

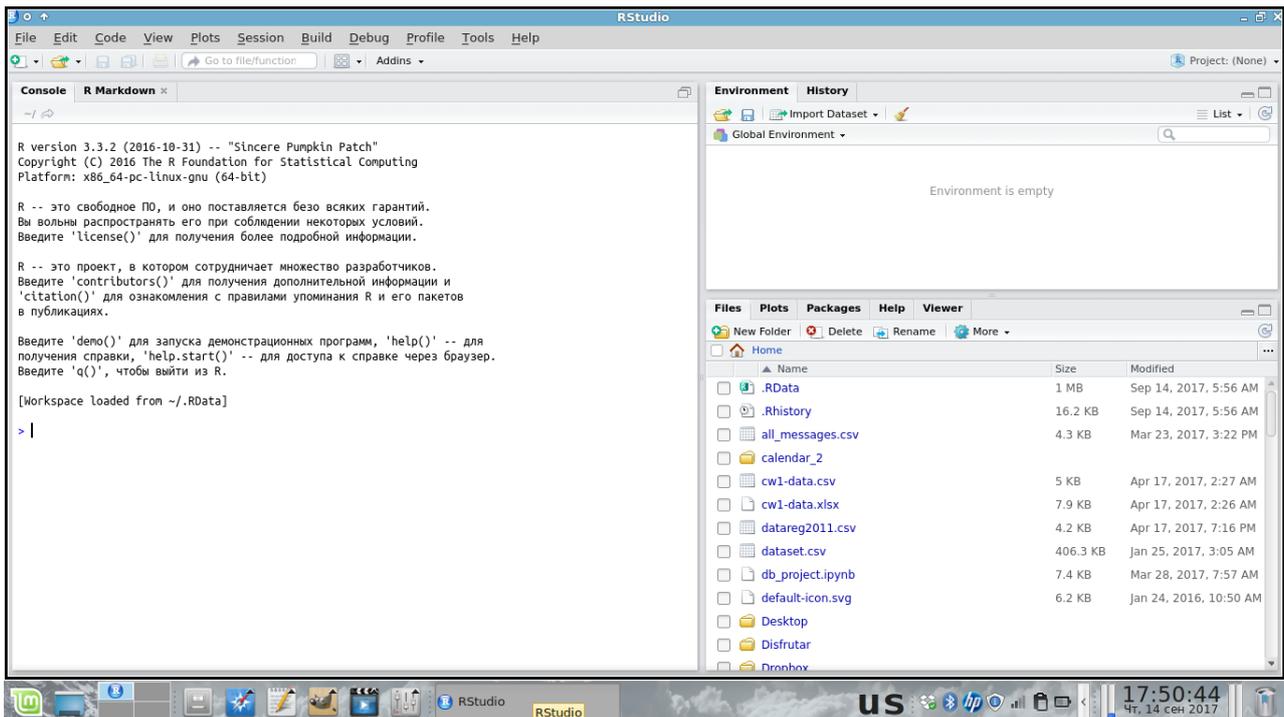
Introduction to RStudio

A brief instruction in the format of FAQ on working in RStudio. It is supposed that R and RStudio are already installed.

