# Calculations in Excel

Part 1:Some practical examples

1. Numbers

"Circle numbers": Mod()

Do you remember when you first learned to divide? Dividing 6 cookies with 3 friends works fine. Everybody gets 2 cookies. But what if you have 7 cookies? There will be one left over (あまり). Dividing with left-overs gives us "circle numbers", numbers that keep going around, like a clock. The technical name for this is MODULO or MOD for short.

left-over
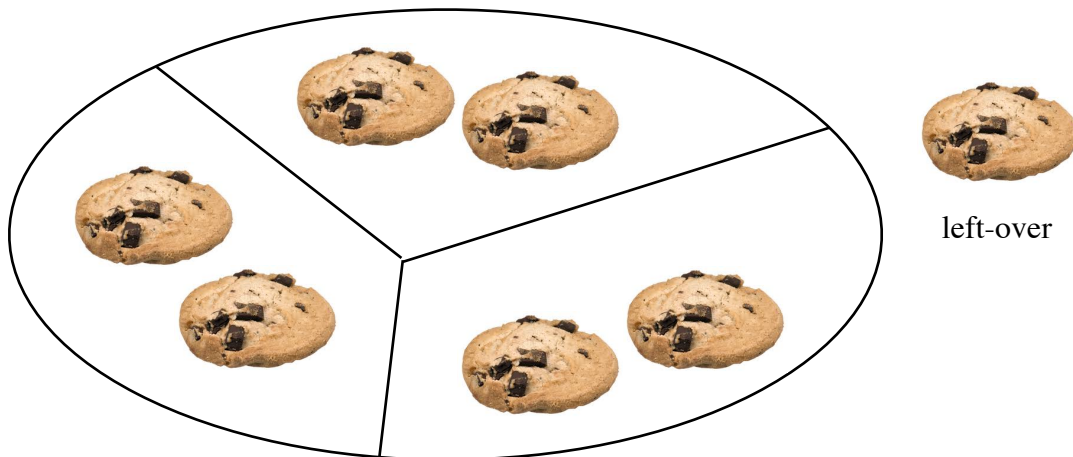
The Chinese zodiac (十二支) is one example:

0	1	2	3	4	5	6	7	8	9	10	11
子	丑	寅	卯	辰	巳	午	未	申	酉	戌	亥
1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
1912	1913	…									
					…	1990	1991	1992	1993	1994	1995
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2008	2009	2010	2011	2012							

You can figure your sign (your "year") like this:

$$= \text{MOD} \, (\, [\text{ birthyear }] - 1900 \, , 12 \,)$$

The answer will be a number between 0 and 11.

2. Text

You can also do "calculations" with text. To understand this, you need to understand how the computer "sees" text. Text data are called STRINGS (文字列), because for the computer, text is a string of letters. Like beads on a string.

The letters are counted. The counter is called the INDEX.

letters:	S	p	a	c	e	s		c	o	u	n	t		t	o	o	!
index:	1				5					10					15		17

What can you do with this?

How long is it? : Len()

You can find out how long a text is, using LEN(). LEN is short for *length*.

LEN("Computing") = 9

LEN("fun") = 3

LEN("a") = 1

LEN("I don't think that "calculation" of text is very difficult.") = 59

Finding things: Find()

You can use FIND() to find a short text inside a longer text.

Short text:

h	e	r	e

Longer text:

I		w	o	n	d	e	r		w	h	e	r	e		i	t		i	s	?

h	e	r	e

FIND() gives its answer using the index:

FIND("here", "I wonder where it is?") = 11

If it can't find the string it gives the answer '#VALUE!':

FIND("fun", "This is a computing class. Please study hard!") = #VALUE!

