

# 1. Computer Systems - Course Overview

CT1100 - J. Duggan

# CT1100 Overview

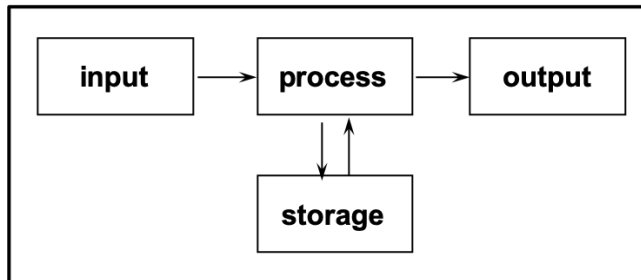
- Exploring the essential building blocks of the information age
- Semester 1 (J. Duggan)
  - Data
  - Hardware
- Semester 2 (M. Rezaei)
  - Software
  - Networks
- Module Information
  - Compulsory for all first year BA students taking IT as a subject
  - Labs from week 4 (1 hour per week, 3 time slots)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

# Overall Plan (Semester 1)

Lecture(s)	Topic
1	Course Introduction
2	The Processing Cycle and Binary Data
3	Data in R with Atomic Vectors
4	The CRAN Library and Calling Functions in R
5	Tidy Data and Data Frames
6-7	<b>ggplot2</b> - A Grammar of Graphics
8-10	<b>dplyr</b> - A Grammar of Data Manipulation
11-12	Introduction to Hardware

# The Processing Cycle in Computing

- Input, Process, Output key stages in computing
- Image recognition
  - Input (a photo)
  - Process (an algorithm)
  - Output (a name)



## Sample Input Data (Match Events)

Time	Team	Scorer	From	Type	Points	Score
1	Dublin	Paul Mannion	Play	Point	1	1
2	Kerry	Sean O'Shea	Play	Point	1	1
3	Dublin	Dean Rock	Play	Point	1	2
4	Dublin	Dean Rock	Free	Point	1	3
10	Kerry	David Clifford	Play	Point	1	2
13	Kerry	Sean O'Shea	FortyFive	Point	1	3
14	Kerry	Stephen O'Brien	Play	Point	1	4
16	Dublin	Paul Mannion	Play	Point	1	4
18	Kerry	Sean O'Shea	Free	Point	1	5
19	Dublin	Jack McCaffrey	Play	Goal	3	7

# Processing - Summarising the Data

```
## # A tibble: 10 x 3
## # Groups:   Team [2]
##   Team    Scorer      Points
##   <chr>   <chr>      <dbl>
## 1 Dublin Dean Rock          10
## 2 Dublin Jack McCaffrey        6
## 3 Dublin Paul Mannion          2
## 4 Dublin Con O'Callaghan        1
## 5 Kerry  Sean O'Shea          10
## 6 Kerry  Killian Spillane        4
## 7 Kerry  David Clifford          2
## 8 Kerry  Gavin Crowley           1
## 9 Kerry  Stephen O'Brien         1
## 10 Kerry Tommy Walsh            1
```

# Processing - Analysing the Scores

```
## # A tibble: 6 x 3
## # Groups:   Team [2]
##   Team    From      Points
##   <chr>  <chr>      <dbl>
## 1 Dublin Play         12
## 2 Dublin Free          6
## 3 Dublin FortyFive     1
## 4 Kerry  Play         12
## 5 Kerry  Free          4
## 6 Kerry  FortyFive     3
```

# Processing - Before the 34th Minute

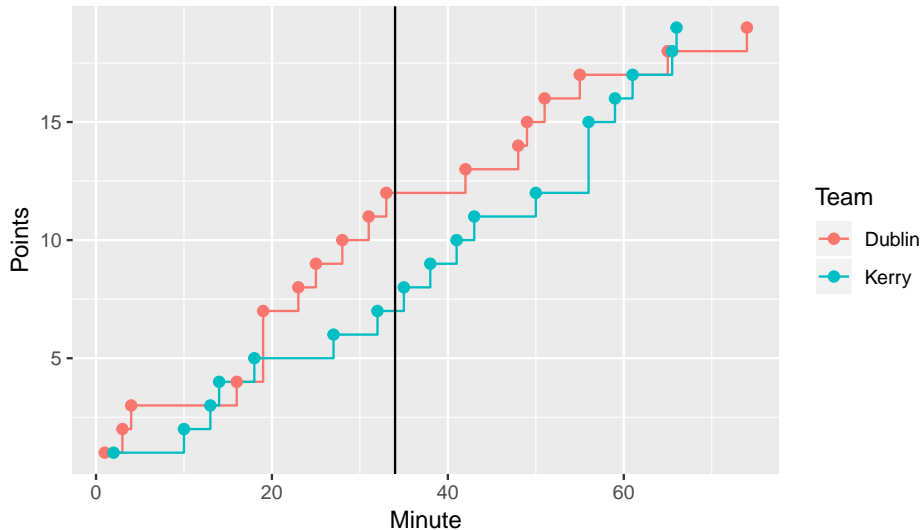
```
## # A tibble: 6 x 3
## # Groups:   Team [2]
##   Team    From      Points
##   <chr>  <chr>      <dbl>
## 1 Dublin Play          8
## 2 Dublin Free          3
## 3 Dublin FortyFive     1
## 4 Kerry  Free          3
## 5 Kerry  Play          3
## 6 Kerry  FortyFive     1
```