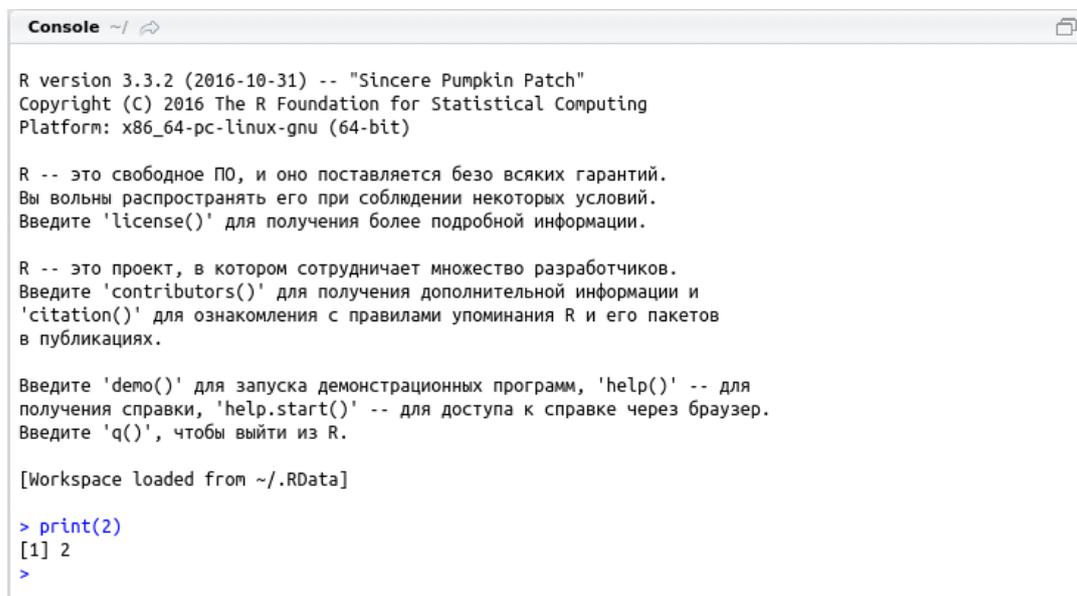
1 RStudio interface

1.1 What happens when we launch RStudio?

1. Here opens the working space that looks approximately like this (R version will be newer):



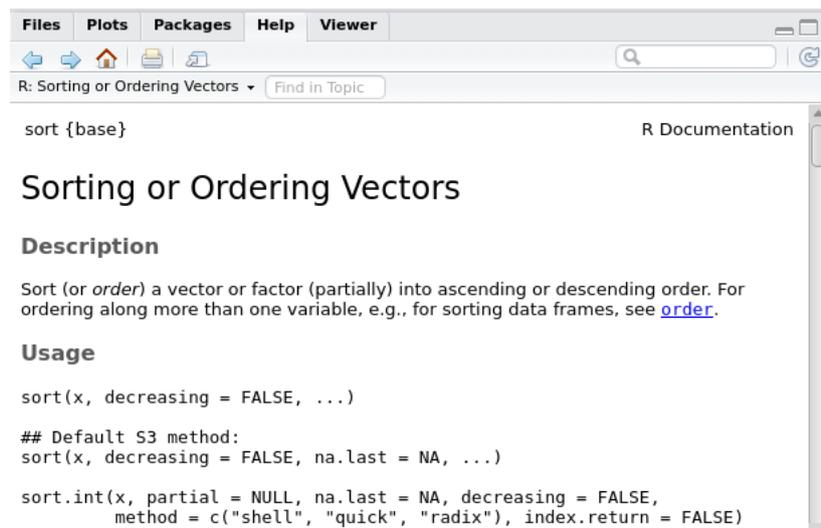
2. In the console window (**Console**) we can print the code and get the results immediately. So as to compile code (i.e. get the results) you should press *Enter*.



3. In the right top corner (**Environment** | **History**) we can view the objects stored in R during a working session (they will be saved for the next sessions unless you sweep it). For example, we create a variable `x` and assign value 2 to it. In the window **Environment** there immediately appears the following note:



4. In the right bottom window there are a lot of tabs. In the **Files** tab we can see files and folders that are stored in a working directory (a directory from which starts R, for instance, `C:/Documents`). In the **Plots** tab there are graphs that we make in RStudio. So as to zoom in a graph for viewing, you should click *Zoom*. Graphs from this window can be saved manually by clicking *Export* and choosing a suitable format. In the **Help** tab we can see a detailed information on the R function of our interest. We can ask R for help using `?` or `help()`. See the example for `sort()` function asking help via `?sort` below:



2 Working in RStudio

2.1 What can we do in RStudio?

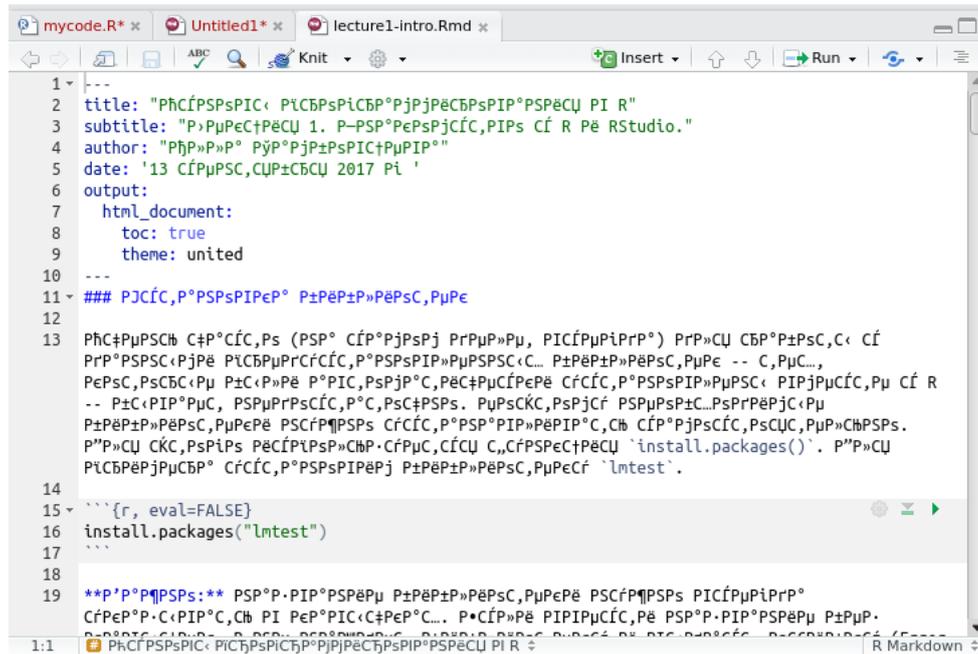
With the help of RStudio we can upload files with R code or create our own code files (R, Rmd, etc.). In RStudio we can edit or compile code and add text comments to the code as well.

2.2 How to upload a file in RStudio (for example, an Rmd-file from the lecture)?

When RStudio is launched, choose *File* in the menu and then *Open*. Choose a file in a usual way (from the folder you need) and open it.

2.3 What to do if an uploaded Rmd-file looks strange?

For instance, like this:



```
1 ---
2 title: "PñCÍPSPsPIC< PíCßPsPíCßP°PjPjPëCßPsPIP°PSPëCÜ PI R"
3 subtitle: "P»PµPëC†PëCÜ 1. P–PSP°PëPsPjCíC,PIPs Cí R Pë RStudio."
4 author: "PñP»P»P° PÿP°PjP±PsPIC†PµPIP°"
5 date: '13 CÍPµPSC,CUP±CßCÜ 2017 Pí '
6 output:
7   html_document:
8     toc: true
9     theme: united
10 ---
11 ### PJCíC,P°PSPsPIPeP° P±PëP±P»PëPsC,PµPe
12
13 PñC†PµPSCß C†P°CíC,Ps (PSP° CÍP°PjPsPj PrPµP»Pµ, PICÍPµPíPrP°) PrP»CÜ CßP°P±PsC,C< Cí
14 PrP°PSPSC<PjPë PíCßPµPrCíCíC,P°PSPsPIP»PµPSPSC<C... P±PëP±P»PëPsC,PµPe -- C,PµC...,
15 PePsC,PsCßC<Pµ P±C<P»Pë P°PIC,PsPjP°C,PëC†PµCíPëPë CíCíC,P°PSPsPIP»PµPSC< PIPjPµCíC,Pµ Cí R
16 -- P±C<PIP°PµC, PSPµPrPpsCíC,P°C,PsC†PSPs. PµPscKc,PsPjCí PSpµPsp±C...PsPrPëPjC<Pµ
17 P±PëP±P»PëPsC,PµPePë PSC†PµPSPs CíCíC,P°PSP°PIP»PëPIP°C,Cß CÍP°PjPsCíC,PsCUC,PµP»CßPSPs.
18 P»P»CÜ CíC,PsPíPs PëCíPíPsP»CñP·CíPµC,CíCÜ C,,CíPSPëC†PëCÜ `install.packages()`. P»P»CÜ
19 PíCßPëPjPµCßP° CíCíC,P°PSPsPIPëPj P±PëP±P»PëPsC,PµPeCí `lmtest`.
20
21 {r, eval=FALSE}
22 install.packages("lmtest")
23
24
25 **P°P°PµPSPs:** PSP°P·PIP°PSPëPµ P±PëP±P»PëPsC,PµPePë PSC†PµPSPs PICÍPµPíPrP°
26 CíPëP°P·C<PIP°C,Cß PI PëP°PIC<C†PëP°C... P·CíP»Pë PIPiPµCíC,Pë PSP°P·PIP°PSPëPµ P±PµP·
27 PñCÍPSPsPIC< PíCßPsPíCßP°PjPjPëCßPsPIP°PSPëCÜ PI R
28 R Markdown
```

These strange things might happen due to the differences in encodings. An Rmd-file could have been created on the Windows platform and then opened on Mac or vice versa. It usually occurs with texts that are written in non-latin letters (for example, in cyrillic ones).