Most often the short string you want to find is only a single character — maybe a space:

FIND(" ", "Abraham Lincoln") = 8

If there is more than one answer, FIND() will only give the first answer:

FIND("i", "Mississippi") = 2

FIND("s", "Mississippi") = 3

FIND("p", "Mississippi") = 9

Cutting text short: Left(), Right(), Mid()

Sometimes you only want a short part of the text.

string: | W | i | n | n | i | e | | t | h | e | | P | o | o | h |

cut string: | W | i | n | n i e   t h e   P o o h

You can cut strings in this way, using LEFT():

    LEFT ("Winnie the Pooh", 3) = "Win"

The number tells LEFT() how much you want.
You can do the same thing from the right side, using RIGHT():

string: | W | i | n | n | i | e | | t | h | e | | P | o | o | h |

cut string: W i n n i e   t h e   P o | o | h |

    RIGHT ("Winnie the Pooh", 2) = "oh"

Finally you can also cut out of the middle of the string, using MID().
In this case you have to say both, where to cut, and how much you want.

string: | C | h | r | i | s | t | o | p | h | e | r | | R | o | b | i | n |

            5   10   15   17

cut string: C h r i | s | t | o | p | h e r   R o b i n

    MID ("Chistopher Robin", 5, 4) = "stop"

The first number says where to start, and the second number says how much.
If the first number is 'too big' you get nothing.
If the second number is 'too big', you get the whole rest of the string.

    MID ("Chistopher Robin", 99, 4) = ""
    MID ("Chistopher Robin", 13, 99) = "Robin"

You can combine MID(), FIND(), and LEN() to split a full name into first name and last name
like this. Find the space between the names, and then cut what's before or after.

First name:

> = LEFT ([name] , FIND (" " , [name]) – 1)

Last name:

> = MID ([name] , FIND (" " , [name]) + 1 , LEN ([name]))

3. Dates

What is today's date? : Today()

You can use TODAY() to find out what day it is. In this case you need to use the parentheses, but you leave them empty.

$$= \text{TODAY}()$$

If you save the file with this in a cell, and open it the next day, the date will be changed!

What is your birth month? : Day(), Month(), Year()

You can use MONTH() to find the month you were born in:

$$= \text{MONTH} (\; [\text{ birthdate }] \;)$$

How old are you? : YearFrac()

Your age is the difference in time between today and your birthdate. TODAY() will tell you what today's date is. Then you can use YEARFRAC() to find the difference between the two dates. You can calculate your age as follows:

$$= \text{YEARFRAC} (\; [\text{ birthdate }] \; , \; \text{TODAY}() \;)$$

If the difference between two dates is not an exact number of years, then YearFrac() will give you a number with a period and following digits. Those digits represent a 'fraction' of a year, which is where the name of the function comes from. For example '2.5' means 'two and a half years'. If we don't care about this fraction we can cut them off.

$$= \text{FLOOR.MATH} (\; \text{YEARFRAC} (\; [\text{ birthdate }] \; , \; \text{TODAY}() \;) \; , \; 1 \;)$$

4. Logic and Comparisons

TRUE and FALSE

You can compare things. For example you might ask which of two numbers is bigger like this:

$$= 1 < 2$$

This might look a bit confusing, but the "=" at the beginning just means that this is a calculation. So this is just asking Excel: "Is 1 smaller than 2?" And of course it is. So Excel will answer TRUE.

You can also compare text. Whatever comes first in alphabetical order is smaller. So …

$$= \text{"Apple"} > \text{"Banana"}$$

… is FALSE.

IsNumber(), IsBlank(), etc.

You can also ask questions. For example you might want to know if a cell contains a number, or whether it's empty.

    ISNUMBER (3)   = TRUE

    ISBLANK ([A5])   will check if cell A5 is empty (= TRUE) or not (= FALSE)

You can use FIND() and ISNUMBER() together to check text,

    ISNUMBER (FIND ("A" , "ABC"))   = TRUE

    ISNUMBER (FIND ("A" , "XYZ"))   = FALSE

This works because when FIND() finds the first text inside the second, it will answer with the index number of the place it found the text. But if it can't find the text, it will give the answer #VALUE! which is not a number.

