

# CT1100: Computer Systems

## Topic 1: Introduction to R

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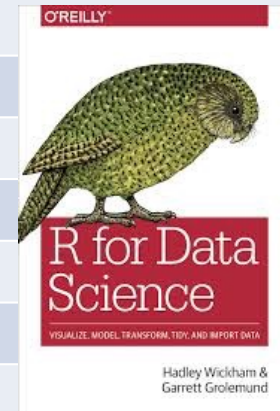
# Module Overview

- Exploring the essential building blocks of the information age
  - Semester 1: Data (R) and Computer Hardware
  - Semester 2 Software & Networks
- Compulsory for all first year BA students taking IT as a subject
  - Labs from week 4 (1 hour per week, 3 time slots)
  - Worth 5 ECTS in credit
  - Continuous Assessment (MCQ tests, Assignments, Lab Exam)
- See also <https://github.com/JimDuggan/CT1100>



# Topics to be Covered (R)

Topic	Description
1	Introduction to R and R Studio Cloud
2	A program in R
3	The tibble – a way of storing information
4	Data Visualisation I
5	Data Transformation I
6	Running a Script in R
7	Data Visualisation II
8	Data Transformation II
9	Exploring Data
10	Communicating Results



<https://r4ds.had.co.nz>



# Gather some data today... see Blackboard link.

CT1100 Survey

Questions Responses

## CT1100 Gathering Data

An anonymous "one or the other" type questions

Animal

☐ Dog

☐ Cat

Movies

☐ Netflix

☐ YouTube

Contacts

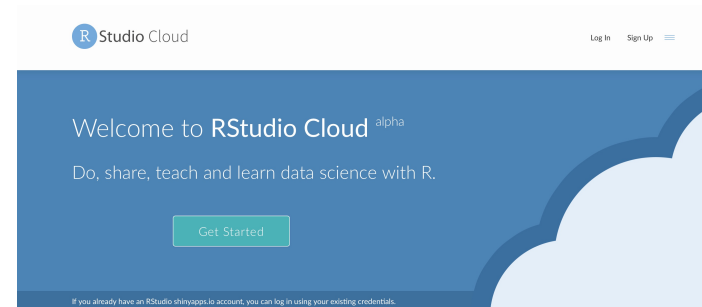
☐ Phone Call

☐ Text



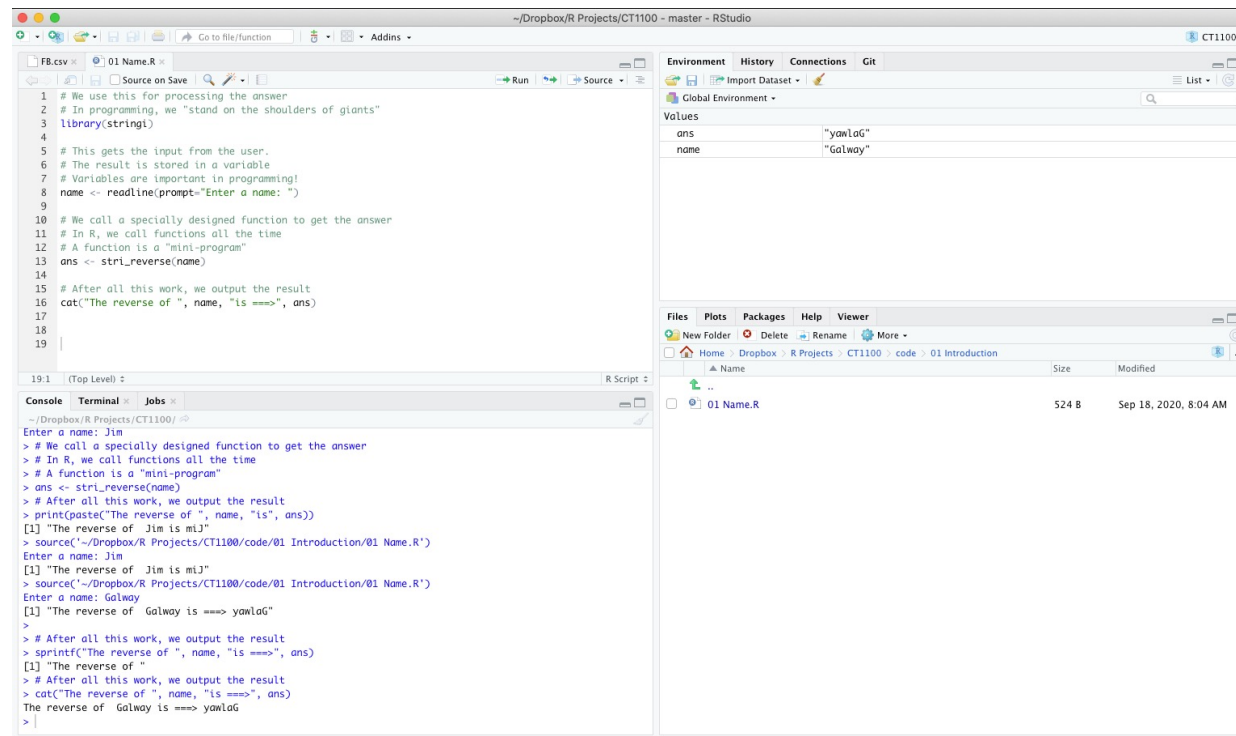
# The R Project for Statistical Computing