## Processing - After the 34th Minute

```
## # A tibble: 5 x 3
## # Groups:   Team [2]
##   Team    From      Points
##   <chr> <chr>      <dbl>
## 1 Dublin Play          4
## 2 Dublin Free          3
## 3 Kerry  Play          9
## 4 Kerry  FortyFive       2
## 5 Kerry  Free           1
```

# Processing - Visualising the Data



# Data processing in R

```
x <- c(3, 4, 5, 6, 7)
x
```

```
## [1] 3 4 5 6 7
```

```
x[1:2]
```

```
## [1] 3 4
```

```
sum(x)
```

```
## [1] 25
```

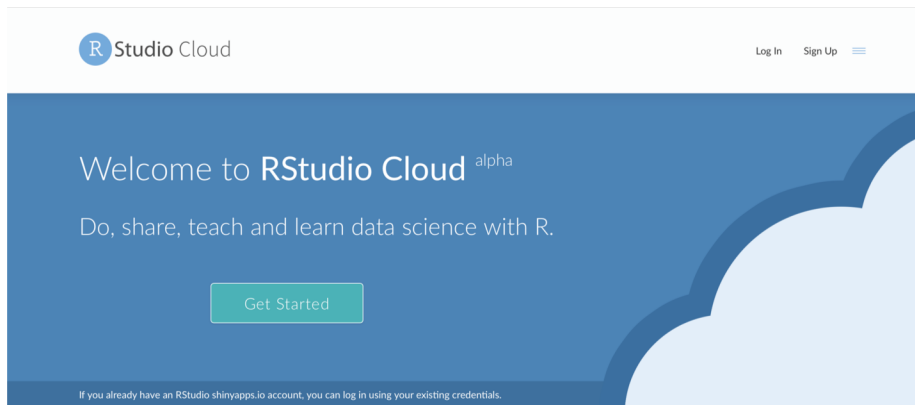
```
mean(x)
```

```
## [1] 5
```

```
x > 5
```

```
## [1] FALSE FALSE FALSE  TRUE  TRUE
```

# Setup an Account on rstudio.cloud



# Create a project

The screenshot displays the RStudio Cloud web interface. On the left is a sidebar with the 'Studio Cloud' logo and navigation links for 'Spaces' (including 'Your Workspace' and 'New Space'), 'Learn' (including 'Guide', 'What's New', 'Primers', 'Cheat Sheets', and 'Feedback and Questions'), and 'Info' (including 'Terms and Conditions'). The main content area is titled 'Your Workspace' and has tabs for 'Projects' (selected) and 'Info'. Below the 'Projects' tab, the heading 'Your Projects' is followed by a large grey box containing the text 'No Projects'. A 'New Project' button is visible, with a dropdown menu open showing two options: '+ New Project' and 'New Project from Git Repo'. On the right side, there is an 'Options' panel with a search bar labeled 'Search Projects', a 'Sort Projects' section with radio buttons for 'By name' (selected) and 'By date created', and a 'Capacity' section explaining that the personal workspace allows for a virtually unlimited number of projects. A link to learn more about the workspace is also present. The top right corner shows a trash icon and the user's profile 'JD Jim Duggan'.

# RStudio ready for use

The screenshot displays the RStudio Cloud interface for a workspace named "CT1100 Workspace / Project 101". The user is logged in as "Jim Duggan".

**Left Sidebar (Navigation):**

- Spaces
  - Your Workspace
  - CT1100 Workspace**
  - New Space
- Learn
  - Guide
  - What's New
  - Primers
  - Cheat Sheets
  - Feedback and Questions
- Info
  - Terms and Conditions
  - System Status

**Top Menu Bar:** File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, Help

**Toolbar:** Includes icons for saving, opening, and navigating files, along with a "Go to file/function" search bar and an "Addins" dropdown.

