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R INSTALLATION AND EXCEL BASICS

In this book, R software is used purely as a tool to speed up the process of learning Excel and applying it to finance. Thus, it is not required that users of this book to understand R. This book would not teach R neither. For a typical user including both instructors and students, the only requirement is to download and install R. Because of this, the first section is devoted to R installation. After that, some basic Excel features and functions will be discussed. In particular, the following topics will be covered:

- R installation
- Spread sheet is a 2-dimensional matrix
- “=A1” what does it mean?
- +,-,/, * have their normal meanings
- Several Excel functions: `average()`, `count()`, `max()`, `min()`, `round()`
- How to format a cell
- How to change the name of your spreadsheet

1.1 R INSTALLATION

To download and install R (free computational software), we have the following 5 steps.

Step 1: Go to <http://www.r-project.org>

Step 2: Click "CRAN" under "Download" (left-hand side)

Step 3: Choose a nearby mirror location

Step 4: Choose appropriate software (Windows or Mac)

Step 5: Click "base"

For more detail, see Appendix A. To use this book and learn Excel more effectively, we have a set of programs prewritten by the author. For the first week, readers could issue the following one-line R code.

```
> source("http://canisius.edu/~yany/fm.R")
```

After hitting the return key, the following menu would pop up.

```

*-----*
* Financial Modeling with Excel   Spring 2018 by Yuxing Yan *
*-----*
* 1: R installation/Excel basics * 16: R basics *
*-----*
* >.c1          # go to chapter 1 (a dot in front c1) *
* >.c16        # go to chapter 16 *
* >.uu         # see all utility functions *
* >.fm         # back to the main menu *
*-----*

```

Again, for the users of this book or taking a related course, students and instructors don't need to understand R. In Chapter 16: R Basics, we introduce some R related basic concepts, such as how to launch and quit R, whether R is case sensitive, how to assign a value to a variable and how to use R as an ordinary calculator. Again, it is not required to understand R to use this book. R is just a tool used by the author to build up a favorable environment for learning Excel. For this purpose, Chapter 16 is short with just 8 pages and even this chapter is optional! In other words, readers could skip chapter 16 without having any negative impact on the understanding of the book. After type `.c1` (note that there is a dot in front of `c1`), we would see 20 explanations. ">" is the R prompt.

```

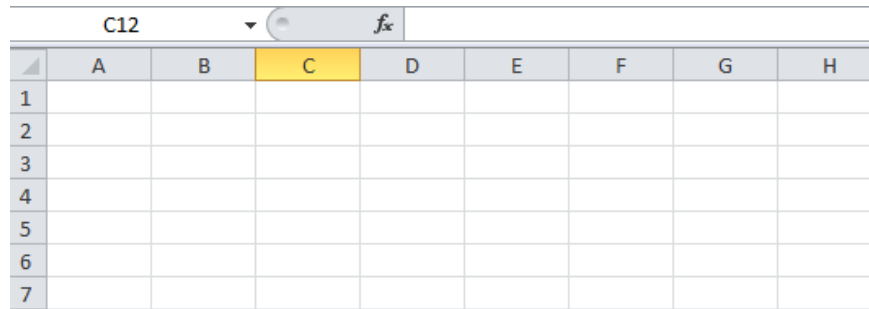
> .c1
function(i){
" i Chapter 1: R installation and Excel Basics
- -----
1 How to install R
2 one line R codes for this course
3 Excel is a two-dimensional spread sheet
4 =A1 What does it mean?
5 +, -, /, and * have their normal meanings
6 format a cell
7 round() function
8 A pair: exp() and ln() functions
9 A pair: 10^x and log(), power(x,10) and log()
10 log() and ln() functions
11 sqrt() function and power function
12 count() and counta() functions
13 average() function
14 max() and min() functions
15 floor() and ceil() functions
16 string variable
17 True and False
18 isnumber() and istext() functions
19 change the name of your spread sheet
20 Links

Example #1:>.c1 # see the above list
Example #2:>.c1(1) # see the 1st explanation

```

1.2 EXCEL IS A TWO-DIMENSIONAL SPREAD SHEET

Excel could be viewed as a huge two dimensional spread sheet, see below.

