

量化金融与金融编程

L01 开课啦 

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厦门大学管理学院

2023-09-15





• 课程简介

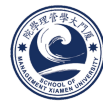
- 量化金融与金融编程 
- 学好这门课的正确方式 
- 谁该选这门课? 

• RStudio 概览

-   

1. 课程简介





{{知乎神回复}}

知乎

有问题 就会有答案

Q: 考上好大学学 IT 是不是当今中国穷人家孩子晋级中产唯一的出路?

A: 对, 就4条路: 写代码; 搞金融; 在代码圈搞金融; 在金融圈写代码



😍 {{清华大学计算机与金融双学士学位}}

当计算机遇上金融
会碰撞出什么样的火花？

2020年高考季

如果你既想学计算机科学与技术改变世界

又想学经济与金融经世济民

你不必再遗憾于鱼和熊掌不可兼得

也不必再纠结未来何时弥补“曲线救国”

清华大学计算机与金融双学士学位

启动本科招生

为你的梦想提出了完美解决方案

{{“状元收割神器”}}



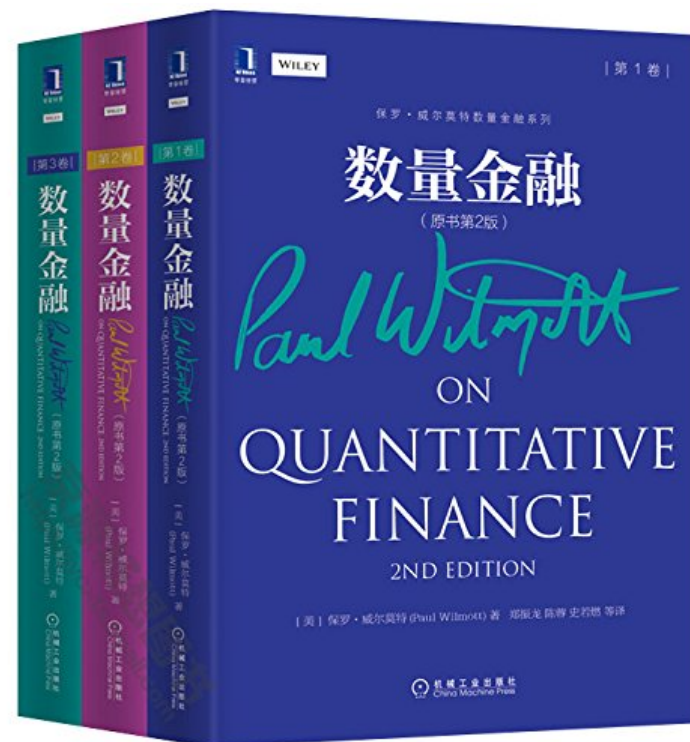
计算机 ⊕ 金融 ⊕ ?
清华大学计算机与金融双学士学位招生项目

1.1 量化金融 与 金融编程

- Paul Wilmott著，郑振龙等译，机械工业出版社，2015年

- 83章，1200+页！

- 第一部分 数理与金融基础、衍生品基本理论、风险与收益
- 第二部分 奇异合约及路径依赖
- 第三部分 固定收益的建模和衍生品
- 第四部分 信用风险
- 第五部分 进阶主题





