Week 28

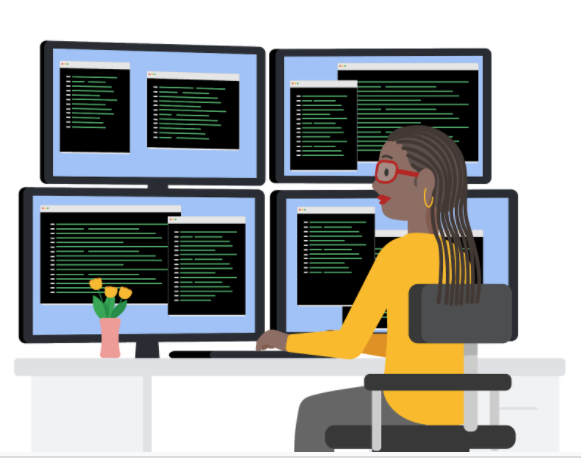
Programming languages: The magical spell.

Benefits of using programming languages:

* Clarify the steps of your analysis
* Saves time
* Reporduce and share your work

# Ways to learn about programming

Writing programming language code can be an exciting and rewarding experience. The programming field has a long history of people helping each other improve their skills and develop best practices. You will focus on the R programming language in this course, but in the future you might choose to pursue additional programming languages based on your interests and professional goals. This reading is a general guide to help you decide which programming languages are best suited for you.



## **Popular programming languages by profession**

Let’s go through some potential job titles you might encounter and the most popular programming languages used in those professions. Also included is a list of additional resources for you to explore and learn more about each of the programming languages introduced.

### **Data analyst**

A data analyst collects, transforms, and organizes data to draw conclusions, make predictions, and drive informed decision-making. The most popular programming languages used by data analysts are R and Python.

R offers convenient statistical features for data analysis and is useful for creating advanced data visualizations. Check out these resources to learn more about R:

* [The R Project for Statistical Computing](https://www.r-project.org/): a website for downloading R, documentation, and help
* [R Manuals](https://cran.r-project.org/manuals.html): links to manuals from the R core team, including introduction, administration, and help
* [Coding Club R Tutorials](https://ourcodingclub.github.io/tutorials.html): a collection of coding tutorials for R
* [R for Beginners](https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf): a starting guide to help you work with data, graphics, and statistics in R

Python is a general-purpose language that you can use to create what you need for data analysis. Here are a few resources to begin learning Python:

[The Python Software Foundation (PSF)](https://www.python.org/about/gettingstarted/): a website with guides to help you get started as a beginner

[Python Tutorial](https://docs.python.org/3/tutorial/): a Python 3 tutorial from the PSF site

* [Coding Club Python Tutorials](https://ourcodingclub.github.io/tutorials.html): a collection of coding tutorials for Python

### **Web designer**

A web designer is responsible for the styling and layout of web pages containing text, graphics, and video. Web designers generally use Hypertext Markup Language v5 (HTML5) and Cascading Style Sheets (CSS) to create web pages.

HTML5 provides structure for web pages and is used to connect to hosting platforms. Learn more about HTML5 and CSS using these resources:

* [HTML Tutorial](https://www.tutorialrepublic.com/html-tutorial/): an introduction to HTML with links to HTML5 features, examples, and references
* [HTML5 Cheat Sheet](https://www.wpkube.com/html5-cheat-sheet/): a handy summary of HTML5 tags, attributes, and compatibility with HTML4
* [HTML5 and CSS Fundamentals course](https://www.edx.org/course/html5-and-css-fundamentals): a free W3C course on edX; a verified course certificate can be issued for $199

CSS is used for web page design and controls graphic elements (color, layout, and font) and page presentation on multiple devices (large screens, mobile screens, and printers). Check out these cheat sheets for CSS:

* [Interactive CSS Cheat Sheet](https://htmlcheatsheet.com/css/): includes the most common CSS snippets for gradient, background, font-family, border, and much more
* [50 Best HTML & CSS Cheat Sheets](https://sharethis.com/best-practices/2020/02/best-html-and-css-cheat-sheets/): a list of 50 cheat sheets–choose a few that are useful to you

### **Mobile application developer**

A mobile application developer uses programming to create applications used on laptops, mobile phones, and tablets. The most popular programming languages for mobile application developers are Swift, Java, and C#.

