

# Badges in Education

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# Chapter 1

## Preface

Still to write



## Chapter 2

# Badges in Stack Overflow

## 2.1 The Stack Exchange Network

### 2.1.1 172 Websites with Stack Overflow as Showpiece

Why I am using Stack Overflow as my primary example to investigate the usefulness of badges in education?

Stack Overflow is a very successful Question and Answer (Q&A) website. It hosts the world's largest programming community and is still growing. Stack Overflow occupies about the 60th position in the world rankings of websites. Currently (June 2018) it has 8.9 million registered user with 16 million questions and 25 million answers. There are already clones in different languages (Russian , Japanese, Spanish and Portuguese) whose user basis at least are partially to add.

But Stack Overflow is just the flagship of StackExchange, a network of (currently) 173 Q&A websites, following the same principles for community management. With this high number of Q&A websites for different issues and target groups it is allowed to assume that at least some principles of the successful community management of programmer are not only restricted to technical subjects but can be transferred to other areas as well. One can see from the graphical representation of the Stack Exchange sites that technology, “hard sciences” like mathematics, physics, chemistry dominate the network. But there are also websites on philosophy, language learning and even websites addressing recreational issues like bicycles, chess and beer, wine & spirits.

Stack Exchange network consists of 173 Q&A communities including Stack Overflow, the largest, most trusted online community for developers to learn, share their knowledge, and build their careers. (Quote from the Stack Overflow website) <sup>1</sup>

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<sup>1</sup>This quote appears in a little window when you are on the meta site and you click in the StackExchange banner left from the search field. But actually in my downloaded data I found just 172 websites. On the about site of StackExchange however I have seen outdated information from the year 2015 (Today: 25th May 2018). You can find another summary of the astonishing success story of StackOverflow from a business perspective on the company page of StackOverflow. – It is sometimes difficult for me to find the right place for some information because of the complex clutter of (similar) sites on different levels (site and meta site).





### 2.1.2 “Graduates” Websites and Websites on Trial (Beta)

### 2.1.3 Stack Exchange Websites by Subject

Status	Users	Rank (Users)
121	3D Printing	14126
32	Academia	809172
128	Amateur Radio	21229
11	Android Enthusiasts	298418
75	Anime and Manga	136640
59	Arduino	66162
19	Arqade	1196579
102	Artificial Intelligence	14471
157	Arts and Crafts	11021
9	Ask Different	712554
111	Ask Patents	19535
3	Ask Ubuntu	2426259
88	Astronomy	78833
171	Augur	1970
71	Aviation	303072
145	Beer, Wine and Spirits	13387
106	Biblical Hermeneutics	78541
68	Bicycles	178700
161	Bioinformatics	11132
65	Biology	191516
37	Bitcoin	144177
51	Blender	216189
82	Board and Card Games	152222
132	Bricks	35808
130	Buddhism	60913
49	Chemistry	279218
105	Chess	65006
110	Chinese Language	57445
78	Christianity	221190
152	CiviCRM	37720
13	Code Review	611983
146	Coffee	13426
159	Community Building	11899
80	Computational Science	64019
136	Computer Graphics	18229
31	Computer Science	217180
148	Computer Science Educators	19698
172	Constructed Languages	3932
139	Craft CMS	52228
12	Cross Validated	786372
46	Cryptography	157410
52	Data Science	56681
18	Database Administrators	469686
134	DevOps	13643
41	Drupal Answers	404345
126	Earth Science	55050
129	Ebooks	11175
108	Economics	43278
16	Electrical Engineering	841553
114	elementary OS	21762
101	Emacs	92732
95	Engineering	42028

## 2.2 Dynamics of the Stack Exchange Community

But before to look into these other websites one should grasp the community dynamics of the most successful member of the network.

