COMP1022Q
Introduction to Computing with Excel VBA

More On Lookup Techniques

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Approximate Matching

- Previously we looked at finding an exact match when we do a lookup
- However, sometimes you need the *closest* match
- For example, a range of course marks are usually mapped to the same letter grade
- This is called *approximate matching*

The Fourth Parameter

`VLOOKUP(` *key* `,` *TargetRange* `,` *ResultColumnNumber* `,` *Approximation* `)`

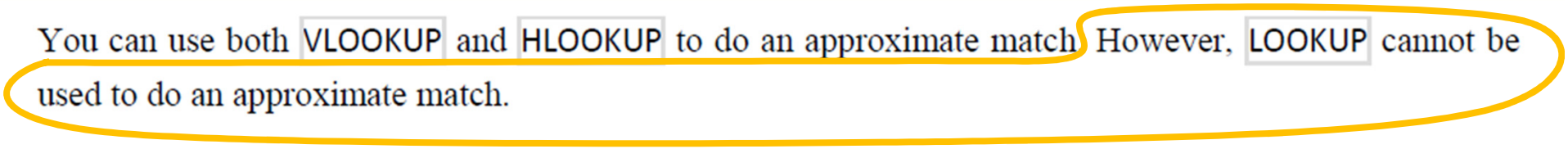
- If this is `TRUE`, an approximate match is made; otherwise an exact match is made

`HLOOKUP(` *key* `,` *TargetRange* `,` *ResultColumnNumber* `,` *Approximation* `)`

- If this fourth parameter is missing, Excel assumes you want approximate matching anyway
- However, if this parameter is `FALSE` then an approximate match is not made, and an error message will be produced if you try to look up something which isn't in the conversion table

Approximate Matching With LOOKUP

- LOOKUP automatically does approximate matching, you can't turn it off
- Page 38 of the course book is incorrect!



You can use both VLOOKUP and HLOOKUP to do an approximate match. However, LOOKUP cannot be used to do an approximate match.

- Please delete this sentence in your copy of the book
- We believe this is the only 'bad' statement in the book!

Example Conversion Table

- In the following example of approximate matching, a letter grade for a course is determined according to the mark for that course, using this conversion table:

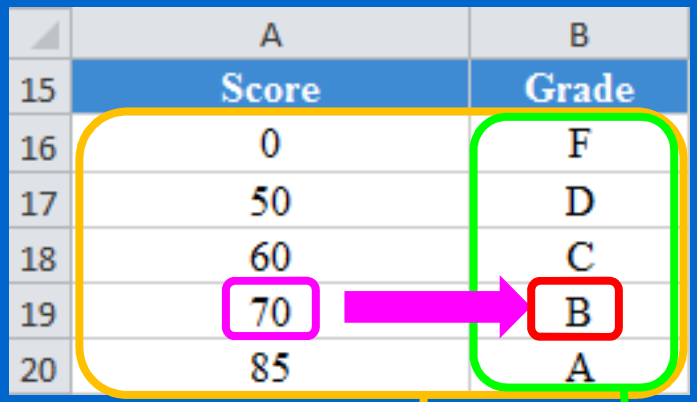
- For example, if the key value is *73*, the highest score less than key is 70, so B is returned as the grade

	A	B
15	Score	Grade
16	0	F
17	50	D
18	60	C
19	70	B
20	85	A

The conversion table

Example Usage

- We can see that the score of 73 is 'B'
  by using the `VLOOKUP` function like this:



	A	B
15	Score	Grade
16	0	F
17	50	D
18	60	C
19	70	B
20	85	A

We want an approximate match

```
VLOOKUP( 73, $A$16:$B$20, 2, TRUE )
```

Approximate Matching Example

4	Subject	Score	Grade
5	English	66	=VLOOKUP(B5, $A$16:$B$20, 2, TRUE)
6	Mathematics	83	=VLOOKUP(B6, $A$16:$B$20, 2, TRUE)
7	Physics	64	=VLOOKUP(B7, $A$16:$B$20, 2, TRUE)
8	Biology	70	=VLOOKUP(B8, $A$16:$B$20, 2, TRUE)
9	Chemistry	62	=VLOOKUP(B9, $A$16:$B$20, 2, TRUE)
10	Business Studies	94	=VLOOKUP(B10, $A$16:$B$20, 2, TRUE)
11	Philosophy	36	=VLOOKUP(B11, $A$16:$B$20, 2, TRUE)
12	Sports	57	=VLOOKUP(B12, $A$16:$B$20, 2, TRUE)

15	Score	Grade
16	0	F
17	50	D
18	60	C
19	70	B
20	85	A

The conversion table

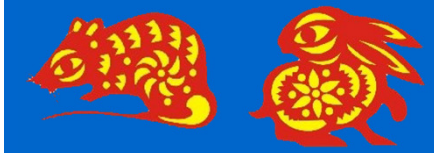
Subject	Score	Grade
English	66	C
Mathematics	83	B
Physics	64	C
Biology	70	B
Chemistry	62	C
Business Studies	94	A
Philosophy	36	F
Sports	57	D

For Approximate Matching, Conversion Data Must Be Sorted

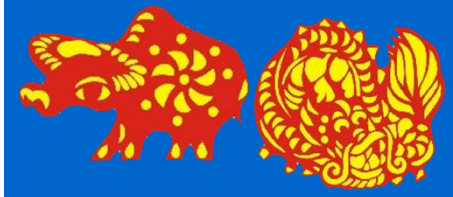
- There is one very important thing to remember if you want to use approximate matching; the data in the conversion table ***must be sorted***
- I.e. if the conversion table uses numbers, those numbers must be in increasing order
- Similarly, if the conversion table uses words, those words must be in alphabetical order

