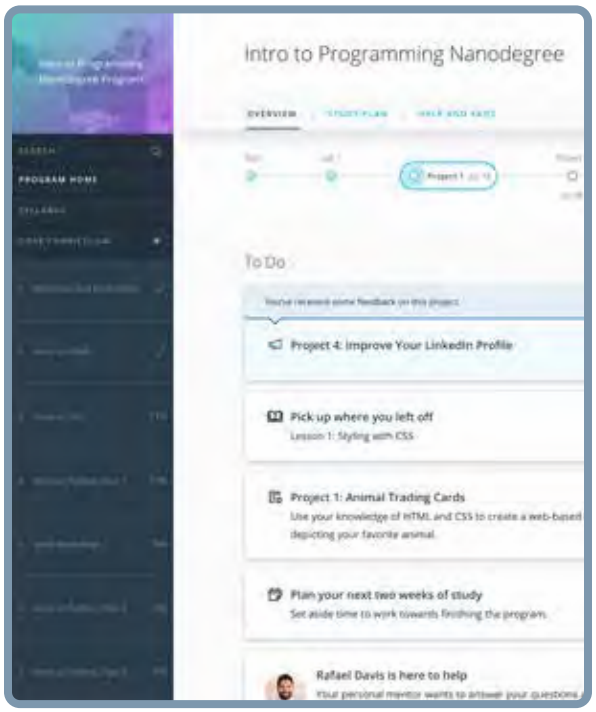
LEVEL
Foundational

PREREQUISITES
Ability to perform basic operations on your computer like opening files and folders, opening applications, and copying & pasting. You should also be able to read, write, and listen in English.

HARDWARE/SOFTWARE REQUIRED
Access to the internet and a 64-bit computer.

LEARN MORE ABOUT THIS NANODEGREE
Contact us at 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

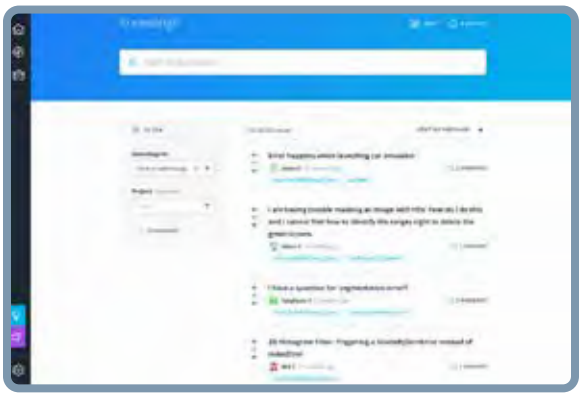
Learners leverage the power of community through a simple, yet powerful chat interface built within the classroom. Learner Hub connects learners with their technical mentor and fellow learners.

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

Josh Bernhard

DATA SCIENTIST AT NERD WALLET

Josh has been sharing his passion for data for nearly a decade at all levels of university, and as Lead Data Science Instructor at Galvanize. He's used data science for work ranging from cancer research to process automation.

Derek Steer

CEO AT MODE

Derek is the CEO of Mode Analytics. He developed an analytical foundation at Facebook and Yammer and is passionate about sharing it with future analysts. He authored SQL School and is a mentor at Insight Data Science.

Juno Lee

CURRICULUM LEAD AT UDACITY

Juno is the curriculum lead for the School of Data Science. She has been sharing her passion for data and teaching, building several courses at Udacity. As a data scientist, she built recommendation engines, computer vision and NLP models, and tools to analyze user behavior.

Richard Kalehoff

INSTRUCTOR

Richard is a Course Developer with a passion for teaching. He has a degree in computer science, and first worked for a nonprofit doing everything from front end web development, to backend programming, to database and server management.

Karl Krueger

COMMAND LINE INSTRUCTOR

Karl is a Course Developer at Udacity. Before joining Udacity, Karl was a Site Reliability Engineer (SRE) at Google for eight years, building automation and monitoring to keep the world's busiest web services online.

Course 1: Introduction to SQL

The first course will teach you the fundamentals of SQL such as JOINs, Aggregations, and Subqueries. Learn how to use SQL to answer complex business problems.

Project: Investigate a Relational Database

In this project, you'll work with a relational database while working with PostgreSQL. You'll complete the entire data analysis process, starting by posing a question, running appropriate SQL queries to answer your questions and finishing by sharing your findings.