All Stack Exchange websites are based of a complex interplay between different elements:

1. **Scores (“reputation” points)** are earned through positive votes by peers for posting useful answers but also for asking questions, if they show research effort and their underlying problems are reproducible.
2. **Badges** as digital token in form of emblems. They are awarded by the system either for fulfilling certain tasks or reaching a certain amount of community awareness.
3. **Privileges** are granted when certain thresholds or milestones of reputation points are transcended. Each privilege opens up a specified user rights in relation to the website.

I am convinced that the study of user interactions of Stack Overflow can be very helpful to understand the success factors for a prosperous community building process. To study user behavior and their reactions to the rules and framework of Stack Overflow one can learn not only much about the effects of gamification elements (e.g. the interplay between reputation points and badges) but also how communities of practice work.

Besides the common review of literature my research in this paper is based on four sources:

1. **Stack Overflow:** Clearly enough this has to be one of my chief source of information.
2. **Stack Exchange API:** The Stack Exchange network provides an Application Programming Interface (API) where one can download data for answering research question.
3. **Meta Stack Overflow:** This website is especially dedicated to Q&A *about* Stack Overflow itself. The discussion on this website is an important resource on qualitative data to my research question.
4. **Meta Stack Exchange:** Another for meta-discussion. This time for the whole Stack Exchange family of Q&A websites, so to speak the meta-meta-website of the Stack Overflow website.

## 2.3 Categorization of Badges

I need to download all types of badges with their description and for further investigation to categorize them.

### 2.3.1 Badges for different activities

The badges are grouped according to the necessary activities to get them. The long version what you have to do to get a specific badge is posted on [meta.stackexchange.com](http://meta.stackexchange.com) under the title: List of all badges with full descriptions. A short and more readable version can be seen on help page for badges:

- 1) Question badges
- 2) Answer badges
- 3) Participation badges
- 4) Moderation badges
- 5) Other badges
- 6) Documentation badges

### 2.3.2 Badges from different sources

Another differentiation is the point of origin the badges come from. Even though all badges are generated automatically by the system, there are two principal sources to get them. There are two different entities responsible for awarding badges.

- There are badges you can get by just doing a certain action once or a needed number of times. \* And there are badges you get only after some community action.

I call the first type **user** and the second type **peer** badges.

#### Examples for user badges:

- Name: “Civic Duty” (Vote 300 times).
- Name: “Enthusiast” (Visit the site each day for 30 consecutive day)

Some of the **user** badges are only available after some threshold value is reached and a certain privileges is granted. For instance voting up needs 15 and voting down 125 reputation points.

#### Examples for peer badges:

- Name: “Favorite Question” (Question favored by 25 users)
- Name: “Popular Question” (Question with 1000 views).

There are also badges tied with certain events, like moderator election, working with the beta version, meeting employees at an event etc. Mostly these badges are in my categorization **user** badges, but you cannot get them at any time, even if you would have the required privileges.

The badge system of Stack Overflow is a dynamic system. When the website was launched (September 15, 2008) it did not start with all 91 badges which are listed today (May 21, 2018). Some of the badges were added during the history of the website but other are not awarded anymore. Some of those badges which are not functional anymore are retired badges (e.g. “Analytical”, for visiting all sections of the FAQ). This means you will still see some veteran users with these badges. Other badges (all three documentation badges for instance) are withdrawn, e.g. they were even deleted from those user accounts they were awarded earlier. I call these two groups of badges **event** and **dead** badges.

To sum up there are 4 points of origin for badges:

- 1) Badges from user action = **user** badges
- 2) Badges from community action = **peer** badges
- 3) Badges from some action during a specified occurrence = **event** badges
- 4) Badges where the point of origin is not interesting anymore as they are now non-functional = **dead** badges

### 2.3.3 Badges with different degrees of difficulty

Badges are ranked by their difficulty. According to their level of difficulty users are awarded with bronze (relatively easy), silver (moderately difficult) or gold (difficult) badges.

There are badges with the same action required but with different amount of repetition. User can see those groups of badges separated by lines on the Stack Overflow website. On this page one can also inspect how many time each badge was awarded.