Swift (for Apple platforms) is an open source scripting language for macOS, iOS, watchOS, and tvOS. Its main goal is to make applications run faster. Browse these resources for more information about Swift:

* [Swift.org](https://swift.org/about/): an open source community with resources to learn how to use Swift, including videos and sample code
* [Swift developer site](https://developer.apple.com/swift/): an Apple developer website with information for developers who want to use Swift

[Swift development resources](https://developer.apple.com/swift/resources/): Apple’s collection of documentation, sample code, videos, and recommended books

Java (for Android devices) is the official language for Android development. The article [I want to develop Android apps - which languages should I learn?](https://www.androidauthority.com/develop-android-apps-languages-learn-391008/) explores some other languages used for Android development. Check out these resources for Java:

* [Android Studio](https://developer.android.com/studio): a downloadable integrated development environment (IDE) with tools to build apps for Android devices
* [Build your first Android app in Java](https://developer.android.com/codelabs/build-your-first-android-app#1): instructions for installing Android Studio and creating your first app
* [Java tutorial for beginners: write a simple app with no previous experience](https://www.androidauthority.com/java-tutorial-for-beginners-write-a-simple-app-with-no-previous-experience-1121975/): an overview of how to learn Java, with examples

C# (pronounced C-sharp) is an object-oriented programming language that is widely used to create mobile apps in the .NET open source developer platform. Xamarin extends the .NET platform with a framework for developers to create cross-platform mobile apps for both iOS and Android. Here are a few resources to help you learn C#:

* [Microsoft .NET learning materials for C#](https://dotnet.microsoft.com/learn/csharp): includes free courses, tutorials, and videos to learn the programming language C#
* [Microsoft Xamarin learning materials](https://dotnet.microsoft.com/learn/xamarin): includes free courses, tutorials, and videos to learn about mobile development with Xamarin
* [Xamarin Tutorial - build your first iOS or Android app in C#](https://dotnet.microsoft.com/learn/xamarin/hello-world-tutorial/intro): instructions for building a mobile app that displays the text “Hello World”
* [Learn C# from Codecademy](https://www.codecademy.com/learn/learn-c-sharp): a website with free basic interactive lessons, and additional activities that can be accessed with a monthly subscription

### **Web application developer**

A web application developer designs and develops network applications used across the web. The most popular programming languages used by web application developers are Java, Python, Ruby, and PHP.

Java is widely used to create enterprise web applications that can run on multiple clients. Java’s main strength is its “Write Once, Run Anywhere” (WORA) approach.Browse these resources to learn more about Java:

[Oracle Java Tutorials](https://docs.oracle.com/javase/tutorial/): Java tutorials from Oracle documentation

* [Java for Beginners](https://www.homeandlearn.co.uk/java/java.html): a free Java course for beginners from the website “Home and Learn”

Python is a general-purpose programming language. Check out the Python resources listed in the data analyst section.

Ruby is a general-purpose, object-oriented programming language used for web application development. Ruby isn't the same as Ruby on Rails, which is an open source web application framework that runs using Ruby. Browse these resources to learn more about Ruby:

* [Ruby news](http://ruby-doc.org/): information about the latest Ruby releases and links to other resources
* [Ruby documentation](http://www.ruby-lang.org/en/documentation/): includes guides, tutorials, and reference material to help you learn more about Ruby
* [Ruby programmer’s guide](http://ruby-doc.com/docs/ProgrammingRuby/): a tutorial and reference guide for Ruby
* [Learn Ruby from Codecademy](https://www.codecademy.com/learn/learn-ruby): a website with free basic interactive lessons, and additional activities that can be accessed with a monthly subscription

PHP is a scripting language particularly suited for web application development. It was based on Perl, another programming language. PHP is simple, flexible, and relatively easy to learn. Check out these resources to learn more about PHP:

* [PHP downloads and documentation](https://www.php.net/): information about the latest PHP releases and links to other resources
* [PHP the Right Way](https://phptherightway.com/): a quick reference for popular PHP coding standards
* [Interactive PHP tutorial](https://www.learn-php.org/): a free tutorial that runs PHP code in exercises

### **Game developer**

A game developer is an application developer who specializes in video game creation. Game developers most commonly use the programming languages C# and C++.

C# is an object-oriented programming language that is widely used to create games. Check out the C# resources listed in the mobile application developer section.