1.1 量化金融 与 金融编程 R 语言编程

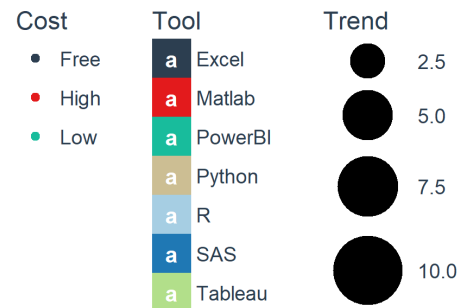
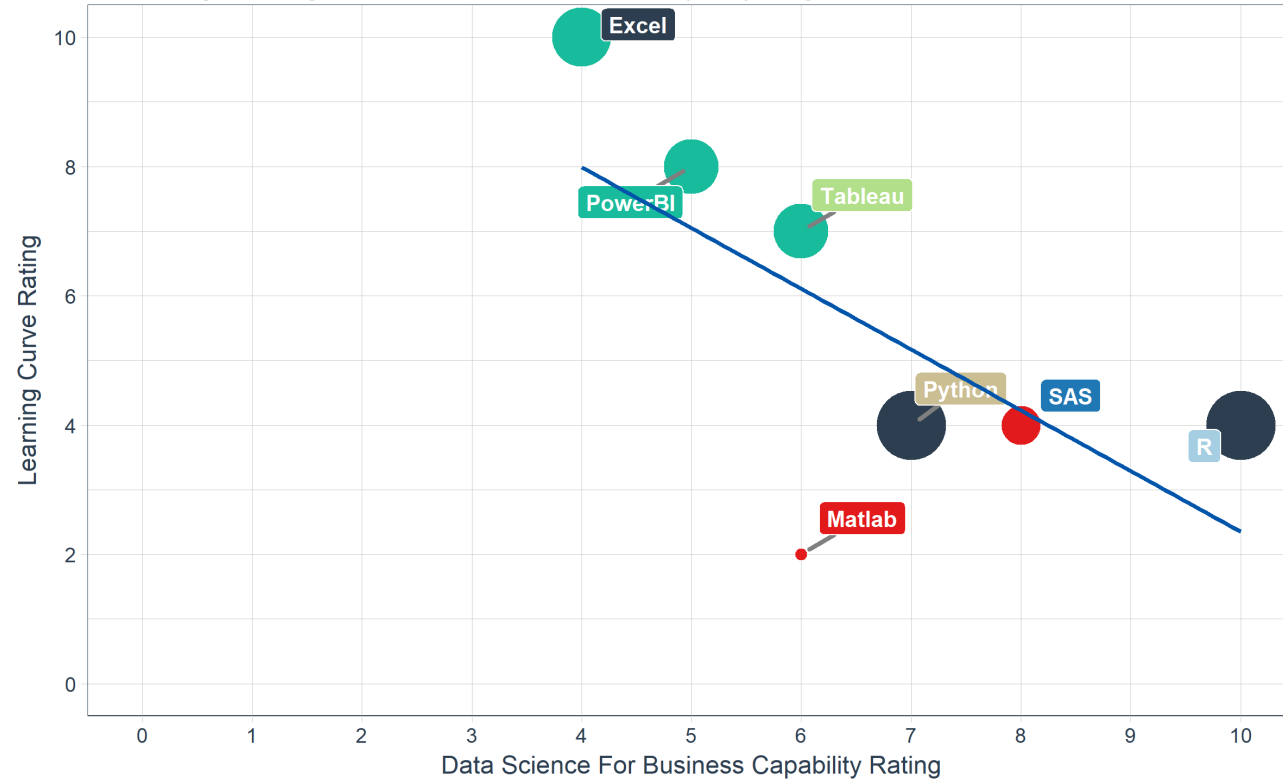


- *"a free software environment for ..."*
- *"... statistical computing and graphics"*











- 支持 Windows、MacOS、Unix 等众多主流操作系统
- 功能强大，“几乎”应有尽有
 - **CRAN** 上现（2023-09-14）有 19877 个扩展 R 包！
 - **github** 上也托管着大量的 R 包
- 学习曲线适中
- 良好的编程社区支持
- 免费、开源！