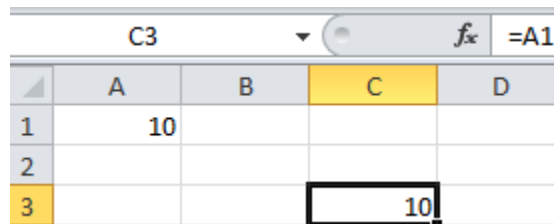


	A	B	C	D	E	F	G	H
1								
2								
3								
4								
5								
6								
7								

Horizontally or for columns, we have letters, such as A, B for Columns A and B. Vertically or for rows, we have numbers, such as 1, 2 for the first and second rows. For name an individual cell, we have letter and number. For example, the first cell is A1, column name first then row name. To name an area, we use the top left cell, colon (“:”) and bottom right cell. For example, A1:E7 means from cell A1 to E7, i.e., the first 7 rows and 5 columns (column A to E).

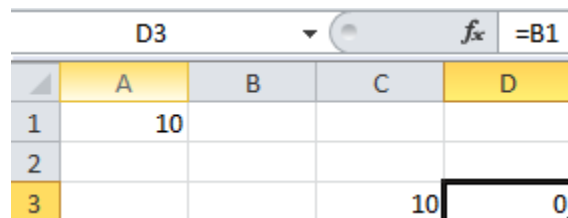
1.3 WHAT DOES =A1 MEAN?

We enter a value such in Cell A1, such as 10. Then randomly choose another cell, such as C3. We type =A1, see below.



	A	B	C	D
1	10			
2				
3			10	

From the image, we could see the formula on the right of f_x . The question is: “what is the meaning for the formula contained in cell C3? Many new learners would say that the formula would be “take the same value as cell A1” since it is “stated” that way. However, this is not correct. The correct answer is that “take the value from the cell two rows above and two columns left”. If we copy the formula to the right, i.e., to D3, we would see the effect, see below.



	A	B	C	D
1	10			
2				
3			10	0

Now, the value of B1 is zero since B1 cell is empty. This type address is called “relative address”. Assume we are sitting in the class room of OM111. If we hear an instruction of “Going to the next classroom”, it means to go OM113. However, if we sit in another classroom whether in the same building or in a different building, the same instruction of “Going to the next classroom” would suggest a different classroom. For the absolute address, read the next section.

1.4 RELATIVE VS. ABSOLUTE ADDRESSES

If we plan to use value A1 even after we copy the formula from C3 to other locations, we have to apply the concept of the “absolute address” by adding \$ signs, see below.

	A	B	C	D
1	10			
2				
3			10	

=A\$1 means that after we copy this formula, both the column number of A and the row number of 1 are fixed. If we apply just a dollar sign, then one dimension would be fixed. For example, =\$A1 means that we fix only column, while the formula of =A\$1 fixes only row. In Chapter 2: Time Value of Money, we would show a few related examples.

1.5 +, -, /, AND * HAVE THEIR NORMAL MEANINGS

The math operators of +, -, /, and * have their conventional meanings. Below are a few examples. The first example is =1+2. The formula is shown in the formula area while the final result is shown in left image below:

fx	=1+2	fx	1+2
D		C	D
3		1+2	

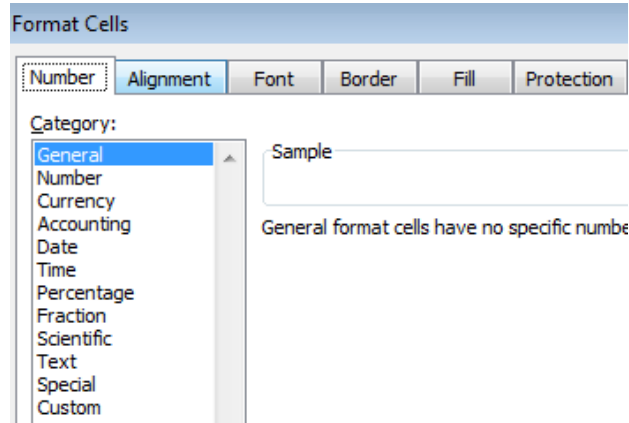
Remember to start our formula with an equal sign of =. If the equal sign is omitted, Excel would treat 1+2 as a text or string, see the right image above. A careful reader would find that if the contents is a value, it is aligned on the right-hand side, while if it is a text or string variable, it is aligned on the left-hand side. Below are two more examples using those math operators, see the images below.

fx	=1+2*5/2.1	fx	=100*(1+0.02)^2
D	E	D	E
5.761905		104.04	

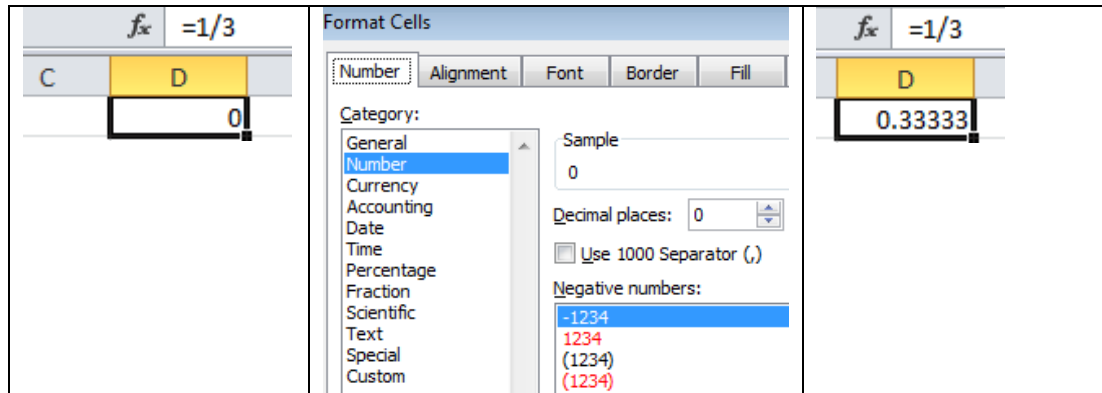
Note that the symbol of \wedge is for a power function. Later in the chapter, another *true* power function will be introduced.

1.6 FORMATTING A CELL

It is quite important to learn how to format a cell or cells. First, highlight one cell or a set of cells. Then right click our mouse, choose “Format Cells...”, see the following image.



Under the “Number” entry, we have 12 choices. The first example shows us a funny result, $1/3$ leads to zero, see the left image below.



The reason is an inappropriate format, see the middle image above. The format is “decimal places are zero” for a value less than 1. After the number of decimal places is increased, such as 5, the correct result would appear, see the right image above.

Below is one example related to date variable. Just type 4/28/2017, see the left image below.

fx		4/27/2019	
	D	E	
	4/27/2019		

fx		43582	
C	D	E	
	43582		

Obviously, the default format for that cell is “date”. If we change that to “Number”, we would see an integer, see the right image above. This suggests a date variable of 4/19/2017 is the same thing as an integer form of 43582. Just enter a value of 1, then change the format to date, we would see the meaning between a date variable and integer.

fx		1/1/1900	
C	D	E	
	1/1/1900		

This indicates that for Excel, an integer of 1 is equivalent to 1/1/1900. Actually, this is Excel starting date for the date variable.