C++ is an extension of the C programming language that is also used to create console games, like those for Xbox. Browse more information about C++:

* [Microsoft resources for C++](https://docs.microsoft.com/en-us/cpp/?view=msvc-160): learn how to install the Visual Studio IDE and write C++ code
* [Microsoft C++ and C# code samples for gaming](https://docs.microsoft.com/en-us/samples/browse/?languages=cpp&terms=gaming): a resource with over 40 C++ and C# code samples for gaming
* [Interactive C++ tutorial](https://www.learn-cpp.org/): a free tutorial that runs C++ code in exercises

## **Tips for learning programming languages**

Here are a few tips to follow when you start learning a new programming language:

* Define a practice project and use the language to help you complete it. This makes the learning process more practical and engaging.
* Keep previous concepts and coding principles in mind. Many of these are transferable between programming languages. So, after you have learned one language, learning a second or third programming language tends to be much easier.
* Create and keep good notes and cheat sheets in whatever format (handwritten or typed) that works best for you.
* Create an online filing system for information that you can easily access while you work in various programming environments.

# From spreadsheets to SQL to R

Although the programming language R might be new to you, it actually has a lot of similarities to the other tools you have explored in this program. In this reading, you will compare spreadsheet programs, SQL, and R to have a better sense of how to use each moving forward.



## **Spreadsheets, SQL, and R: a comparison**

As a data analyst, there is a good chance you will work with SQL, R, and spreadsheets at some point in your career. Each tool has its own strengths and weaknesses, but they all make the data analysis process smoother and more efficient. There are two main things that all three have in common:

* They all use filters: for example, you can easily filter a dataset using any of these tools. In R, you can use the filter function. This performs the same task as a basic SELECT-FROM-WHERE SQL query. In a spreadsheet, you can create a filter using the menu options.
* They all use functions: In spreadsheets, you use functions in formulas, and in SQL, you include them in queries. In R, you will use functions in the code that is part of your analysis.

The table below presents key questions to explore a few more ways that these tools compare to each other. You can use this as a general guide as you begin to navigate R.

| **Key question** | **Spreadsheets** | **SQL** | **R** |
| --- | --- | --- | --- |
| What is it? | A program that uses rows and columns to organize data and allows for analysis and manipulation through formulas, functions, and built-in features | A database programming language used to communicate with databases to conduct an analysis of data | A general purpose programming language used for statistical analysis, visualization, and other data analysis |
| W​hat is a primary advantage? | I​ncludes a variety of visualization tools and features | A​llows users to manipulate and reorganize data as needed to aid analysis | P​rovides an accessible language to organize, modify, and clean data frames, and create insightful data visualizations |
| Which datasets does it work best with? | Smaller datasets | Larger datasets | Larger datasets |
| What is the source of the data? | Entered manually or imported from an external source | Accessed from an external database | Loaded with R when installed, imported from your computer, or loaded from external sources |
| Where is the data from my analysis usually stored? | In a spreadsheet file on your computer | Inside tables in the accessed database | In an R file on your computer |
| Do I use formulas and functions? | Yes | Yes | Yes |
| Can I create visualizations? | Yes | Yes, by using an additional tool like a database management system (DBMS) or a business intelligence (BI) tool | Yes |