DS4B Tools: Capability Vs Learning Curve

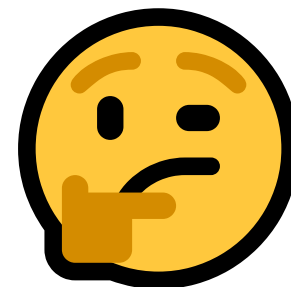
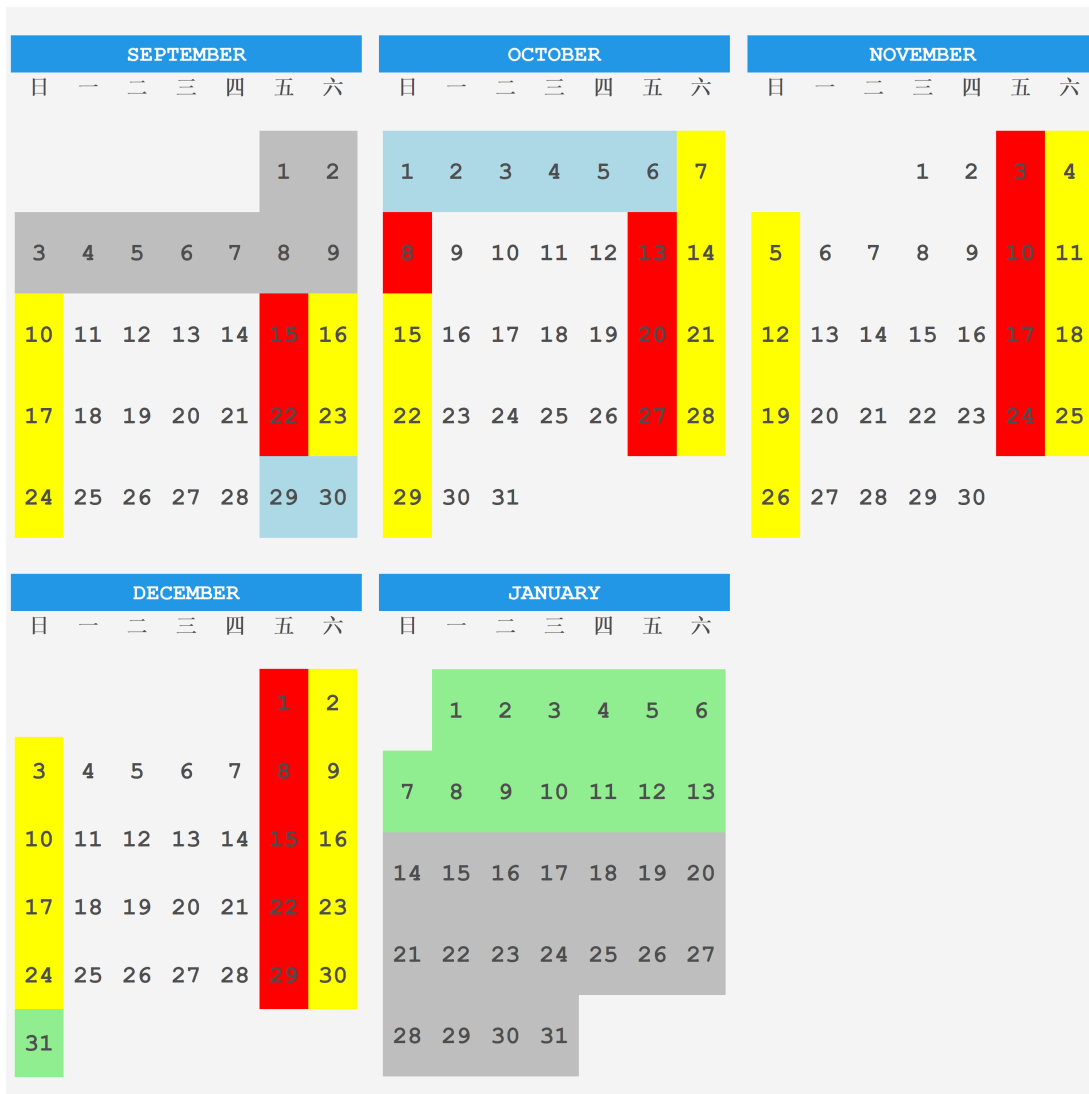
R has a longer learning curve but has a massive business capability rating



}}Six Reasons To Learn R For Business}}

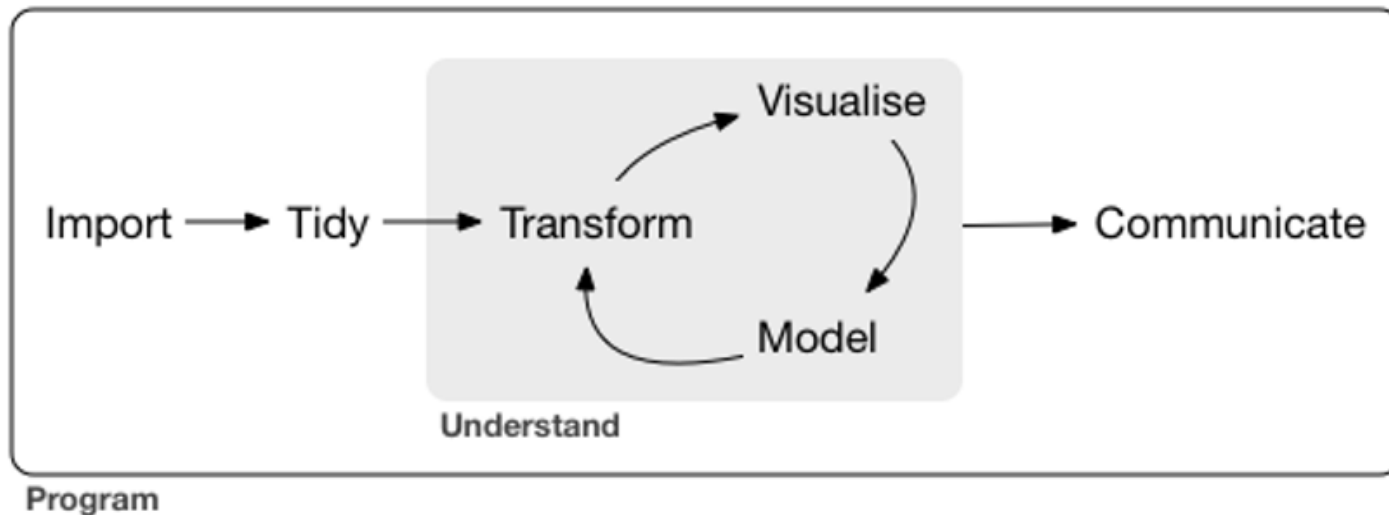
Sep 2023	Sep 2022	Change	Programming Language	Ratings	Change
1	1		 Python	14.16%	-1.58%
2	2		 C	11.27%	-2.70%
3	4	▲	 C++	10.65%	+0.90%
4	3	▼	 Java	9.49%	-2.23%
5	5		 C#	7.31%	+2.42%
6	7	▲	 JavaScript	3.30%	+0.48%
7	6	▼	 Visual Basic	2.22%	-2.18%
8	10	▲	 PHP	1.55%	-0.13%
9	8	▼	 Assembly language	1.53%	-0.96%
10	9	▼	 SQL	1.44%	-0.57%
11	15	▲▲	 Fortran	1.28%	+0.26%
12	12		 Go	1.19%	+0.03%
13	14	▲	 MATLAB	1.19%	+0.13%
14	22	▲▲	 Scratch	1.08%	+0.51%
15	13	▼	 Delphi/Object Pascal	1.02%	-0.07%
16	16		 Swift	1.00%	+0.02%
17	26	▲▲	 Rust	0.97%	+0.47%
18	18		 R	0.97%	+0.02%
19	20	▲	 Ruby	0.95%	+0.30%
20	34	▲▲	 Kotlin	0.90%	+0.59%