- R's *mission* is to enable the best and most thorough exploration of data possible (Chambers 2008).
- It is a dialect of the S language, developed at Bell Laboratories
- ACM noted that S “*will forever alter the way people analyze, visualize, and manipulate data*”



```
1 # We use this for processing the answer
2 # In programming, we "stand on the shoulders of giants"
3 library(stringi)
4
5 # This gets the input from the user.
6 # The result is stored in a variable
7 # Variables are important in programming!
8 name <- readline(prompt="Enter a name: ")
9
10 # We call a specially designed function to get the answer
11 # In R, we call functions all the time
12 # A function is a "mini-program"
13 ans <- stri_reverse(name)
14
15 # After all this work, we output the result
16 cat("The reverse of ", name, "is ==>", ans)
```

# First Steps: RStudio Cloud!



The screenshot displays the RStudio Cloud interface. The main editor window shows an R script named '01 Name.R' with the following code:

```
1 # We use this for processing the answer
2 # In programming, we "stand on the shoulders of giants"
3 library(stringr)
4
5 # This gets the input from the user.
6 # The result is stored in a variable
7 # Variables are important in programming!
8 name <- readline(prompt="Enter a name: ")
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10 # We call a specially designed function to get the answer
11 # In R, we call functions all the time
12 # A function is a "mini-program"
13 ans <- str_reverse(name)
14
15 # After all this work, we output the result
16 cat("The reverse of ", name, " is ==> ", ans)
17
18
19
```

The console window at the bottom shows the execution of the script, including user input and the output of the function:

```
~/Dropbox/R Projects/CT1100/ >
Enter a name: Jim
> # We call a specially designed function to get the answer
> # In R, we call functions all the time
> # A function is a "mini-program"
> ans <- str_reverse(name)
> # After all this work, we output the result
> print(paste("The reverse of ", name, " is", ans))
[1] "The reverse of Jim is mIj"
> source("~/Dropbox/R Projects/CT1100/code/01 Introduction/01 Name.R")
> Enter a name: Jim
[1] "The reverse of Jim is mIj"
> source("~/Dropbox/R Projects/CT1100/code/01 Introduction/01 Name.R")
Enter a name: Galway
[1] "The reverse of Galway is ==> yawlaG"
>
> # After all this work, we output the result
> sprintf("The reverse of ", name, " is ==> ", ans)
[1] "The reverse of "
> # After all this work, we output the result
> cat("The reverse of ", name, " is ==> ", ans)
The reverse of Galway is ==> yawlaG
>
```