1.7 ROUND(), SQRT(), COUNT(), AND COUNTA()

The Excel round() function is quite useful to make our Excel spreadsheet more readable.

fx		=1/3	
	D	E	
	0.333333		

General		fx		=ROUND(D1,2)	
\$	%	,	←.0	.00	→.0
Number					

fx		=ROUND(D1,2)	
	D	E	F
	0.333333	0.33	

To make values more readable, we could change the number of digits shown. For this reason, we could click the right-arrow image to reduce the number of decimal spaces, shown in the middle image above. Alternatively, the Excel round() function could be applied, see the right image above. The second input for the formula is the number of decimal places. The function of sqrt() is for the square root, see an example below.

fx		=SQRT(2)	
	D	E	
	1.414214		

The Excel count() function is used to count the number of numerical values, while the counta() function would count the number of both numerical values and characters.

E1		fx =COUNT(D1:D6)			
	A	B	C	D	E
1				1	3
2				2	
3				3	
4				good	
5					
6					

E1		fx =COUNTA(D1:D6)			
	A	B	C	D	E
1				1	4
2				2	
3				3	
4				good	
5					
6					

1.8 CHARACTER VARIABLES

Character variable is also called a string variable. For a cell, we could type a value or a string, see the left image below. The `len()` function shows that the length of the string is 13 including blanks. The `left(text,num_chars)` and `right(text,num_chars)` functions choose a substring from a given string from left or right. The first input variable of `text` is the input string, while the second input variable of `num_chars` specifies the number of letters we intend to cut (see two examples shown in the left image below):

D4		fx =RIGHT(D1,3)			
	A	B	C	D	E
1				this is great	
2				13	=LEN(D1)
3				this	=LEFT(D1,4)
4				eat	=RIGHT(D1,3)

fx '1				
	D	E	F	
1	1	TRUE	=ISTEXT(D1)	
	1	FALSE	=ISTEXT(D2)	

Sometimes, we want to treat a numerical value as a string. For those cases, we could start our input with a prime or apostrophe, see the right image above. The `istext()` function would test whether the input is a text or not. The output would be a logic value: TRUE or FALSE.

1.9 PAIRS OF EXP() AND LN(), POW() AND LOG()

The Excel `exp()` and `ln()` functions are a pair. The `exp()` function is the exponential function while `ln()` is the natural logarithm function. Their relationship is given below.

$$\begin{cases} y = \exp(x) \\ x = \ln(y) \end{cases} \quad (1)$$

With an input value of 1, `exp(1)` would offer a value of 2.718281828. The command of `exp(5)` will lead to a y-value of 148.4131591, while `ln(148.4132)` would return a value of 5, see below.

D3		fx =LN(D2)			
	A	B	C	D	E
1				2.718282	=EXP(1)
2				148.4132	=EXP(5)
3				5	=LN(D2)

Several Excel functions are related to logarithm such as $\log()$ and $\log_{10}()$, see examples below.

D1		fx =LOG(2)				
	A	B	C	D	E	F
1				0.30103	=LOG(1)	
2				0.693147	=LOG(1,2.718281828)	
3				0.30103	=LOG(2,10)	

For the $\log()$ function, the second value is the base. Its default value is 10. Thus, $\log(x)$ and $\log_{10}(x)$ are equivalent.

1.10 PAIRS OF 10^X , POWER(10,X) AND LOG10(),LOG(X)

Similar to the pair of $\exp()$ and $\ln()$, 10^x and $\log_{10}()$ function could be viewed as a pair, see a few examples below.

D1		fx =10^3.2				
	A	B	C	D	E	F
1				1584.893	=10^3.2	
2				1584.893	=POWER(10,3.2)	
3				3.2	=LOG(D1)	
4				3.2	=LOG10(D1)	
5				3.2	=LOG(D1,10)	

From the above example, 10^x is equivalent to $\text{power}(10, x)$, $\log(x)$, $\log_{10}()$ and $\log(x, 10)$ would lead to the same answer.

1.11 MAX(), MIN(), FLOOR(), CEILING() AND INT() FUNCTIONS

The Excel $\text{max}()$ function offers the maximum value while the $\text{min}()$ function gives the minimum values, see below.

D1		fx =MAX(A1:C3)				
	A	B	C	D	E	
1	23	4	8	100	=MAX(A1:C3)	
2	1	5	-3	-3	=MIN(A1:C3)	
3	2	100	0			

The `ceil()` function offers the smallest integer than the input value while the `ceiling()` offer the largest integer smaller than the input floating value, see one example in cell E2 below.