1.2 学好这门课的正确方式



1.2 学好这门课的正确方式

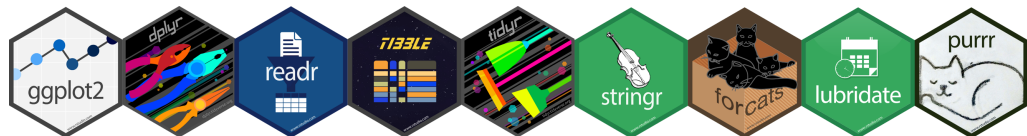
☑ 掌握科学的**workflow**，提升效率



{{Workflow from "R for Data Science, 2e"}}

1.2 学好这门课的正确方式

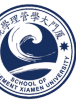
☑ Start with `tidyverse`



☑ `R Markdown` | `Quarto`

- 将 (`R`、`R` ...) 代码 (及其动态计算结果, 如图表等) 和 `Markdown` 文字汇编成文档, 并可转化为多种格式的输出
-> efficient and *reproducible research*

☑ Stay in  Studio[®]



1.2 学好这门课的正确方式

☑ **task**导向, 掌握核心  

- 专题任务

- 数据搜集-整理-可视化
- 投资组合优化
- 资产定价模型
- 衍生品定价
- 量化交易策略
- 实证研究文献复刻 ...

- **{{CRAN Task views}}**

- Econometrics
- Finance
- TimeSeries
- Optimization
- MachineLearning
- Graphics
- ReproducibleResearch ...



1.2 学好这门课的正确方式

☑ **practice makes perfect!** 🏹 → 100!

纸上得来终觉浅，绝知此事要躬行。

——陆游·冬夜读书示子律

- 课上 2 学时/周
 - 我：概要 + 出题 + 答疑 + 扩展
 - 同学：听讲 + 练习 + 反馈
- **课后 5 小时/周起**
 - 同学：预习 + 复习 + 作业
 - 我：备课 + (在线) 答疑解惑

• 课程的成绩构成：

- 考勤：5%
- 课堂参与：15%
- 个人作业/随堂小测：40%
- 小组研究项目：40%*

* 每个小组 ~ 4 名同学



1.3 谁该选这门课?