There is also a special group of badges intimately linked with reputation of the user’s expertise. These **Tag Badges** also come with different degrees of difficulty.

I will focus in my research on those badges where users are mainly responsible. Those are the badges where I can show if users are motivated to strive for them.

#### Visit the site each day for [...] consecutive days. (Days are counted in UTC.)

- 30 (Enthusiast)
- 100 (Fanatic)

#### Ask a well-received question [...] and maintain a positive question record

- on 5 separate days (Curious)
- on 30 separate days (Inquisitativ)

- on 100 separate days (Socratic)

**Complete at least [...]. This badge is awarded once per review type**

- one review task (Custodian)
- 250 review tasks (Reviewer)
- 1000 review tasks (Steward)

**Edit and answer [...] (both actions within 12 hours, answer score > 0)**

- 1 question (Explainer)
- 50 questions (Refiner)
- 500 questions (Illuminator)

**Edit**

- first post (Editor)
- 80 posts (Strunk & White)
- 500 posts (Copy Editor)

**Edit [...] that was inactive for 6 months**

- first post (Excavator)
- 100 posts (Archaeologist)

The **user** badges are of utmost importance for my research. Most of these badges are granted for quality assurance work on the website and are not linked with reputation points. They are – from a systemic perspective – important for the dynamic of the website and maintain respective raise the quality of the platform and their ecological sustainability.

When I can show that people are striving to get **user** badges – even when they are not linked with reputation points – than it is evident that badges are some additional (motivational) factors for the community development.

Table 2.1: Badges in Stack Overflow

	ID	Name	Count	Rank	Activity	Origin	Alike	Description
1	222	Altruist	8158	bronze	Question	User	XX	First bounty you manually award on another person's question
2	1306	Analytical	43743	bronze	Other	Dead	XX	Visited every section of the FAQ (retired)
3	260	Announcer	131289	bronze	Other	Peer	22	Share a link to a question later visited by 25 unique IP addresses
4	1286	Archaeologist	1883	silver	Moderation	User	20	Edit 100 posts that were inactive for 6 months
5	9	Autobiographer	799567	bronze	Participation	User	XX	Complete "About Me" section of user profile
6	221	Benefactor	38879	bronze	Question	User	XX	First bounty you manually award on your own question
7	30	Beta	2510	silver	Participation	Event	13	Voted 10 times, added 3 posts score > 0, and visited the site on 3 separate days during the private beta
8	261	Booster	3234	silver	Other	Peer	22	Share a link to a question later visited by 300 unique IP addresses
9	1973	Caucus	573681	bronze	Participation	Event	09	Visit an election during any phase of an active election and have enough reputation to cast a vote
10	6644	Census	71168	silver	Other	Event	XX	Completed the annual Stack Overflow survey; your responses are anonymous
11	8	Citizen Patrol	177509	bronze	Moderation	User	16	First flagged post
12	32	Civic Duty	80312	silver	Moderation	User	XX	Vote 300 or more times
13	4	Cleanup	40887	bronze	Moderation	User	XX	First rollback
14	31	Commentator	799870	bronze	Participation	User	10	Leave 10 comments
15	3108	Constable	0	gold	Moderation	Event	17	Served as a pro-tem moderator for at least 1 year or through site graduation
16	1974	Constituent	186464	silver	Participation	Event	09	Vote for a candidate in the final phase of an election
17	901	Convention	2041	silver	Participation	Peer	14	10 posts with score of 2 on meta
18	223	Copy Editor	2807	gold	Moderation	User	19	Edit 500 posts (excluding own or deleted posts and tag edits)
19	7	Critic	337868	bronze	Moderation	User	XX	First down vote
20	4127	Curious	283493	bronze	Question	User	01	Ask a well-received question on 5 separate days, and maintain a positive question record
21	2278	Custodian	660176	bronze	Moderation	User	18	Complete at least one review task. This badge is awarded once per review type
22	1002	Deputy	10655	silver	Moderation	User	16	Raise 80 helpful flags