E2		fx =FLOOR(D2,0.1)					
	A	B	C	D	E	F	G
1				0.333333	0.34	=CEILING(D1,0.01)	
2				2.3567	2.3	=FLOOR(D2,0.1)	

The second input for both `floor()` and `ceiling()` is precision, see two examples above. The `int()` is the function which takes only the integer part, see an example below.

E1		fx =INT(D1)				
	A	B	C	D	E	
1				3.456	3	

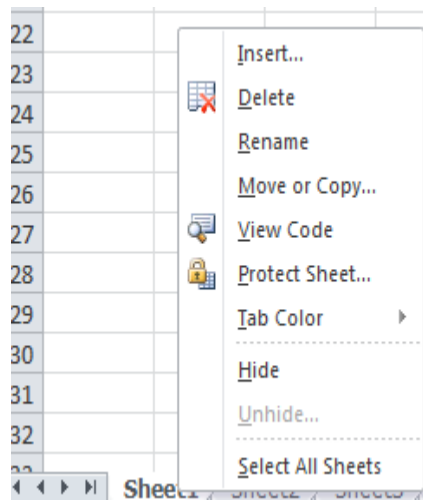
1.12 TRUE/FALSE, ISNUMBER() AND ISTEXT()

The TRUE or FALSE is called logic value. For some functions their output is such logic true or false, such as the Excel `ISNUMBER()` and `ISTEXT()` functions, see four examples below.

D1		fx '1					
	A	B	C	D	E	F	G
1			1	1	TRUE	=ISTEXT(D1)	
2					FALSE	=ISNUMBER(D1)	
3				1	FALSE	=ISTEXT(D2)	
4					TRUE	=ISNUMBER(D3)	

1.13 CHANGING THE NAME OF SPREADSHEET

To change the name of your spread sheet is easy. Just right click the name of the spread, then choose rename.

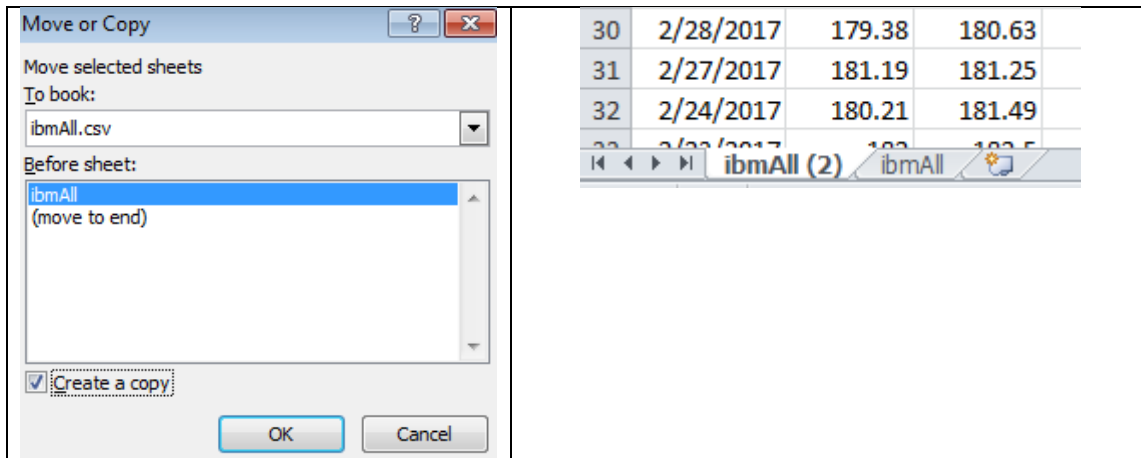


1.14 MAKING A COPY OF OUR EXISTING SPREADSHEET

It is quite often that we want to copy the existing spreadsheet before we work on it. For example, we download historical daily price data for IBM from Yahoo!finance, see a few observations below.