☑ 想继续读研深造的同学

☑ 毕业后想和金融（💰）、数据打交道的同学

☑ 想更好理解金工、固收、金融数学、风险管理等专业课程的同学

☑ 希望能学习并掌握酷炫好玩新工具和新“姿势”的同学

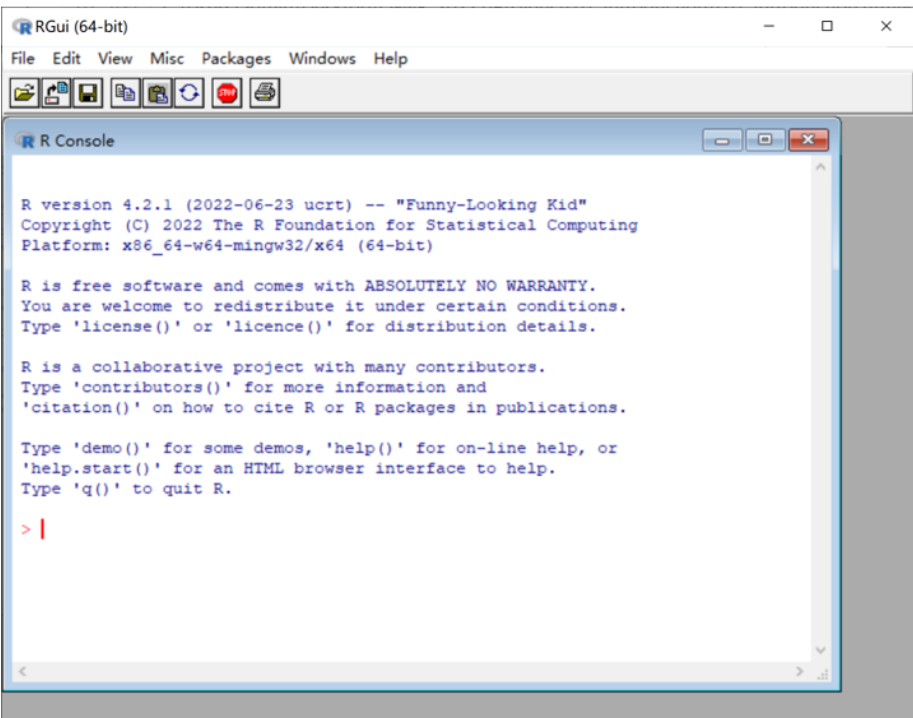
☑ 其他

2. RStudio 概览

< R 语言的赋能工具! >



>> RStudio 为 R 赋能 [{{rstudio-IDE-cheatsheet}}](#) [{{本地pdf版本}}](#)



RStudio IDE :: CHEATSHEET

Documents and Apps

- Open Shiny, R Markdown, knitr, Sweave, LaTeX, Rd files and more in Source Pane
- Check spelling
- Render output
- Choose output format
- Configure render options
- Insert code chunk
- Publish to server

Source Editor

- Navigate backwards/forwards
- Open in new window
- Save
- Find and replace
- Compile notebook
- Run selected code
- Re-run previous code
- Source with or without Echo or as a Local Job
- Multiple cursors/column selection with **Alt + mouse drag**
- Code diagnostics that appear in the margin. Hover over diagnostic symbols for details.
- Syntax highlighting based on your file's extension
- Tab completion to finish function names, file paths, arguments, and more.
- Multi-language code snippets to quickly use common blocks of code.
- Jump to function in file
- Change file type

Tab Panes

- Import data with wizard
- History of past commands to run/copy
- Manage external databases
- View memory usage
- R tutorials
- Load workspace
- Save workspace
- Clear workspace
- Search inside environment
- Choose environment to display from list of parent environments
- Display objects as list or grid
- Displays saved objects by type with short description
- View in data viewer
- View function source code
- Create folder
- Delete file
- Rename file
- Change directory
- Path to displayed directory
- A File browser keyed to your working directory. Click on file or directory name to open.

Version Control

- Turn on at **Tools > Project Options > Git/SVN**
- Added
- Deleted
- Modified
- Renamed
- Untracked
- Stage files
- Commit staged files
- Push/Pull to remote
- View History
- Current branch
- Open shell to type commands
- Show file diff to view file differences

Package Development

- Create a new package with **File > New Project > New Directory > R Package**
- Enable roxygen documentation with **Tools > Project Options > Build Tools**
- Roxygen guide at **Help > Roxygen Quick Reference**
- See package information in the **Build Tab**
- Install package and restart R
- Run devtools::load_all() and reload changes
- Clear output and rebuild
- Run R CMD check
- Test Package
- Check Package
- Build Source Package
- Build Binary Package
- Run package tests
- Customize package build options
- Configure Build Tools...