Table 2.1: Badges in Stack Overflow (*continued*)

	ID	Name	Count	Rank	Activity	Origin	Alike	Description
23	37	Disciplined	10866	bronze	Moderation	User	XX	Delete own post with score of 3 or higher
24	6157	Documentation Beta	294	silver	Documentation	Dead	XX	Contributed 3+ substantive pieces of documentation during the private beta
25	6158	Documentation Pioneer	2359	silver	Documentation	Dead	XX	Contributed 3+ substantive pieces of documentation in the first month of documentation
26	7358	Documentation User	43292	silver	Documentation	Dead	XX	Earned at least one badge for contributing to Stack Overflow Documentation
27	3	Editor	1941240	bronze	Moderation	User	19	First edit
28	155	Electorate	17053	gold	Moderation	User	XX	Vote on 600 questions and 25% or more of total votes are on questions
29	19	Enlightened	326889	silver	Answer	Peer	XX	First to answer and accepted with score of 10 or more
30	71	Enthusiast	184881	silver	Participation	User	11	Visit the site each day for 30 consecutive days. (Days are counted in UTC.)
31	145	Epic	659	silver	Participation	Peer	12	Earn 200 daily reputation 50 times
32	1287	Excavator	116182	bronze	Moderation	User	20	Edit first post that was inactive for 6 months
33	4368	Explainer	55984	bronze	Answer	User	05	Edit and answer 1 question (both actions within 12 hours, answer score > 0)
34	28	Famous Question	531146	gold	Question	Peer	04	Question with 10,000 views
35	83	Fanatic	28042	gold	Participation	User	11	Visit the site each day for 100 consecutive days. (Days are counted in UTC.)
36	33	Favorite Question	42126	silver	Question	Peer	02	Question favorited by 25 users
37	15	Generalist	1018	silver	Answer	Peer	XX	Provide non-wiki answers of 15 total score in 20 of top 40 tags
38	24	Good Answer	338757	silver	Answer	Peer	06	Answer score of 25 or more
39	21	Good Question	158537	silver	Question	Peer	03	Question score of 25 or more
40	25	Great Answer	58424	gold	Answer	Peer	06	Answer score of 100 or more
41	22	Great Question	26490	gold	Question	Peer	03	Question score of 100 or more

Table 2.1: Badges in Stack Overflow (*continued*)

	ID	Name	Count	Rank	Activity	Origin	Alike	Description
42	18	Guru	107423	silver	Answer	Peer	XX	Accepted answer and score of 40 or more
43	4370	Illuminator	92	gold	Answer	User	05	Edit and answer 500 questions (both actions within 12 hours, answer score > 0)
44	2600	Informed	1728997	bronze	Other	User	XX	Read the entire tour page
45	4128	Inquisitive	28311	silver	Question	User	01	Ask a well-received question on 30 separate days, and maintain a positive question record
46	219	Investor	16376	bronze	Question	User	XX	First bounty you offer on another person's question
47	146	Legendary	250	gold	Participation	Peer	12	Earn 200 daily reputation 150 times
48	1298	Marshal	2512	gold	Moderation	User	16	Raise 500 helpful flags
49	144	Mortarboard	29156	bronze	Participation	Peer	12	Earn at least 200 reputation (the daily maximum) in a single day
50	17	Necromancer	451138	silver	Answer	Peer	07	Answer a question more than 60 days later with score of 5 or more
51	23	Nice Answer	1020981	bronze	Answer	Peer	06	Answer score of 10 or more
52	20	Nice Question	491031	bronze	Question	Peer	03	Question score of 10 or more
53	6381	Not a Robot	892	silver	Other	Event	XX	Met a Stack Overflow employee at an event where Stack Overflow was an organizer or participant with 50 or more attendees
54	27	Notable Question	1859667	silver	Question	Peer	04	Question with 2,500 views
55	5	Organizer	111063	bronze	Moderation	User	XX	First retag
56	998	Outspoken	1156	silver	Participation	Peer	15	Post 10 messages in chat starred by 10 different users
57	38	Peer Pressure	186488	bronze	Moderation	User	XX	Delete own post with score of -3 or lower
58	26	Popular Question	3725497	bronze	Question	Peer	04	Question with 1,000 views
59	62	Populist	16770	gold	Answer	Peer	XX	Highest scoring answer that outscored an accepted answer with score of more than 10 by more than 2x
60	892	Precognitive	0	bronze	Participation	Dead	13	Followed the Area 51 proposal for this site before it entered the commitment phase
61	220	Promoter	69063	bronze	Question	User	XX	First bounty you offer on your own question
62	1276	Proofreader	16465	bronze	Moderation	User	XX	Approve or reject 100 suggested edits