**Console:** Shows the R version 3.6.0 (2019-04-26) startup message and instructions for using the RStudio interface.

```
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 'licence()' 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.

> |
```

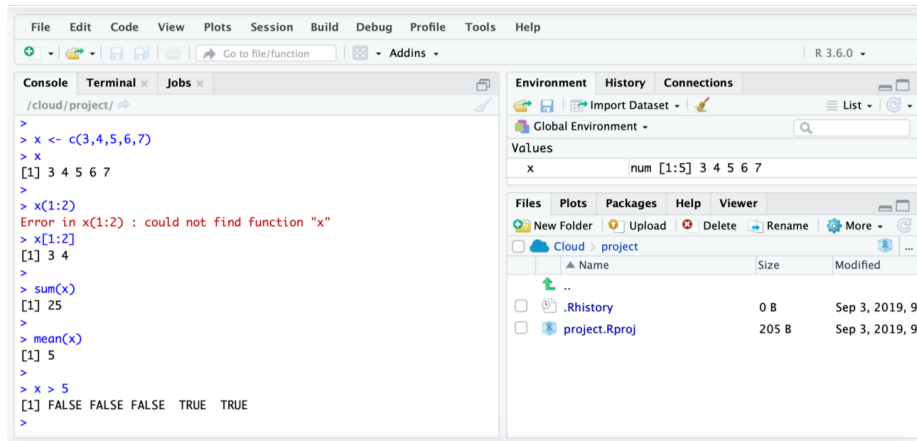
**Environment Pane:** Shows the "Global Environment" with the message "Environment is empty".

**Files Pane:** Displays the file structure of the project.

Name	Size	Modified
..		
.Rhistory	0 B	Sep 3, 2019, 9:20 AM
project.Rproj	205 B	Sep 3, 2019, 9:20 AM

# Run code in console.

- `x` is data!
- R allows you process the data with function calls



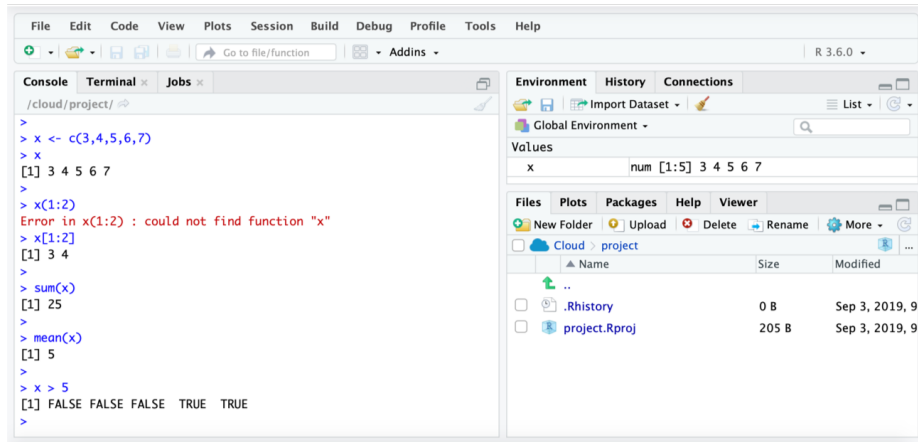
The screenshot displays the RStudio environment. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. The right sidebar shows the Environment pane with 'Global Environment' and a search bar. Below it, the 'Values' pane shows the variable 'x' with its value 'num [1:5] 3 4 5 6 7'. The bottom right pane shows the 'Files' view of the 'project' directory, listing files like '.Rhistory' and 'project.Rproj'.

**Console Output:**

```
/cloud/project/

>
> x <- c(3,4,5,6,7)
> x
[1] 3 4 5 6 7
>
> x(1:2)
Error in x(1:2) : could not find function "x"
> x[1:2]
[1] 3 4
>
> sum(x)
[1] 25
>
> mean(x)
[1] 5
>
> x > 5
[1] FALSE FALSE FALSE TRUE TRUE
>
```

# Challenge 1.1 - Replicate the following in RStudio Cloud



The screenshot displays the RStudio Cloud interface. The top menu bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. Below the menu is a toolbar with icons for creating a new file, opening a file, saving, and other standard file operations. The main workspace is divided into three panes: Console, Environment, and Files.

**Console Pane:** Shows the following R code and its output:

```
>
> x <- c(3,4,5,6,7)
> x
[1] 3 4 5 6 7
>
> x[1:2]
Error in x[1:2] : could not find function "x"
> x[1:2]
[1] 3 4
>
> sum(x)
[1] 25
>
> mean(x)
[1] 5
>
> x > 5
[1] FALSE FALSE FALSE TRUE TRUE
>
```

**Environment Pane:** Shows the Global Environment with a search bar. The Values section displays the variable `x` as a numeric vector of length 5, with values 3, 4, 5, 6, and 7.

**Files Pane:** Shows the file structure of the project. It includes a table with columns for Name, Size, and Modified:

	Name	Size	Modified
<input type="checkbox"/>	..		
<input type="checkbox"/>	.Rhistory	0 B	Sep 3, 2019, 9
<input type="checkbox"/>	project.Rproj	205 B	Sep 3, 2019, 9



# Summary

- Welcome to CT1100
- Semester 1
  - Practical focus - understanding and manipulating data
  - Using RStudio Cloud
- Next Week
  - Input - Process - Output
  - Binary data
  - More on R (atomic vectors)