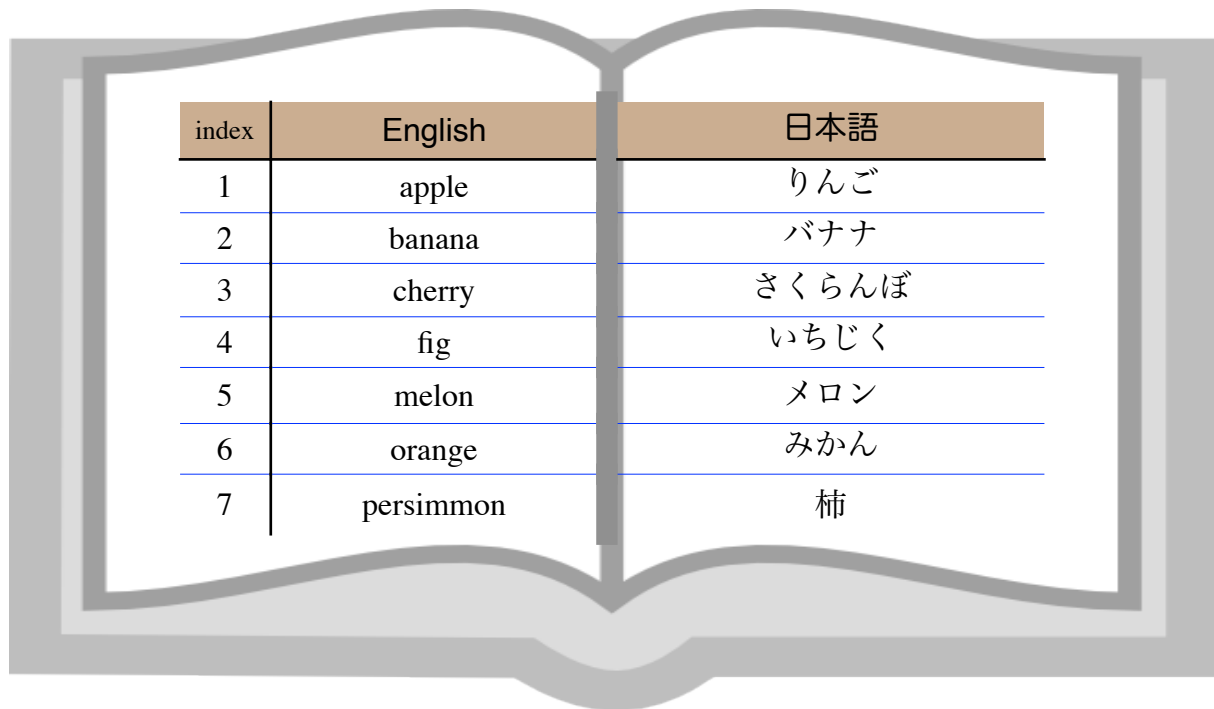There are many other Is… type questions in Excel.

If(), And(), Not()

You can use a comparison to decide what to do next.

IF   yes

                no

Part 2:Looking things up

Using Match(), Index(), and LookUp():

Imagine a dictionary:

index	English	日本語
1	apple	りんご
2	banana	バナナ
3	cherry	さくらんぼ
4	fig	いちじく
5	melon	メロン
6	orange	みかん
7	persimmon	柿

A dictionary contains a list of words in order. Each word in the list is matched to items in a second list, for example words in another language. You LOOK UP words in the dictionary and find the matching word in the second list or language.

Excel can do the same thing. First it MATCHES the word you are looking for, to the words in the list. Then it uses the INDEX to find the matching item in another list.

= MATCH ("cherry" , [English])

$\implies$ 3

= INDEX ([日本語] , 3)

$\implies$ "さくらんぼ"

But it also lets you LOOK UP words directly:

= LOOKUP ("orange", [English] , [日本語])

$\implies$ "みかん"

Another example: Improving the Chinese Zodiac

Using MATCH(), INDEX(), and LOOKUP(), you can make your calculations more convenient. Remember the formula for the Chinese zodiac (十二支)?

$$= \text{MOD} (\; [\; \text{birthyear} \;] – 1900 \; , \; 12 \;)$$

This works, but it is hard to use because the answer is a number between 0 and 11.

As a first step let's make a "dictionary" called "Chinese zodiac":

index	Chinese zodiac
1	子
2	丑
3	寅
4	卯
5	辰
6	巳
7	午
8	未
9	申
10	酉
11	戌
12	亥

Then you can use INDEX() like this:

$$= \text{INDEX} (\; [\; \text{Chinese zodiac} \;] \; , \; \text{MOD} (\; [\; \text{birthyear} \;] – 1900 \; , \; 12 \;) \; \mathbf{+ \; 1} \;)$$

Important Note: MOD() will give us a number between 0–11. Since INDEX() runs from 1–12 we need to add one to make it match. Another method would be to make our own index and let it run from 0–11. In that case we will need to use LOOKUP() instead of INDEX().