So as to fix it, do not close the file with 'strange' symbols and click *File* → *Reopen with Encoding*, choose the encoding needed (usually UTF-8 if an Rmd-file has opened in a strange way on Windows, and WINDOWS-1251 if a file looks strange on Mac) and click *OK*.

2.4 How to create a new R code file in RStudio (file with the extension .R)?

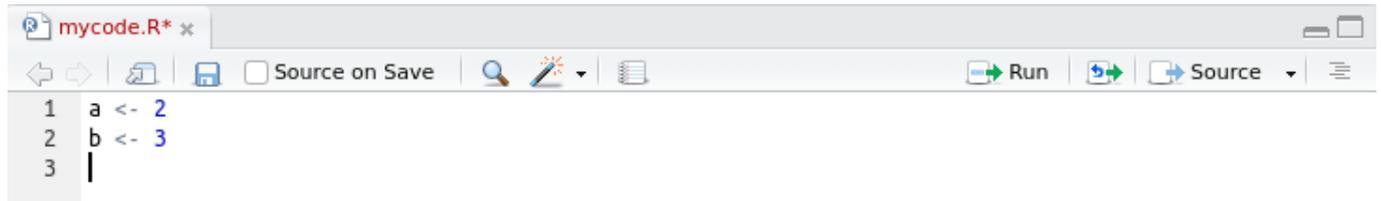
When RStudio is launched, choose in the menu: *File* → *New File* → *R Script*. For those who likes keyboard shortcuts: you can press *Ctrl + Shift + N* instead (*Command + Shift + N* on Mac). Above the console window you will see the file *Untitled1.R*.

2.5 We have created a new R file. What's next?

1. Save file and name it choosing *File* → *Save* or pressing *Ctrl + S* (*Command + S* on Mac).
2. In an R code file we can write code and add text comments.

We want to write code.

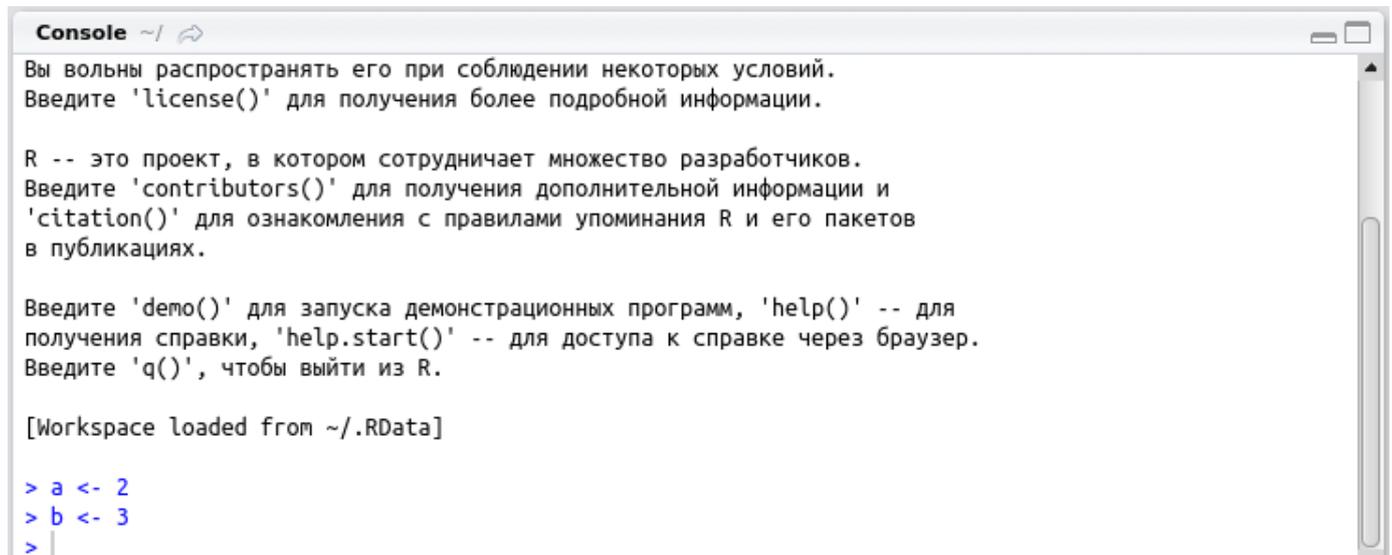
Enter code (create variables `a` и `b` and assign them values 2 and 3 correspondingly):



```
1 a <- 2
2 b <- 3
3 |
```

