Introduction to Geoinformatics

tbd

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# Introduction to R

## About this module

This module will provide you with the fundamental skills in

* basic programming in R
* data wrangling

**Learning objectives**

* xxx
* xxx

Upon the completion of this lesson, you will ....

## R programming language

One of the most widely used programming languages and an effective tool for *(geospatial)* data science

* data wrangling
* statistical analysis
* machine learning
* data visualisation and maps
* processing spatial data
* geographic information analysis

## Schedule

The lectures and practical sessions have been designed to follow the schedule below

* **1 R coding**
* 100 Introduction
* 110 R programming
* **2 Data wrangling**
* 200 Selection and manipulation
* 210 Table operations
* 220 Reproducibility
* **3 Data analysis**
* 300 Exploratory data analysis
* 310 Comparing data
* 320 Regression models
* **4 Machine learning**
* 400 Unsupervised
* 410 Supervised

## Reference books

Suggested reading

* *Programming Skills for Data Science: Start Writing Code to Wrangle, Analyze, and Visualize Data with R* by Michael Freeman and Joel Ross, Addison-Wesley, 2019. See book [webpage](https://www.pearson.com/us/higher-education/program/Freeman-Programming-Skills-for-Data-Science-Start-Writing-Code-to-Wrangle-Analyze-and-Visualize-Data-with-R/PGM2047488.html) and [repository](https://programming-for-data-science.github.io/).
* *R for Data Science* by Garrett Grolemund and Hadley Wickham, O'Reilly Media, 2016. See [online book](https://r4ds.had.co.nz/).
* *Discovering Statistics Using R* by Andy Field, Jeremy Miles and Zoë Field, SAGE Publications Ltd, 2012. See book [webpage](https://www.discoveringstatistics.com/books/discovering-statistics-using-r/).
* *Machine Learning with R: Expert techniques for predictive modeling* by Brett Lantz, Packt Publishing, 2019. See book [webpage](https://subscription.packtpub.com/book/big_data_and_business_intelligence/9781788295864).

Further reading

* *The Art of R Programming: A Tour of Statistical Software Design* by Norman Matloff, No Starch Press, 2011. See book [webpage](https://nostarch.com/artofr.htm)
* *An Introduction to R for Spatial Analysis and Mapping* by Chris Brunsdon and Lex Comber, Sage, 2015. See book [webpage](https://uk.sagepub.com/en-gb/eur/an-introduction-to-r-for-spatial-analysis-and-mapping/book241031)
* *Geocomputation with R* by Robin Lovelace, Jakub Nowosad, Jannes Muenchow, CRC Press, 2019. See [online book](https://bookdown.org/robinlovelace/geocompr/).

## R

Created in 1992 by Ross Ihaka and Robert Gentleman at the University of Auckland, New Zealand

* Free, open-source implementation of *S*
  + statistical programming language
  + Bell Labs
* Functional programming language
* Supports (and commonly used as) procedural (i.e., imperative) programming
* Object-oriented
* Interpreted (not compiled)

## Interpreting values

When values and operations are inputted in the *Console*, the interpreter returns the results of its interpretation of the expression

2

## [1] 2

"String value"

## [1] "String value"

# comments are ignored

## Basic types

R provides three core data types

* numeric
  + both integer and real numbers
* character
  + i.e., text, also called *strings*
* logical
  + TRUE or FALSE

## Numeric operators

R provides a series of basic numeric operators

|  |  |  |  |
| --- | --- | --- | --- |
| Operator | Meaning | Example | Output |
| + | Plus | 5 + 2 | 7 |
| - | Minus | 5 - 2 | 3 |
| \* | Product | 5 \* 2 | 10 |
| / | Division | 5 / 2 | 2.5 |
| %/% | Integer division | 5 %/% 2 | 2 |
| %% | Module | 5 %% 2 | 1 |
| ^ | Power | 5^2 | 25 |

5 + 2

## [1] 7

## Logical operators

R provides a series of basic logical operators to test

|  |  |  |  |
| --- | --- | --- | --- |
| Operator | Meaning | Example | Output |
| == | Equal | 5 == 2 | FALSE |
| != | Not equal | 5 != 2 | TRUE |
| > (>=) | Greater (or equal) | 5 > 2 | TRUE |
| < (<=) | Less (or equal) | 5 <= 2 | FALSE |
| ! | Not | !TRUE | FALSE |
| & | And | TRUE & FALSE | FALSE |
| | | Or | TRUE | FALSE | TRUE |

5 >= 2

## [1] TRUE

## Summary

An introduction to R

* Basic types
* Basic operators

**Next**: Core concepts

* Variables
* Functions
* Libraries

# Lesson 2 heading

# Data Types

# Lesson 4 heading

# Functions

# Lesson 6 heading

# Selection and filtering

# References