LESSON TITLE	LEARNING OUTCOMES
BASIC SQL	• Write common SQL commands including SELECT, FROM, and WHERE. • Learn how to use logical operators like LIKE, AND, and OR.
SQL JOINS	• Learn to write JOINs in SQL, which will enable you to combine data from multiple sources to answer more complex business questions. • Understand different types of JOINs and when to use each type.
SQL AGGREGATIONS	• Write common aggregations in SQL including COUNT, SUM, MIN, and MAX. • Write CASE and DATE functions, as well as work with NULLs.
ADVANCED SQL QUERIES	• Use subqueries, also called CTEs, in a number of different situations. • Use other window functions including RANK, NTILE, LAG, LEAD along with partitions to complete complex tasks.

Course 2: Introduction to R Programming

In this part, you'll learn to represent and store data using R data types and variables, and use conditionals and loops to control the flow of your programs. You'll harness the power of complex data structures like lists, sets, dictionaries, and tuples to store collections of related data. You'll define and document your own custom functions, write scripts, and handle errors. You will also learn to use two powerful R libraries: Numpy, a scientific computing package, and Pandas, a data manipulation package.

Project: Explore US Bikeshare Data

You will use R to answer interesting questions about bikeshare trip data collected from three US cities. You will write code to collect the data, compute descriptive statistics, and create an interactive experience in the terminal that presents the answers to your questions.

LESSON TITLE	LEARNING OUTCOMES
INTRODUCTION TO R	• Understand common use cases of R and why it's popular. • Install and setup R Environment and learn basic syntax associated with R. • Understand how you can get help when writing R code.
SYNTAX & DATA TYPES	• Explore data structures available in R including scalars, factors, vectors arrays, lists, and dataframes. • Manipulate, compare, and perform fundamental operations associated with each of the data structures.
CONTROL FLOW & FUNCTIONS	• Write conditional expressions using if statements and boolean expressions. • Use loops and other built-in functions to iterate over and manipulate data. • Define your own custom functions.

Nanodegree Program Overview

Course 2: Introduction to R Programming, cont.

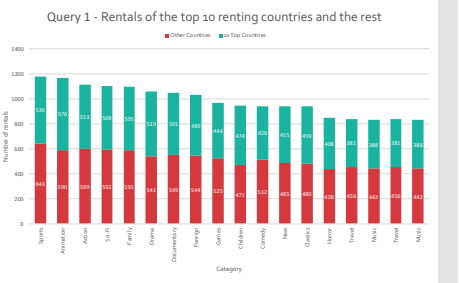
LESSON TITLE	LEARNING OUTCOMES
DATA VISUALIZATIONS & EDA	• Make beautiful visualizations using the ggplot2 library. • Create commonly used data visualizations for each data type including histograms, scatter plots, and box plots. • Improve your data visualizations using facets. • Create reference variables using appropriate scope. • Use the popular diamonds dataset to put your R skills to work.

Project Example

Investigate a Relational Database

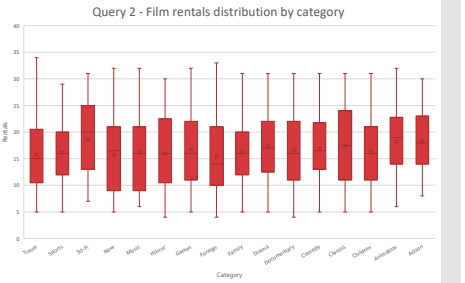
How do the rentals for the 10 top renting countries compare to the other countries for each category?

Description: This bar chart shows the comparison between the number of rentals of the top 10 renting countries and the rest of the countries.



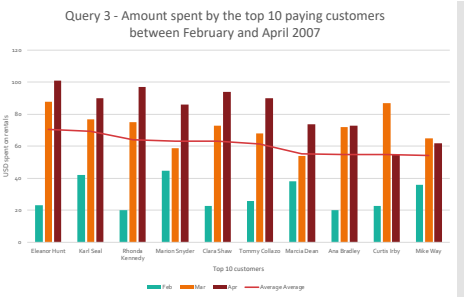
How are the movies distributed by the amount of times they were rented inside of a category?

Description: This box and whisker chart shows the distribution of number of rentals of movies in each category.