GUI Package manager lists every installed package

- Install Packages
- Update Packages
- Browse package site
- Click to load package with **library()**. Unclick to detach package with **detach()**.
- Package version installed
- Delete from library

Plots pane

- RStudio opens plots in a dedicated **Plots** pane
- Export plot
- Delete plot
- Delete all plots

Help pane

- RStudio opens documentation in a dedicated **Help** pane
- Home page of helpful links
- Search within help file
- Search for help file

Viewer pane

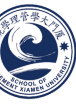
- Viewer pane displays HTML content, such as Shiny apps, R Markdown reports, and interactive visualizations
- Stop Shiny app
- Publish to shinyapps.io, rpubs, RSCONnect, ...
- Refresh

View<-data> pane

- View<-data> opens spreadsheet like view of data set
- Filter rows by value or value range
- Sort by values
- Search for value

Debug Mode

- Use **debug()**, **browser()**, or a breakpoint and execute your code to open the debugger mode.
- Launch debugger mode from origin of error
- Open traceback to examine the functions that R called before the error occurred
- Run commands in environment where execution has paused
- Examine variables in executing environment
- Select function in traceback to debug
- Step through code one line at a time
- Step into and out of functions to run
- Resume execution
- Quit debug mode



>> RStudio 快捷键

- Search command history `Ctrl+↑`
- Interrupt current command `Esc`
- Clear console `Ctrl+L`
- Restart R Session `Ctrl+Shift+F10`
- Run current line/selection `Ctrl+Enter`

- Attempt completion `Tab` or `Ctrl+Space`
- Insert `<-` `Alt+-`
- Insert `%>%` `Ctrl+Shift+M`
- (Un)Comment lines `Ctrl+Shift+C`

- Knit document (knitr) `Ctrl+Shift+K`
- Insert chunk `Ctrl+Alt+I`
- Run the current chunk `Ctrl+Alt+C`

- Show command palette `Ctrl+Shift+P`
- Keyboard shortcuts help `Alt+Shift+K`

>> RStudio's



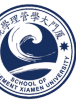
Showtime 

A large, stylized graphic element consisting of a thick yellow swoosh that starts under the 'S' and ends under the 'e', with a yellow five-pointed star at the end of the swoosh.

3. SOS

(getting help)





>> help()

```
help(topic, package = NULL, lib.loc = NULL,
      verbose = getOption("verbose"),
      try.all.packages = getOption("help.try.all.packages"),
      help_type = getOption("help_type"))
```

```
help(mean)      # ?mean
help("for")     # ?"for"
help(files)    # ?files
help(package = "fs") # package?fs
#-----
```

```
example(topic, package = NULL,
         lib.loc = NULL, ...)
vignette(topic, package = NULL,
         lib.loc = NULL,
         all = TRUE)
browseVignettes(package = NULL,
                 lib.loc = NULL,
                 all = TRUE)
```

mean (base) **1** 函数名及其所在的包 R Documentation

Arithmetic Mean **2** 标题

Description **3** 描述

Generic function for the (trimmed) arithmetic mean.

Usage **4** 用法

```
mean(x, ...)
```

Default S3 method:
mean(x, trim = 0, na.rm = FALSE, ...)

Arguments **5** 参数

- x An R object. Currently there are methods for numeric/logical vectors and [date](#), [date-time](#) and [time interval](#) objects. Complex vectors are allowed for `trim = 0`, only.
- trim the fraction (0 to 0.5) of observations to be trimmed from each end of `x` before the mean is computed. Values of trim outside that range are taken as the nearest endpoint.
- na.rm a logical value indicating whether NA values should be stripped before the computation proceeds.
- ... further arguments passed to or from other methods.

Value **6** 返回值

If `trim` is zero (the default), the arithmetic mean of the values in `x` is computed, as a numeric or complex vector of length one. If `x` is not logical (coerced to numeric), numeric (including integer) or complex, `NA_real_` is returned, with a warning.

If `trim` is non-zero, a symmetrically trimmed mean is computed with a fraction of `trim` observations deleted from each end before the mean is computed.

References **7** 参考资料

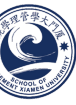
Becker, R. A., Chambers, J. M. and Wilks, A. R. (1988) *The New S Language*. Wadsworth & Brooks/Cole.

See Also **8** 另参见

[weighted.mean](#), [mean.POSIXct](#), [colMeans](#) for row and column means.