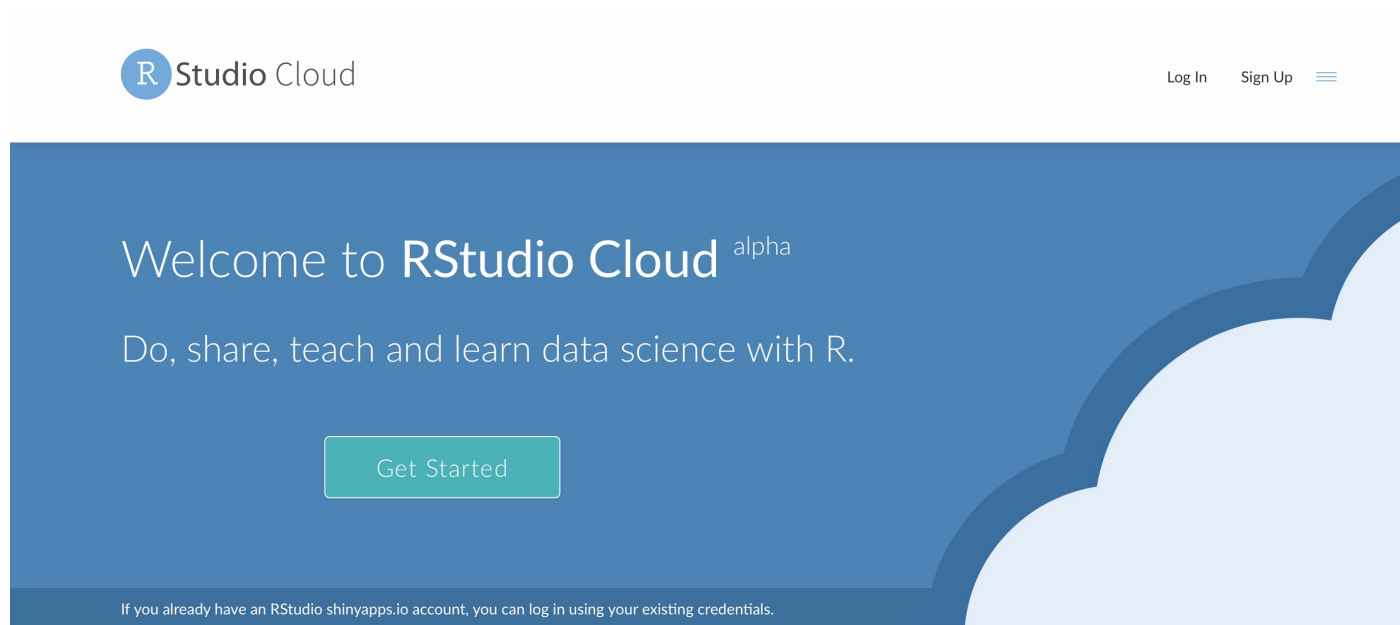
The Environment pane on the right shows the Global Environment with the following values:

ans	name
"yawlaG"	"Galway"

The Files pane at the bottom shows the project structure:

- Home
- Dropbox
- R Projects
- CT1100
- code
- 01 Introduction
- 01 Name.R (524 B, Sep 18, 2020, 8:04 AM)