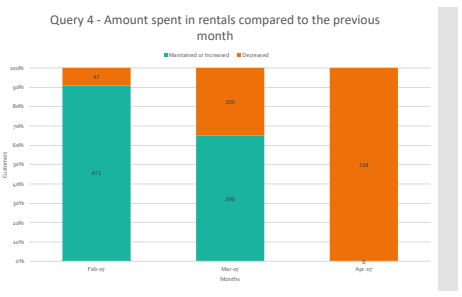
How much did the top 10 paying customers spend on DVD rental over 2007?

Description: this chart shows the spending pattern of the all-time top 10 paying customers. The plotted line represents the average spent by each customer individually from February, 2007 to April, 2007, and it works as comparison between customers.



How many customers have paid less in rentals compared to the previous month?

Description: this chart shows the amount and proportion of customers that have decreased the amount spent in rentals when compared to the previous month. The chart suggests the beginning of a downward trend in amount spent by customers, although the data is insufficient to show an actual trend in customers' behavior.



Images from an actual learner-submitted project.

Course 3: Introduction to Version Control

In this course, you will learn how to use version control and share your work with other people in the data science industry.

Project Post your work on Github

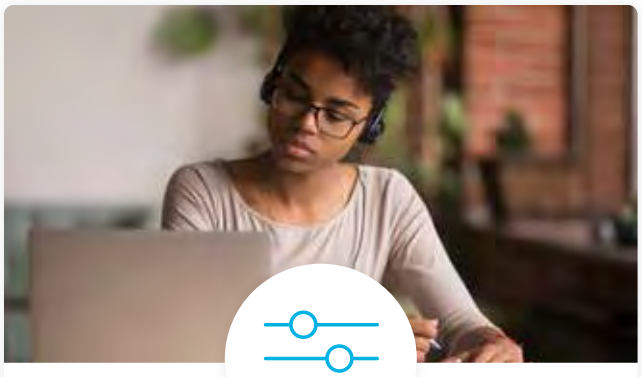
In this project, you will learn important tools that all programmers use. First, you'll get an introduction to working in the terminal. Next, you'll learn to use git and Github to manage versions of a program and collaborate with others on programming projects. In this project you will add a completed project on GitHub, work with branches, edit a README file and project files, merge branches, stage and commit your changes to your project GitHub repository.

LESSON TITLE	LEARNING OUTCOMES
SHELL WORKSHOP	• Learn to clearly articulate and communicate a problem statement for a data project.
PURPOSE & TERMINOLOGY	• Create an issue tree and hypothesis driven structure. • Create a "ghost deck" — a skeleton deck commonly used by management consultants to identify a client's needs.
CREATE A GIT REPO	• Identify potential limitations and sources of bias in your analyses. • Communicate the appropriate caveats of a recommendation.
REVIEW A REPO'S HISTORY	• Create an analysIs roadmap that encompasses the analyses you plan to do. • Clearly articulate the "so what" of your analysis. • Communicate your data story to support a concise set of recommendations.

Course 3: Introduction to Shell and Version Control, cont.

LESSON TITLE	LEARNING OUTCOMES
ADD COMMITS TO A REPO	• Master the Git workflow and make commits to an example project. • Use git diff to identify parts of a file that changed in a commit. • Mark files as “untracked” using .gitignore.
TAGGING, BRANCHING, AND MERGING	• Discover tagging, branching, and merging and organize your commits with tags and branches. • Jump to particular tags and branches using git checkout. • Learn how to merge together changes on different branches and crush those pesky merge conflicts.
UNDOING CHANGES	• Learn how and when to edit or delete an existing commit. • Use git commit and amend flag to alter the last commit. • Use git reset and git revert to undo and erase commits.
WORKING WITH REMOTES	• Create remote repositories on GitHub and learn how to pull and push changes to the remote repositories.
WORKING ON ANOTHER REPOSITORY	• Fork another developer’s project and use GitHub to contribute to a public project.
STAYING IN SYNC WITH A REMOTE REPOSITORY	• Discover how to sync new changes to a forked remote repository, retrieve and sync updates. • Create pull requests and squash commits with git rebase.

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.

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

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.**

900+

Expert Project Reviewers

Are hand-picked to provide detailed feedback on your project submissions.

1.8M

Projects Reviewed

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

3

Hours Average Turnaround

You can resubmit your project on the same day for additional feedback.

4.85 /5

Average Reviewer Rating

Our learners love the quality of the feedback they receive from our experienced reviewers.

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2440 W El Camino Real, #101
Mountain View, CA 94040, USA - HQ

For more information visit: www.udacity.com/enterprise