Examples **9** 示例

```
x <- c(0:10, 50)
xm <- mean(x)
```

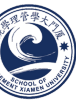


>> help.search() & RSiteSearch()

```
help.search(pattern, fields = c("alias", "concept", "title"),
  apropos, keyword, whatis, ignore.case = TRUE,
  package = NULL, lib.loc = NULL,
  help.db = getOption("help.db"),
  verbose = getOption("verbose"), rebuild = FALSE,
  agrep = NULL, use_UTF8 = FALSE,
  types = getOption("help.search.types"))
```

```
# Search for key words or phrases in help pages, vignettes or task views,
# using the search engine at http://search.r-project.org and view them
# in a web browser.
```

```
RSiteSearch(string,
  restrict = c("functions", "descriptions", "news", "Rfunctions",
    "rmanuals", "READMEs", "views", "vignettes"),
  format,
  sortby = c("score", "date:late", "date:early", "subject",
    "subject:descending", "size", "size:descending"),
  matchesPerPage = 20,
  words = c("all", "any"))
```



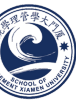
>> sos::findFn() & packagefinder::fp()

```
# Search Contributed R Packages, Sort by Package
# install.packages("sos")
help(package = "sos")

sos::findFn(string, maxPages = 100, sortby = NULL, verbose = 1, ...)
## ???string(maxPages)
# Returns a data.frame from RSiteSearch(string, "functions") which can be
# sorted and subsetted by user specifications and viewed in an HTML table.
```

```
# Comfortable Search for R Packages on CRAN
# install.packages("packagefinder")
help(package = "packagefinder")
```

```
findPackage(keywords = NULL, query = NULL, mode = "or",
            case.sensitive = FALSE, always.sensitive = NULL,
            weights = c(2, 2, 1, 2), display = "viewer",
            results.longdesc = FALSE, limit.results = 15,
            silent = FALSE, index = NULL,
            advanced.ranking = TRUE, return.df = FALSE,
            clipboard = FALSE)
```



>> {{CRAN Task views}}

```
# install.packages("ctv")
ctv::available.views(repos = "https://cran.r-project.org")[[14]]
```

```
#> CRAN Task View
```

```
#> -----
```

```
#> Name: ExperimentalDesign
```

```
#> Topic: Design of Experiments (DoE) & Analysis of Experimental Data
```

```
#> Maintainer: Ulrike Groemping, Tyler Morgan-wall
```

```
#> Contact: ulrike.groemping@bht-berlin.de
```

```
#> Version: 2023-04-05
```

```
#> Repository: https://cran.r-project.org
```

```
#> Source: https://github.com/cran-task-views/ExperimentalDesign/
```

```
#> Packages: acebayes, agricolae*, agridat, AlgDesign*, ALTopt, asd,
```

```
#> BatchExperiments, bcrm, BHH2, binseqtest, bioOED,
```

```
#> blocksdesign, blockTools, BOIN, choiceDes, Combins,
```

```
#> conf.design*, crmPack, crossdes*, Crossover, dae, daewr,
```






```
#> designmatch, desirability, desplot, dfcomb, dfcrm, dfmta,
```

```
#> DiceDesign, DiceEval, DiceKriging, DiceView, docopulae,
```

```
#> DoE.base*, DoE.MIParray, DoE.wrapper*, DoseFinding,
```

```
#> dynaTree, eacynover, EngrExpt, experiment, ez, FMC
```


>> 网络社区

- 有问题就问  或者直接上  **stack overflow**
- 登录  **posit**[™], 关注
 - Products 栏目下的 **{{Open Source}}**, 特别是其中的 **{{R Packages}}**
 - Learn & Support 栏目下的 **{{Resources}}**, 包括 **{{Blogs}}**、**{{Videos}}** 和 **{{Cheatsheets}}**
 - **{{Posit Community}}**
- 订阅  -bloggers, 和 **R** 圈保持同步! 

-
- 登录  **CAPITAL OF STATISTICS**
PROFESSION, HUMANITY & INTEGRITY



>> QQ课程群



群名：量化金融与金融编程
群号：922652997

>> {{reprex 包: Help Me Help You}}



Prepare Reproducible Example Code via the Clipboard

The screenshot displays the RStudio interface. The main editor window shows a script with the following code:

```
1 mtcars
2 ggplot(mtcars) %>%
3   geom_point(aes(mpg, wt))
```