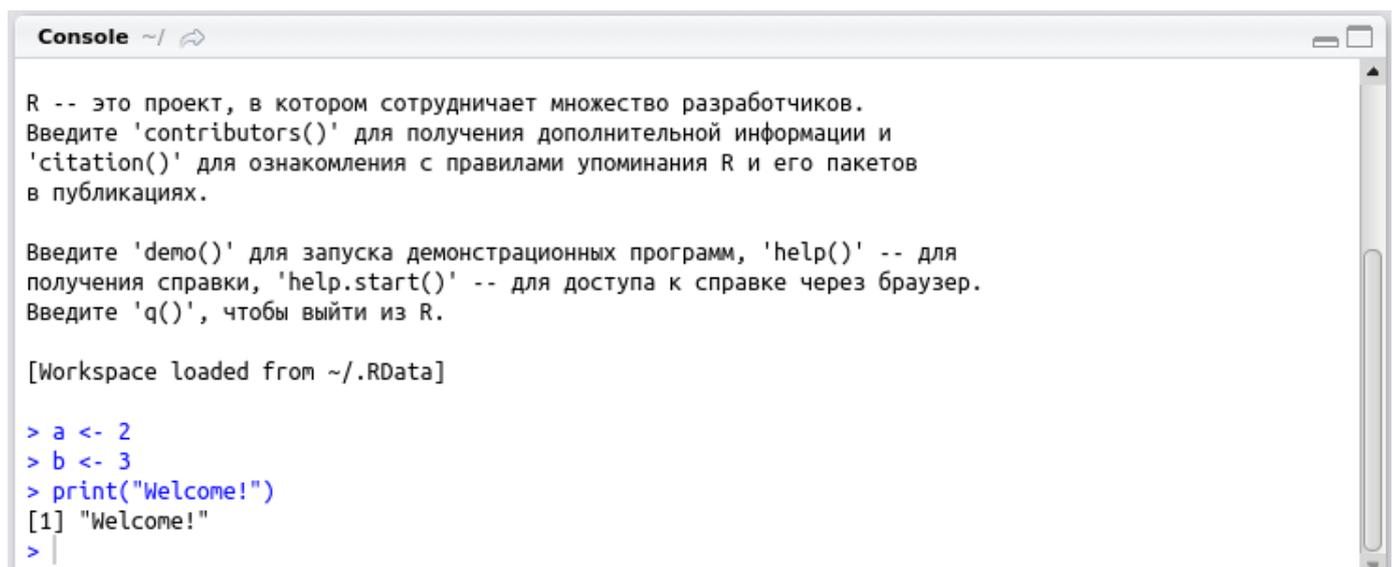
Compile code: put the cursor in any place of the line of code and press *Ctrl+Enter* (*Command+Enter* on Mac) or click *Run*, the green arrow above.

When the code is compiled (executed), the lines of code appear in the console window (in blue):



```
> a <- 2
> b <- 3
> |
```