Table 2.1: Badges in Stack Overflow (*continued*)

	ID	Name	Count	Rank	Activity	Origin	Alike	Description
63	262	Publicist	953	gold	Other	Peer	22	Share a link to a question later visited by 1000 unique IP addresses
64	94	Pundit	9207	silver	Participation	Peer	10	Leave 10 comments with score of 5 or more
65	900	Quorum	25227	bronze	Participation	Peer	14	One post with score of 2 on meta
66	4369	Refiner	1774	silver	Answer	User	05	Edit and answer 50 questions (both actions within 12 hours, answer score > 0)
67	1656	Research Assistant	280	silver	Moderation	User	21	Edit 50 tag wikis
68	95	Reversal	291	gold	Answer	Peer	XX	Provide an answer of +20 score to a question of -5 score
69	1478	Reviewer	33425	silver	Moderation	User	18	Complete at least 250 review tasks. This badge is awarded once per review type
70	837	Revival	324339	bronze	Answer	User	07	Answer more than 30 days after a question was asked as first answer scoring 2 or more
71	10	Scholar	1597231	bronze	Question	User	XX	Ask a question and accept an answer
72	14	Self-Learner	122119	bronze	Answer	User	XX	Answer your own question with score of 3 or more
73	3109	Sheriff	36	gold	Moderation	Event	17	Served as an elected moderator for at least 1 year
74	4129	Socratic	3362	gold	Question	User	01	Ask a well-received question on 100 separate days, and maintain a positive question record
75	805	Sportsmanship	2572	silver	Moderation	User	XX	Up vote 100 answers on questions where an answer of yours has a positive score
76	36	Stellar Question	6046	gold	Question	Peer	02	Question favorited by 100 users
77	2279	Steward	11887	gold	Moderation	User	18	Complete at least 1,000 review tasks. This badge is awarded once per review type
78	12	Strunk & White	14705	silver	Moderation	User	19	Edit 80 posts
79	2	Student	1937383	bronze	Question	User	XX	First question with score of 1 or more
80	804	Suffrage	43785	bronze	Moderation	User	XX	Use 30 votes in a day
81	6	Supporter	1168643	bronze	Moderation	User	XX	First up vote
82	1224	Synonymizer	899	bronze	Moderation	Peer	XX	First approved tag synonym
83	254	Tag Editor	21974	bronze	Moderation	User	21	First tag wiki edit
84	884	Talkative	9613	bronze	Participation	Peer	15	Post 10 messages, with 1 or more starred, in chat



Table 2.1: Badges in Stack Overflow (*continued*)

	ID	Name	Count	Rank	Activity	Origin	Alike	Description
85	11	Taxonomist	11747	silver	Moderation	Peer	XX	Create a tag used by 50 questions
86	1	Teacher	1266655	bronze	Answer	User	XX	Answer a question with score of 1 or more
87	225	Tenacious	48183	silver	Answer	User	08	Zero score accepted answers: more than 5 and 20% of total
88	63	Tumbleweed	998633	bronze	Question	Peer	XX	Asked a question with zero score, no answers, no comments, and low views for a week
89	226	Unsung Hero	18860	gold	Answer	Peer	08	Zero score accepted answers: more than 10 and 25% of total
90	1108	Vox Populi	28464	bronze	Moderation	User	XX	Use the maximum 40 votes in a day
91	13	Yearling	1329469	silver	Participation	Event	XX	Active member for a year, earning at least 200 reputation



## Chapter 3

# Introduction

Still to write



## Chapter 4

# Methods

We describe our methods in this chapter.