	A	B	C	D	E	F	G
1	Date	Open	High	Low	Close	Volume	Adj.Close
2	4/7/2017	172.08	172.93	171.28	172.14	3556000	172.14
3	4/6/2017	173.47	173.47	172.25	172.45	3416100	172.45
4	4/5/2017	174.7	176.33	172.81	172.88	6199500	172.88
5	4/4/2017	173.52	174.96	173.26	174.52	3097400	174.52
6	4/3/2017	173.82	174.87	173.38	174.5	4271600	174.5

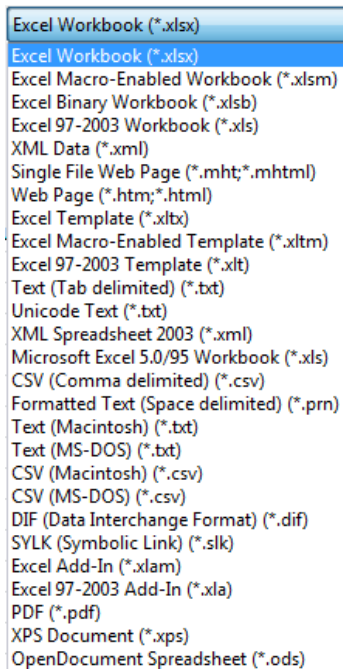
We might plan to copy the data to another spreadsheet before we delete unnecessary columns. Right click the name of the spreadsheet, then choose “Move or Copy...”, see the image in the previous section.



The copy of the original spreadsheet would have the similar name except extra (2) was added, see the right image above.

1.15 SAVING AN EXCEL FILE

There are many different output formats, such as .xlsx, CSV (comer separated value), text format, see a complete list below.



At the moment, just remember that the extension for an “ordinary” Excel file is .xlsx, the first one shown above. One of quite frequently happened errors is that students submit their Excel files for a term project with an extension of csv. The reason is that students retrieve a data set with a csv format. Then they work on this data set for many hours. When saving, they adopted the same format of csv as the extension. Because of this, they lost all their formulae and related work! We would come back to this in Chapter 24: Data Output.

REFERENCES

R home page: <http://r-project.org>

YouTube: How to install R and Rstudio?

https://www.youtube.com/watch?v=d-u_7vdag-0 (1m59s)

https://www.youtube.com/watch?v=cX532N_XLIs (4m53s)

SUMMARY

In this chapter, first we show how to install R. Then we have discussed 2 dozen basic concepts or functions related to Excel. In the next chapter, Chapter 2: Time Value of Money, we would review many basic finance concepts and their related Excel functions such as `pv()`, `fv()`, `pmt()`, `rate()`, `nper()`. In addition, several decision rules such as NPV rule, IRR rule and pay-pack period rule will be introduced and explained.

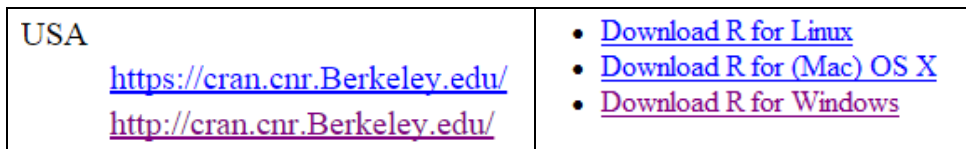
Appendix A: How to install R on your computer.

Step 1: Go to <http://www.r-project.org>, see the left image below.



Step 2: Click "CRAN" under "Download", see the right image above.

Step 3: Choose a mirror address, see the left image below.



Step 4: Choose appropriate software (PC, Mac), see the right image above.

Step 5: Click "base". For example, for Windows, we have the following result.