(1) Create your account on <https://rstudio.cloud> and login



## (2) In your workspace, create a project

☰ Your Workspace **Projects** Info

### Your Projects

**MyDSORR**  
Created Sep 11, 2019 9:26 PM 🔒

**R Course**  
Created Aug 1, 2019 4:23 PM 🔒

**New Project** ▼

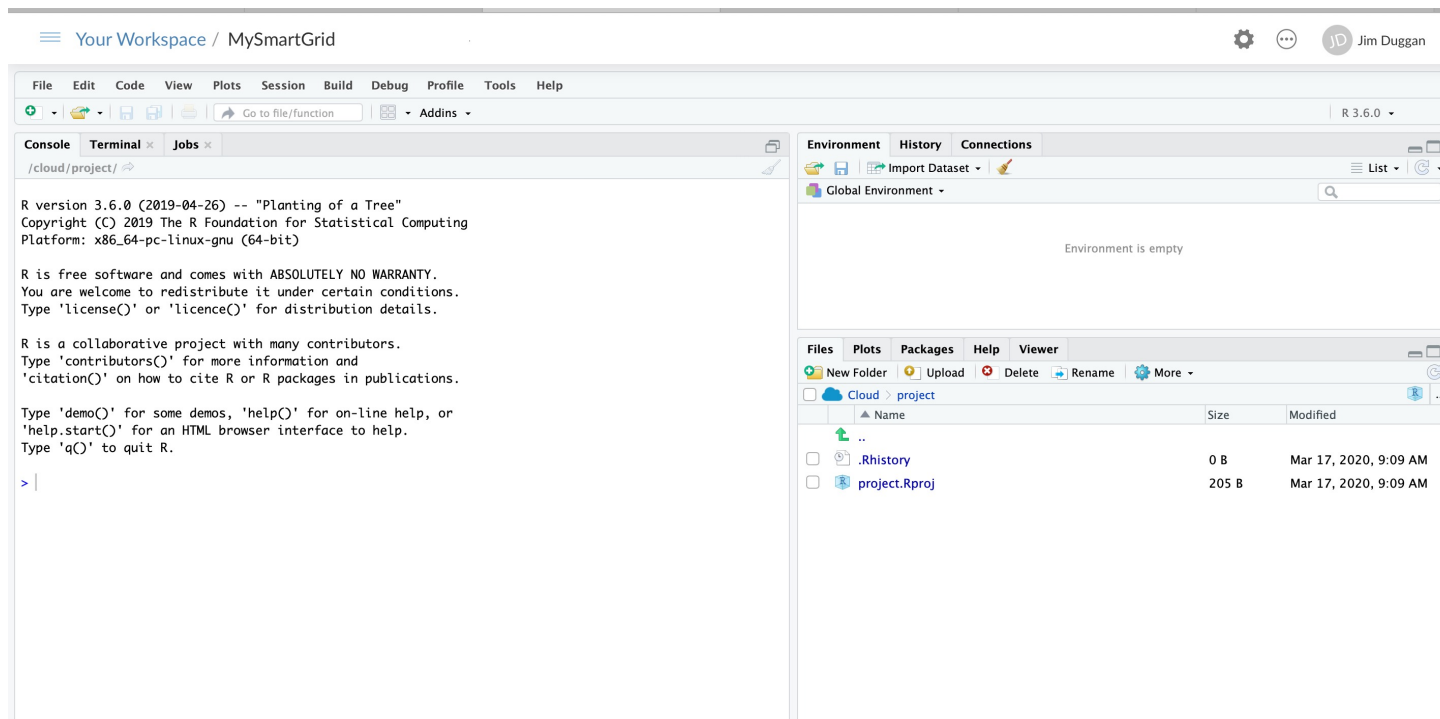
- + New Project
- New Project from Git Repo