## Chapter 5

# Applications

Some *significant* applications are demonstrated in this chapter.

### 5.1 Example one

### 5.2 Example two





## Chapter 6

# Final Words

We have finished a nice book.



# Chapter 7

## Appendix

### 7.1 Material from original bookdown files

#### 7.1.1 Prerequisites

This is a *sample* book written in **Markdown**. You can use anything that Pandoc's Markdown supports, e.g., a math equation  $a^2 + b^2 = c^2$ .

The **bookdown** package can be installed from CRAN or Github:

```
> install.packages("bookdown")
> # or the development version
> # devtools::install_github("rstudio/bookdown")
```

Remember each Rmd file contains one and only one chapter, and a chapter is defined by the first-level heading #.

To compile this example to PDF, you need XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): <https://yihui.name/tinytex/>.

#### 7.1.2 Intro of the minimal book example

You can label chapter and section titles using {#label} after them, e.g., we can reference Chapter 3. If you do not manually label them, there will be automatic labels anyway, e.g., Chapter 4.

Figures and tables with captions will be placed in **figure** and **table** environments, respectively.

```
> par(mar = c(4, 4, .1, .1))
> plot(pressure, type = 'b', pch = 19)
```

Reference a figure by its code chunk label with the **fig:** prefix, e.g., see Figure 7.1. Similarly, you can reference tables generated from **knitr::kable()**, e.g., see Table 7.1.

```
> knitr::kable(
+   head(iris, 20), caption = 'Here is a nice table!',
+   booktabs = TRUE
+ )
```

You can write citations, too. For example, we are using the **bookdown** package (Xie, 2018) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015).