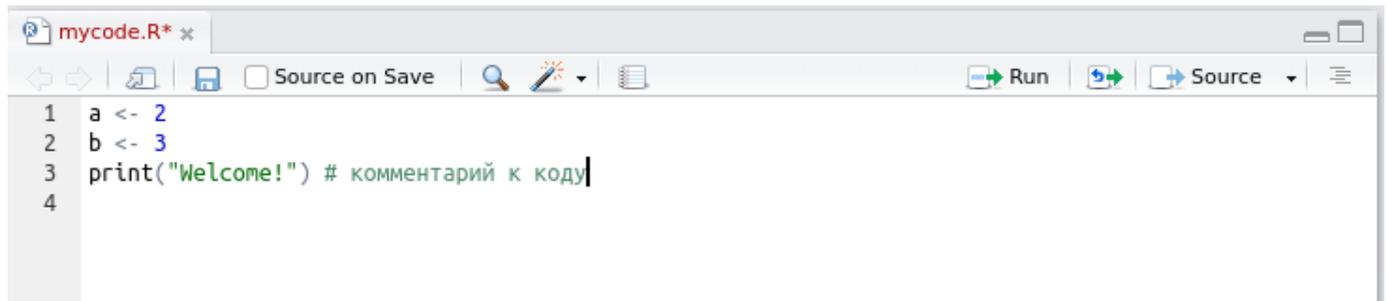
If the code implies printing something on the screen, the desired output will appear in the console window as well:



```
> a <- 2
> b <- 3
> print("Welcome!")
[1] "Welcome!"
> |
```

We want to add comments to our code.

Any comment should start with the symbol `#` (you can use more than one `#` if you wish). This symbol tells R that everything in a line that follows `#` is not a code, so should not be compiled.



```
mycode.R* x
Source on Save
Run Source
1 a <- 2
2 b <- 3
3 print("Welcome!") # комментарий к коду
4
```

2.6 How to create a new RMarkdown-file in RStudio (file with the extension .Rmd)?

When RStudio is launched, choose in the menu: *File* → *New File* → *R Markdown*.

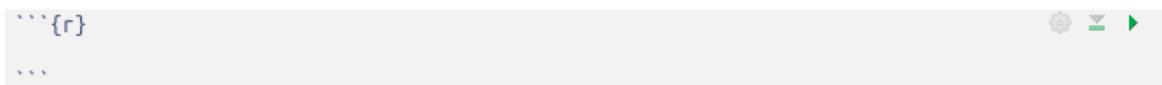
If we create an Rmd-file the first time, as we choose the needed option in the menu, RStudio will suggest to install useful libraries. We should agree with R and wait for some time (make sure the computer is connected to the Internet).

Then RStudio shows a window *New R Markdown*. The type of the document by default is **Document**, we should not change it. We should enter the title of a document **Title** (it is not a file name, it is the main title of the document that will be seen as a first line in a document) and author's name **Author**. Leave **output format** HTML и click OK.

2.7 We have created a new Rmd-file. What's next?

1. Save file and name it choosing *File* → *Save* or pressing *Ctrl + S* (*Command + S* on Mac).
2. To an Rmd-file we can add a marked up text (see the materials on RMarkdown and Markdown language), code, links, figures, tables, etc.

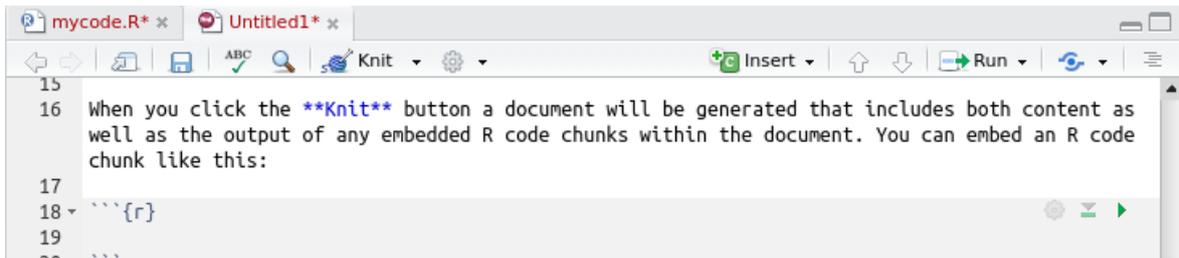
When we create an Rmd-file, it is not empty. RStudio shows an example explaining how it is possible to design a text with code in RMarkdown. Blocks of code (*code chunks*) are surrounded by special delimiters:



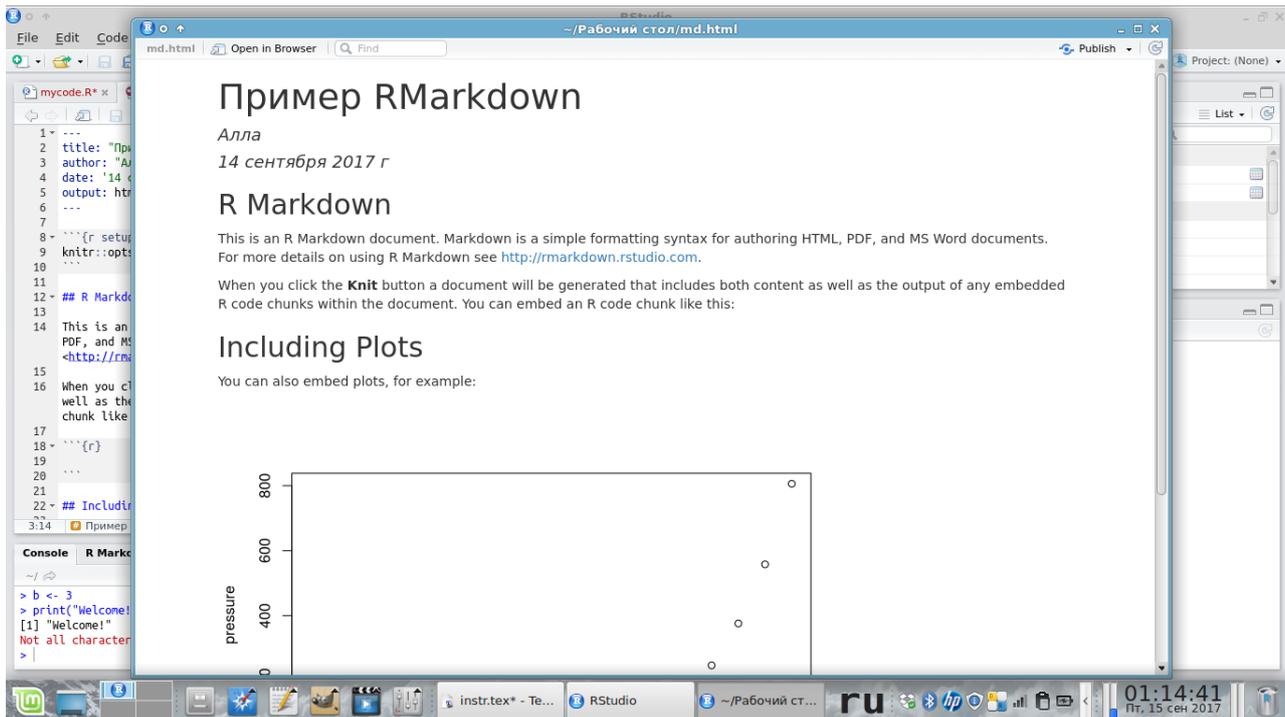
```
```{r}
...
```
```

It is not necessary to add this delimiters manually by typing them from the keyboard, you can click *Insert* and choose *R*. Then a new empty code chunk will be created.

3. Rmd-file can be knit into an html-file, so we can get a pretty html-page. Just click **Knit**:



In the window with suggested encodings take the first one (by default) and click OK. Then the file will knit into an html-page and open:



And what if it does not open? Probably, there were errors while compiling the file. In the console window there appears the **RMarkdown** tab. When an html-file knits, the different lines are shown in this window. The errors are detected as well. Usually here appears the number of a line with an error and a brief comment. It is important to understand that when an html-file is knit, all code in code chunks `{r}` is compiled. That is why, if there are errors in code (incorrect syntax, etc.), html-file will not knit.