🗑 Delete 📁 Move

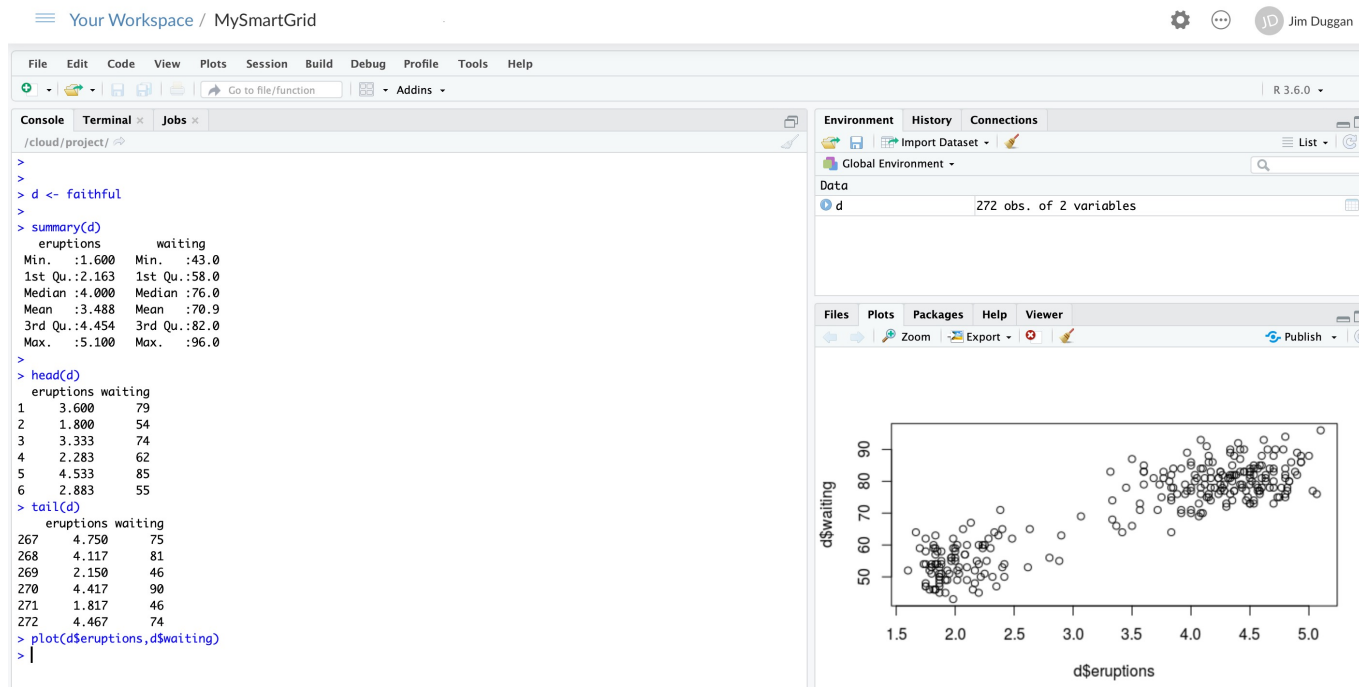




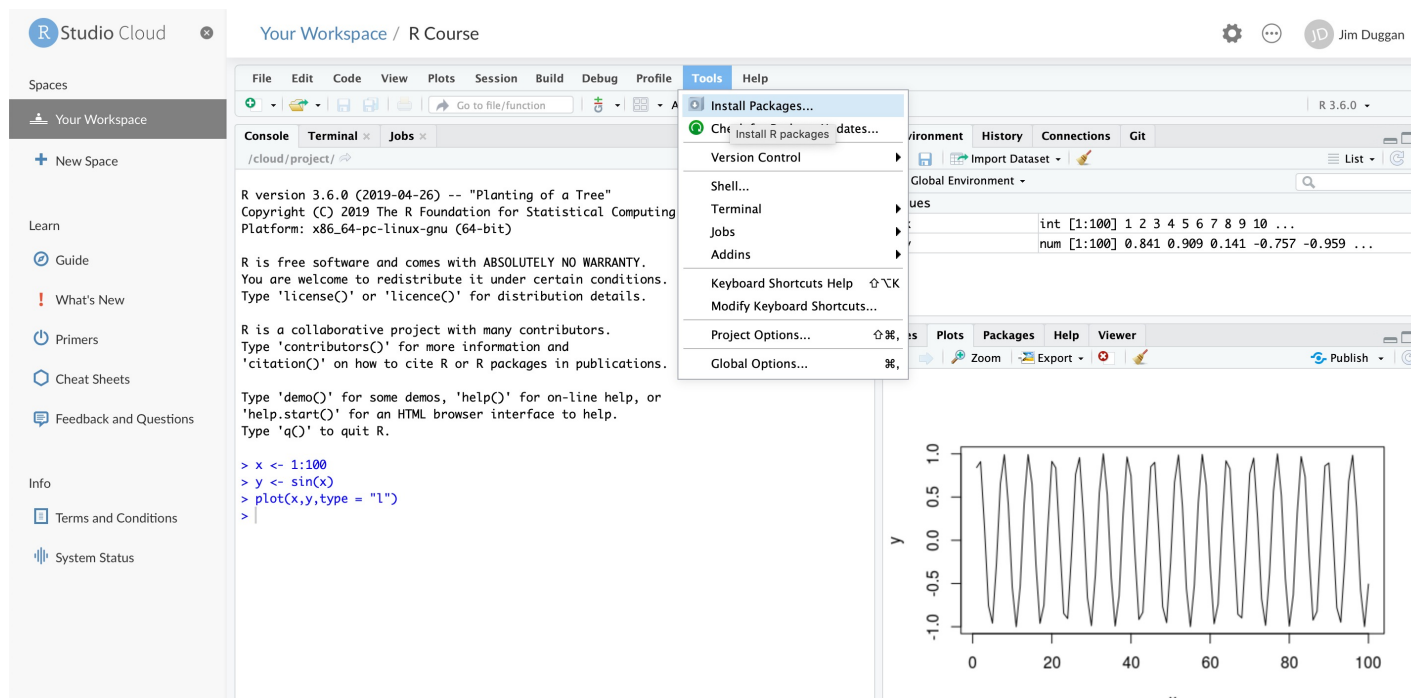
### (3) Name the project (e.g. MySmartGrid)