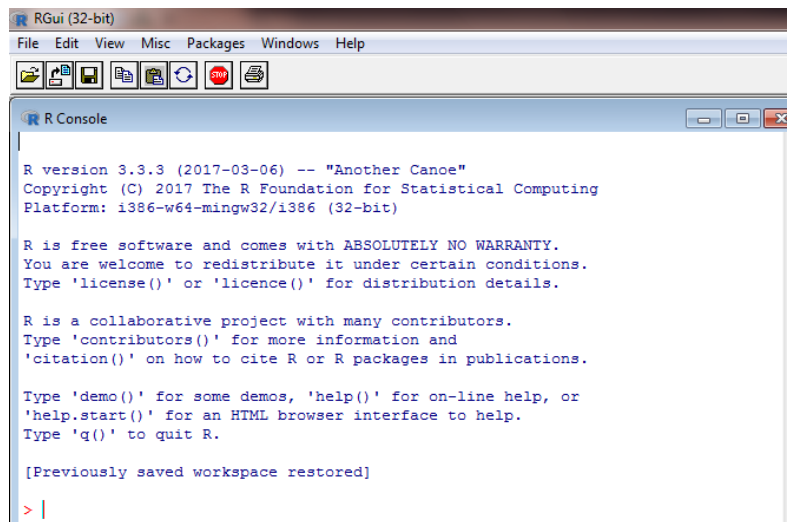
[Download R 3.2.3 for Windows](#) (62 megabytes, 32/64 bit)

[Installation and other instructions](#)

[New features in this version](#)

Appendix B: How to launch and quit R?

How to launch R? Click the R icon on your desktop or click Windows icon, then “All programs”, find R directory and click the R icon, see the following image.



```
RGui (32-bit)
File Edit View Misc Packages Windows Help

R Console

R version 3.3.3 (2017-03-06) -- "Another Canoe"
Copyright (C) 2017 The R Foundation for Statistical Computing
Platform: i386-w64-mingw32/i386 (32-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.

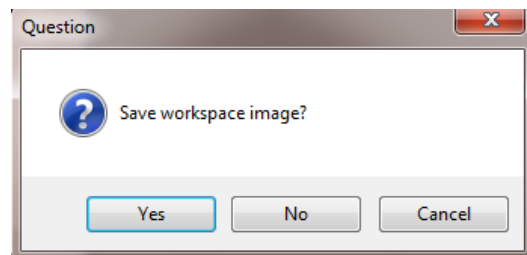
R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

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.

[Previously saved workspace restored]

> |
```

To quit, just type q(). After typing q(), we would see the following image. It means whether we would keep our variables and function. At this stage, just answer no.



EXERCISES

- 1.1 How to install R?
- 1.2 What is the only line a student has to remember in terms of R codes?
- 1.3 How to change the name of your current spreadsheet?
- 1.4 What is logic function of TRUE or FALSE?
- 1.5 How to make a copy of our current spreadsheet?

- 1.6 How to find the maximum value of 20 values?
- 1.7 How to count the numbers of observations of 2 columns?
- 1.8 How to find out the number of text variables?
- 1.9 How to estimate the average of 12 returns?
- 1.10 How to find the ratio of maximum value to the average and minimum value to the average?
- 1.11 What is the difference between `floor()` and `int()`? Under what condition, they are equal?
- 1.12 How to estimate the average of 10 values?
- 1.13 How to count the number of non-numerical values?
- 1.14 For a give p_0 and p_1 , we have two ways to estimate their return: percentage return and log return.

$$R(\text{percentage}) = \frac{p_1 - p_0}{p_0} \quad (1)$$

$$R^{\log} = \ln\left(\frac{p_1}{p_0}\right) \quad (2)$$

The log return is defined as $\ln(p_1/p_0)$. What is the difference between the Excel `log()` and `ln()` functions?

- 1.15 How to pick up the left 5 characters for a string variable?
- 1.16 Assume that we have a string of 20 characters. How to pick 5 characters starting from 10?
- 1.17 What is the usage of a string variable?
- 1.18 What is the difference between the Excel `count()` and `counta()`?
- 1.19 Why should we care about the format for our export data?
- 1.20 We could use `^` for a power function, such as `10^2`. What is the related Excel function?

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