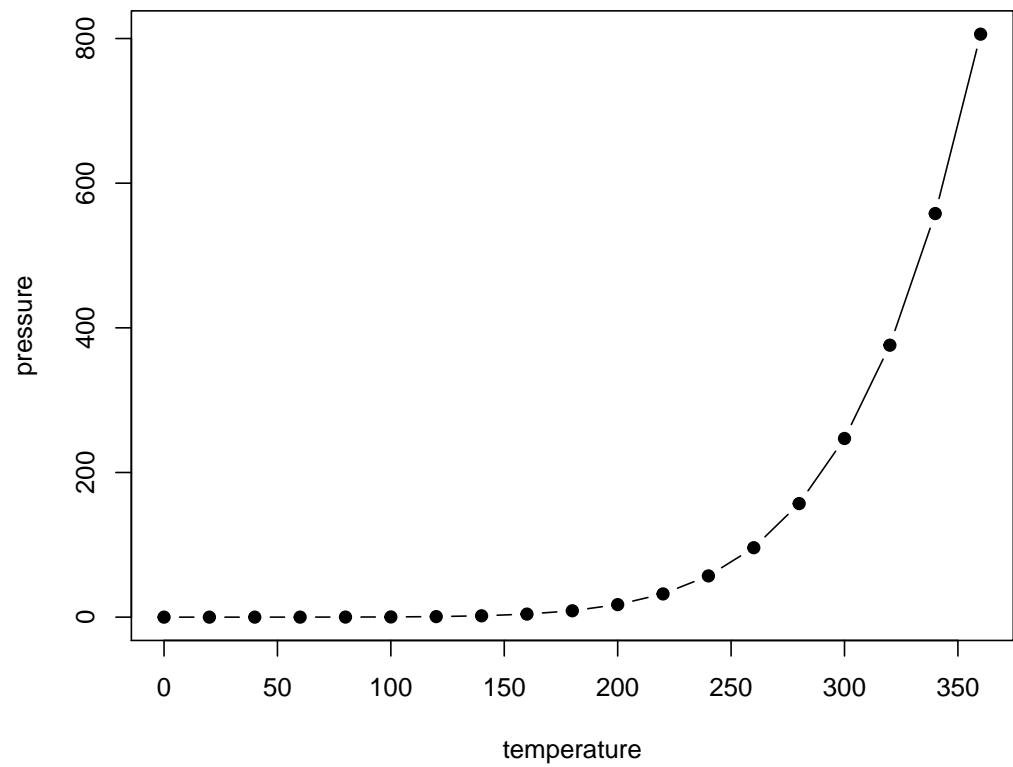


Figure 7.1: Here is a nice figure!

Table 7.1: Here is a nice table!

Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
5.1	3.5	1.4	0.2	setosa
4.9	3.0	1.4	0.2	setosa
4.7	3.2	1.3	0.2	setosa
4.6	3.1	1.5	0.2	setosa
5.0	3.6	1.4	0.2	setosa
5.4	3.9	1.7	0.4	setosa
4.6	3.4	1.4	0.3	setosa
5.0	3.4	1.5	0.2	setosa
4.4	2.9	1.4	0.2	setosa
4.9	3.1	1.5	0.1	setosa
5.4	3.7	1.5	0.2	setosa
4.8	3.4	1.6	0.2	setosa
4.8	3.0	1.4	0.1	setosa
4.3	3.0	1.1	0.1	setosa
5.8	4.0	1.2	0.2	setosa
5.7	4.4	1.5	0.4	setosa
5.4	3.9	1.3	0.4	setosa
5.1	3.5	1.4	0.3	setosa
5.7	3.8	1.7	0.3	setosa
5.1	3.8	1.5	0.3	setosa

## 7.2 My own (miscellaneous) tests

### 7.2.1 Install stackr with vignettes

Building vignettes takes some time. So if you are in a hurry, than just install stackr. You can still look at the vignettes in R help. The difference is: With `build_vignettes = TRUE` and then `browseVignettes("stackr")` you can look at the vignettes in your default browser. This is slightly more comfortable.

```
> devtools::install_github("dgrtwo/stackr", build_vignettes = TRUE)
> browseVignettes("stackr")
```

## 7.3 Load several packages at once

The following code is part of a debate at SO with different suggestions. It seems to me, that all suggestions (utility packages, code examples) has some disadvantages:

- **lapply:** For me the best approach – it uses just `lapply`. I have changed `require` to `library` because of the arguments by Yihui. My lines now gives a error message and stops if one of the called packages is not installed.
- **easypackages:** is not available on CRAN anymore, has very poor downloads.
- **pacman:** a very sophisticated programm, but – for me at least – to complex and therefore to much overhead.
- **installed.packages:** ipak.R This loads *and* installs missing packages. It is quite similar as `lapply`-version, but – because of the if-condition – more complex. Additionally it is checking which packages are installed:

“This can be slow when thousands of packages are installed, so do not use this to find out if a named package is installed (use `system.file` or `find.package`) nor to find out if a package is usable (call `require` and check the return value) ...”

So maybe the best would be to combine the `lapply` with the `installed.packages` version. But insted to use `installled.packages` I should use in the if-statement `require`, check for the return value and – if necessary – to install missing packages.

```
> x <- c("plyr", "psych", "tm")
> lapply(x, library, character.only = TRUE)
```

### 7.3.1 How many downloads of a defined packages?

```
> library(dlstats)
> y <- cran_stats("learnr")
> ggplot(y, aes(start, downloads, group = package, color = package)) +
+   geom_line() + geom_point(aes(shape = package))
> # cranApp()
```

## 7.4 Some data to remind

1. How to find answers tagged with `r` and not active since 6 month: Search
3. What kind of actions are are allowed with `combine_url1`?