## (4) Run some R code in Console



## (5) Install required packages



The screenshot displays the RStudio Cloud interface. On the left is a sidebar with navigation options: Spaces, Your Workspace, New Space, Learn (Guide, What's New, Primers, Cheat Sheets, Feedback and Questions), and Info (Terms and Conditions, System Status). The main workspace area shows the R console with the following text:

```
R version 3.6.0 (2019-04-26) -- "Planting of a Tree"
Copyright (C) 2019 The R Foundation for Statistical Computing
Platform: x86_64-pc-linux-gnu (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> x <- 1:100
> y <- sin(x)
> plot(x,y,type = "l")
>
```

The 'Tools' menu is open, showing options like 'Install Packages...', 'Version Control', 'Shell...', 'Terminal', 'Jobs', 'Addins', 'Keyboard Shortcuts Help', 'Modify Keyboard Shortcuts...', 'Project Options...', and 'Global Options...'. The 'Install Packages...' option is highlighted. In the background, a plot of a sine wave is visible, with the x-axis ranging from 0 to 100 and the y-axis from -1.0 to 1.0.

## (6) For example, ggplot2

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```
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Type 'q()' to quit R.

> x <- 1:100
> y <- sin(x)
> plot(x,y,type = "l")
>
```

An 'Install Packages' dialog box is open in the center, showing the following details:

- Repository (CRAN, RSPM)
- Packages (separate multiple with space or comma): ggplot2
- Install to Library: /home/rstudio-user/R/x86\_64-pc-linux-gnu-library/3.6 [Default]
- ☒ Install dependencies

The dialog has 'Install' and 'Cancel' buttons. In the background, a plot window shows a sine wave graph of y = sin(x) for x from 0 to 100.

## (7) Packages required

Package	Purpose
<b>ggplot2</b>	Produce graphics for data
<b>dplyr</b>	Analysis of data held in tibbles/data frames
<b>aimsir17</b>	2017 Weather data for Ireland
<b>stringi</b>	For manipulating strings



# Challenge 1.1

- At the R Console, try it out as a calculator
- Try some classic equations
  - Convert miles to kilometers (use 1.6)
  - Convert Celsius to Fahrenheit ( $9/5 C + 32$ )
- Now, using the `<-` assignment operator to store your answer in a variable
- ***Variables*** are the names you give to *computer memory locations* which are used *to store values in a computer program*