2.8 How to publish a file on RPubs?

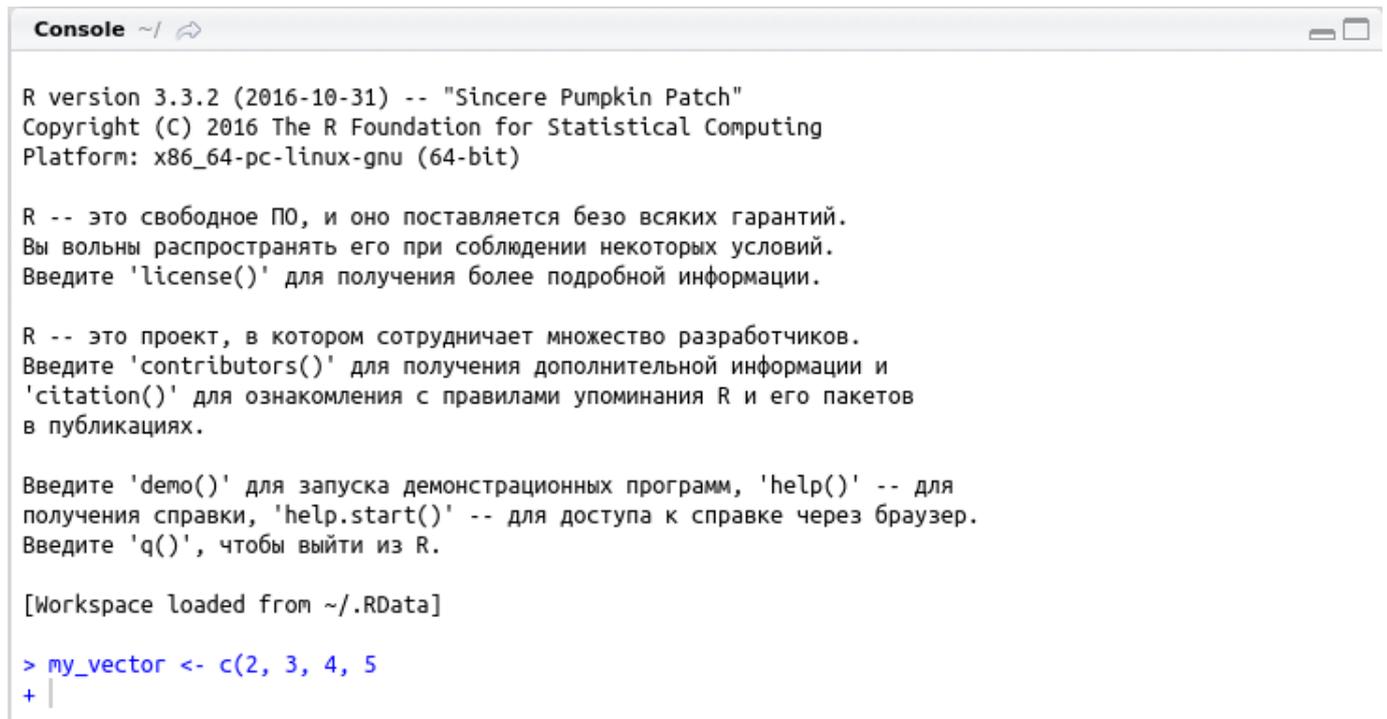
It is possible to publish an html-file that is created in RStudio after knitting. In the right top corner there is the **Publish** button. When we click it the first time, R suggests to install several libraries. Agree, choose RPubs in a new window and click **Publish**. Then the browser will open and you will be suggested to create an account (or sign in). Create an account (it is free) and proceed. The last step is left: give a name to your document, add a description and make up a link address. The link to the file will look like `http://rpubs.com/user/filename`, where `filename` is our invented link address.

2.9 How to stop R if it is frozen (or we did something wrong)?

In the menu choose the *Session* tab and the corresponding option: *Interrupt R*. If this option is not available, choose *Terminate R* or *Restart R*. In this case all the code should be executed again as these two operations are equivalent to quitting RStudio and launching it again.

2.10 What to do if we made a mistake and our code does not compile?

There is + in the beginning of a line in the console instead of an usual arrow > and R does not respond. For instance, we created a vector and forgot to put a bracket at the end:



```
Console ~/ | ↵

R version 3.3.2 (2016-10-31) -- "Sincere Pumpkin Patch"
Copyright (C) 2016 The R Foundation for Statistical Computing
Platform: x86_64-pc-linux-gnu (64-bit)

R -- это свободное ПО, и оно поставляется безо всяких гарантий.
Вы вольны распространять его при соблюдении некоторых условий.
Введите 'license()' для получения более подробной информации.

R -- это проект, в котором сотрудничает множество разработчиков.
Введите 'contributors()' для получения дополнительной информации и
'citation()' для ознакомления с правилами упоминания R и его пакетов
в публикациях.

Введите 'demo()' для запуска демонстрационных программ, 'help()' -- для
получения справки, 'help.start()' -- для доступа к справке через браузер.
Введите 'q()', чтобы выйти из R.

[Workspace loaded from ~/.RData]

> my_vector <- c(2, 3, 4, 5
+ |
```

So as to make R work again, put a cursor in a line with + and press *Esc* on the keyboard. The arrow > will get back and the code can be compiled further.