The console window shows the R startup message:

```
D:/_Rwd2/
R version 4.0.2 (2020-08-22) -- Taking Off Again
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (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.

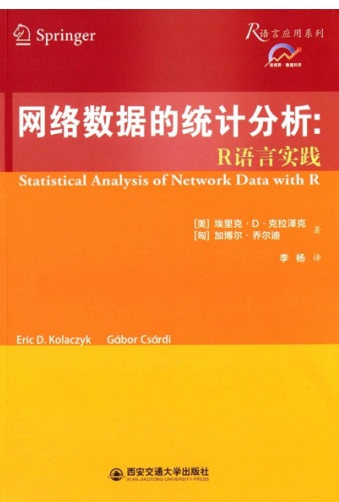
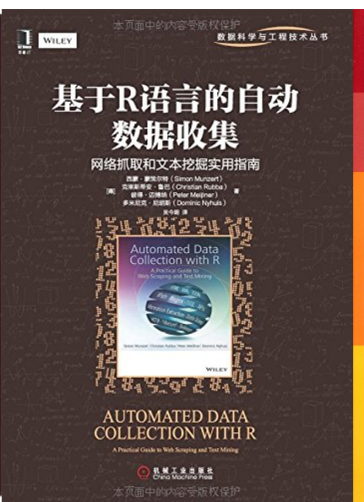
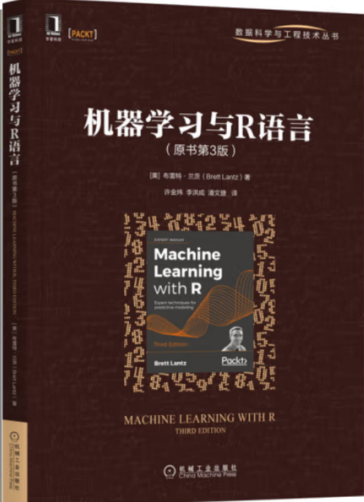
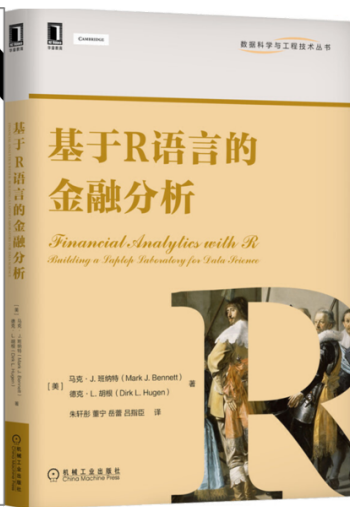
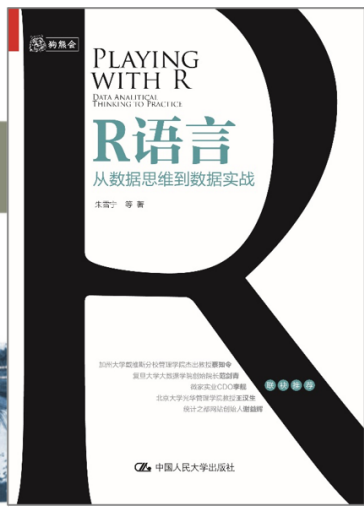
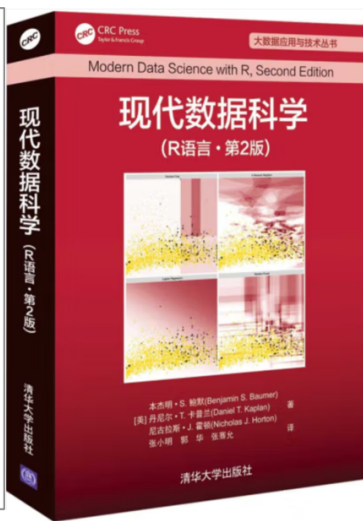
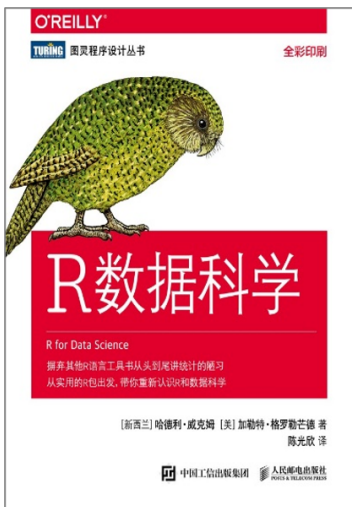
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

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.

> |
```



>> 领域 + R 书籍



课后作业与课前预习





🕒 明确是否选修这门课程

- 若确定不选，请尽快在 **厦门大学教学服务平台** 上提出退课（申请）
 - 若确定选修本门课程，请于2023年9月17日24:00前通过 **坚果云链接** 回答几道问题
-

🕒 初步了解 RStudio 的工作界面，并大致浏览下 **rstudio-IDE-cheatsheet**

🕒 在 RStudio 命令窗口中键入 `help(mean)` 和 `help(files)`，了解 R 帮助文档的整体结构

🕒 到前面课件中提到的那些 **网络社区** 随意逛逛

🕒 完成课前预习（具体任务下周一前我会在 QQ 课程群上通知）



本网页版讲义的制作由 R 包 `{}xaringan{}` 赋能!