Introduction to R

* Accessible
* Data-centric programming lanugage
* Open source
* Community

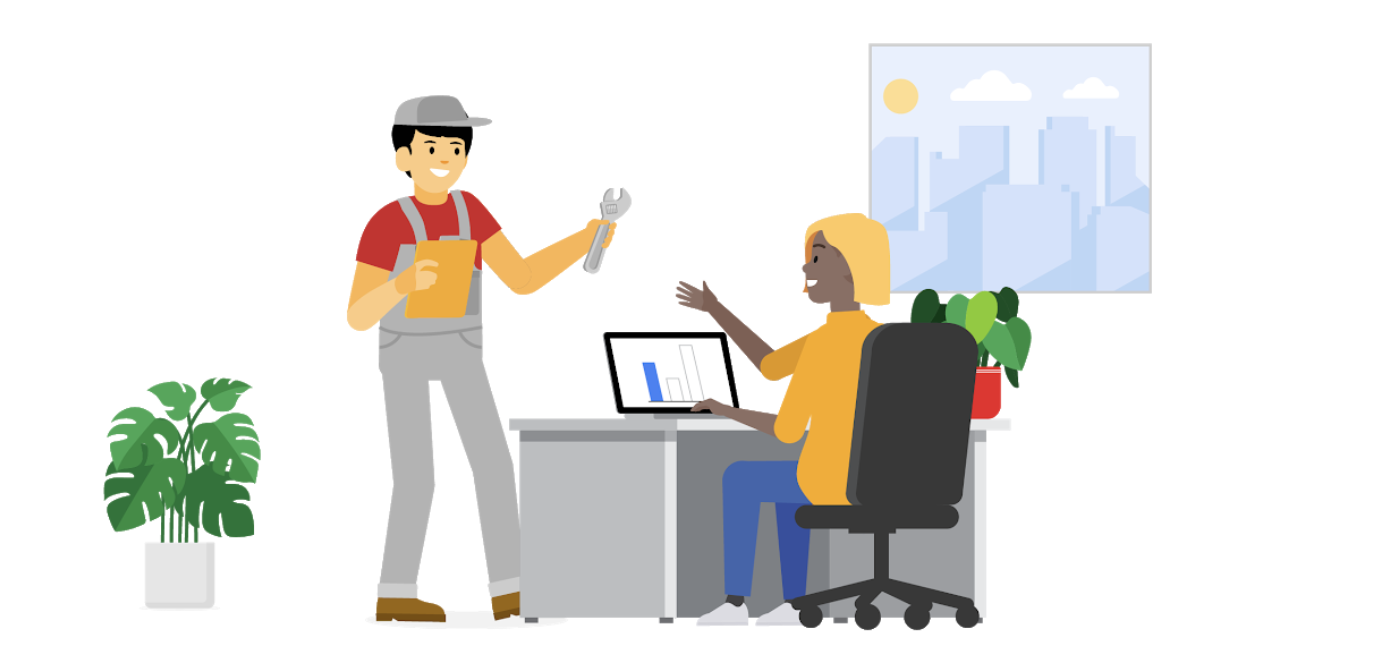
Common use of R:

* Reproducing your analysis
* Processing lots of data
* Creating data visualizations

Integrated Development Environment (IDE): A software application that brigbs together all the tools you may want to use in a single place.

# When to use RStudio

As a data analyst, you will have plenty of tools to work with in each phase of your analysis. Sometimes, you will be able to meet your objectives by working in a spreadsheet program or using SQL with a database. In this reading, you will go through some examples of when working in R and RStudio might be your better option instead.



## **Why RStudio?**

One of your core tasks as an analyst will be converting raw data into insights that are accurate, useful, and interesting. That can be tricky to do when the raw data is complex. R and RStudio are designed to handle large data sets, which spreadsheets might not be able to handle as well. RStudio also makes it easy to reproduce your work on different datasets. When you input your code, it's simple to just load a new dataset and run your scripts again. You can also create more detailed visualizations using RStudio.

## **When RStudio truly shines**

When the data is spread across multiple categories or groups, it can be challenging to manage your analysis, visualize trends, and build graphics. And the more groups of data that you need to work with, the harder those tasks become. That’s where RStudio comes in.

For example, imagine you are analyzing sales data for every city across an entire country. That is a lot of data from a lot of different groups–in this case, each city has its own group of data.

Here are a few ways RStudio could help in this situation:

* Using RStudio makes it easy to take a specific analysis step and perform it for each group using basic code. In this example, you could calculate the yearly average sales data for every city.
* RStudio also allows for flexible data visualization. You can visualize differences across the cities effectively using plotting features like facets–which you’ll learn more about later on.
* You can also use RStudio to automatically create an output of summary stats—or even your visualized plots—for each group.

As you learn more about R and RStudio moving forward in this program, you’ll get a better understanding of when RStudio should be your data analysis tool of choice.

## **For more information**

* [The Advantages of RStudio](https://www.theanalysisfactor.com/the-advantages-of-rstudio/): This web page explains some of the reasons why RStudio is many analysts’ preferred choice for interfacing with R. You’ll learn about the advantages of using RStudio for data analysis, from ease of use to accessibility of graphics and more.
* [Data analysis and R programming](https://lgatto.github.io/2017_11_09_Rcourse_Jena/before-we-start.html): This online introduction to data analysis and R programming is a good starting point for R and RStudio users. It also includes a list of detailed explanations about the advantages of using R and RStudio. You’ll also find a helpful guide for getting set up with RStudio.