I have added timeline to the list!

### 7.4.1 Some experiments

```
> library(tidyverse)
> library(lubridate)
> library(jsonlite)
>
> # returns: "Error in open.connection(con, "rb") : HTTP error 400."
>
> json_file1 <- "https://api.stackexchange.com/2.2/events?site=stackoverflow&key=mRTYimh499J3lInIGjcxFA"
> json_list1 <- jsonlite::fromJSON(json_file1, flatten = TRUE)
> df1 <- as_tibble(json_list1[[1]])
> df1 <- df1 %>% mutate(created = with_tz(as.POSIXct(creation_date, origin = "1970-01-01"), "UTC"))
```

```
> library(dplyr)
> mtcars[1:10, 1:2] %>%
+   mutate(
+     car = row.names(.),
+     # You don't need format = "latex" if you have ever defined options(knitr.table.format)
+     mpg = cell_spec(mpg, "latex", color = ifelse(mpg > 20, "red", "blue")),
+     cyl = cell_spec(cyl, "latex", color = "white", align = "c", angle = 45,
+       background = factor(cyl, c(4, 6, 8), c("#666666", "#999999", "#BBBBBB")))
+ ) %>%
+ select(car, mpg, cyl) %>%
+ kable("latex", escape = F, booktabs = T, linesep = "")
```

car	mpg	cyl
Mazda RX4	21	6
Mazda RX4 Wag	21	6
Datsun 710	22.8	4
Hornet 4 Drive	21.4	6
Hornet Sportabout	18.7	8
Valiant	18.1	6
Duster 360	14.3	8
Merc 240D	24.4	4
Merc 230	22.8	4
Merc 280	19.2	6

```
> library(knitr)
> library(kableExtra)
> library(tidyverse)
> dt_lb <- as_tibble(data.frame(
+   Item = c("Hello\nWorld", "This\nis a cat"),
+   Value = c(10, 100),
+   Third = c("xx\nxx", "yyyy") # does not work without linebreak!!!
+ ))
>
>
>
> dt_lb %>%
+   mutate_all(linebreak) %>% # to keep the hard linebreaks in the text items
+   kable(booktabs = T, escape = F,
```

```
+ col.names = linebreak(c("xxxy\n(Name)", "zzzy\n(Number)", "Another\n(Name)")))
```

xxxy (Name)	zzzy (Number)	Another (Name)
Hello World This is a cat	10 100	xx xx 2

### 7.4.2 Problems with & in cell text with linebreak

see github issue

```
> library(knitr)
> library(kableExtra)
> dt_lb <- data.frame(
+   Item = c("Hello\nWorld", "This & is\na cat"), # & generates error
+   Value = c(10, 100)
+ )
>
>
>
> dt_lb %>%
+   mutate_all(linebreak) %>%
+   kable(booktabs = T, escape = F,
+   col.names = linebreak(c("Item\n(Name)", "Value\n(Number)"))))

> library(knitr)
> library(kableExtra)
>
> test <- head(mtcars, head = 10)
> test <- test[, c(1:6)]
>
> p <- kable(test) %>%
+   add_header_above(c(" " = 1, "Group 1" = 3, "Group 2" = 3))
> p
```

	Group 1			Group 2		
	mpg	cyl	disp	hp	drat	wt
Mazda RX4	21.0	6	160	110	3.90	2.620
Mazda RX4 Wag	21.0	6	160	110	3.90	2.875
Datsun 710	22.8	4	108	93	3.85	2.320
Hornet 4 Drive	21.4	6	258	110	3.08	3.215
Hornet Sportabout	18.7	8	360	175	3.15	3.440
Valiant	18.1	6	225	105	2.76	3.460





# Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.

Xie, Y. (2018). *bookdown: Authoring Books and Technical Documents with R Markdown*. R package version 0.7.