Using Lookup As Part of a Formula

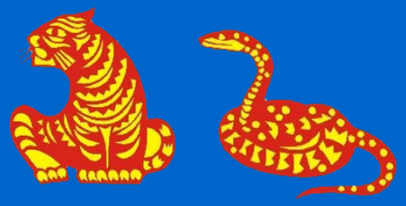
- Finally, let's look at a more complex example
- This example uses lookup as part of a clever formula
- For this example, we will use the Chinese Zodiac
- Each year is regarded as an animal, in a 12-year cycle:



1. Rat (鼠)
2. Ox (牛)



3. Tiger (虎)
4. Rabbit (兔)



5. Dragon (龍)
6. Snake (蛇)

7. Horse (馬)
8. Goat (羊)

9. Monkey (猴)
10. Rooster (雞)

11. Dog (狗)
12. Pig (豬)

Chinese Zodiac Conversion Data

- This example uses `HLOOKUP` to find which year belongs to which Chinese Zodiac animal
- For this example, we first added a new worksheet called *Chinese_Zodiac_Table* and put the Chinese Zodiac conversion table there:

	A	B	C	D	E	F	G	H	I	J	K	L	M
2	**Order**	1	2	3	4	5	6	7	8	9	10	11	12
3	**Chinese Zodiac's Animal in English**	Rat	Ox	Tiger	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig
4	**Chinese Zodiac's Animal**	鼠	牛	虎	兔	龍	蛇	馬	羊	猴	雞	狗	豬

Find_Chinese_Zodiac | **Chinese_Zodiac_Table**

Referring to Another Worksheet

- In any formula (not just lookups) you may need to refer to another worksheet
- The way to do that is to use the name of the worksheet, followed by an exclamation mark, and then the cell(s)
- For example, we can refer to one of the cells in the conversion table worksheet of our example like this:

```
= Chinese_Zodiac_Table!B3
```

Calculating the Animal For Any Year

- If we know that 1960 is the first year in the sequence, which is a year of the Rat, then we can write an Excel formula to work out all the other years
- `MOD` is very helpful when handling patterns
- The `MOD` function returns the remainder after dividing two numbers i.e. `=MOD(8, 5)` is `3`
- We can use that function to compute the order number of the year (in the range 1 to 12), like this:

  `=MOD(` *YearCell* `- 1960, 12 ) + 1`

Calculating the Animal For Any Year

- For example, let's say we want to know the animal for 2013

```
= MOD(   2013 - 1960, 12 )   +1
= MOD(        53,   12 )     +1
=                5            +1
=                6
```

- The result is 6, which is a Year of the Snake

	A	B	C	D	E	F	G	H	I	J	K	L	M
2	Order	1	2	3	4	5	6	7	8	9	10	11	12
3	Chinese Zodiac's Animal in English	Rat	Ox	Tiger	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig
4	Chinese Zodiac's Animal	鼠	牛	虎	兔	龍	蛇	馬	羊	猴	雞	狗	豬

Find_Chinese_Zodiac | Chinese_Zodiac_Table

Determining the English Name

- We want to fill all these cells with correct Chinese Zodiac names:

	A	B	C
4	Year	Chinese Zodiac's Animal in English	Chinese Zodiac's Animal
5	1990		
6	1991		
7	1992		
8	1993		
9	1994		
10	1995		
11	1996		

- First, we enter this formula in the top cell (B5) to find the Chinese Zodiac animal in English:

key *TargetRange* *ResultRowNumber*

```
=HLOOKUP( MOD(A5-1960,12)+1, Chinese_Zodiac_Table!$B$2:$M$4, 2 )
```

	A	B	C	D	E	F	G	H	I	J	K	L	M
2	Order	1	2	3	4	5	6	7	8	9	10	11	12
3	Chinese Zodiac's Animal in English	Rat	Ox	Tiger	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig
4	Chinese Zodiac's Animal	鼠	牛	虎	兔	龍	蛇	馬	羊	猴	雞	狗	豬

Find_Chinese_Zodiac | Chinese_Zodiac_Table

Determining the Chinese Name

- Now we want to fill up the cells in the next column with the appropriate Chinese names

	A	B	C
4	Year	Chinese Zodiac's Animal in English	Chinese Zodiac's Animal
5	1990	Horse	
6	1991		
7	1992		
8	1993		
9	1994		
10	1995		
11	1996		

- We put nearly the same formula in the top cell (C5):

```
=HLOOKUP( MOD(A5-1960,12)+1, Chinese_Zodiac_Table!$B$2:$M$4, 3 )
```

	A	B	C	D	E	F	G	H	I	J	K	L	M
2	Order	1	2	3	4	5	6	7	8	9	10	11	12
3	Chinese Zodiac's Animal in English	Rat	Ox	Tiger	Rabbit	Dragon	Snake	Horse	Goat	Monkey	Rooster	Dog	Pig
4	Chinese Zodiac's Animal	鼠	牛	虎	兔	龍	蛇	馬	羊	猴	雞	狗	豬

Find_Chinese_Zodiac | Chinese_Zodiac_Table

Duplicating the Formula

- Like before, we can duplicate the formulas to the cells underneath (by selecting cells B5 and C5, then double clicking)
- Now you can easily see, for example, which animal year you and your friends were born in:

	A	B	C
4	**Year**	**Chinese Zodiac's Animal in English**	**Chinese Zodiac's Animal**
5	**1990**	Horse	馬
6	**1991**	Goat	羊
7	**1992**	Monkey	猴
8	**1993**	Rooster	雞
9	**1994**	Dog	狗
10	**1995**	Pig	豬
11	**1996**	Rat	鼠
	⋮		⋮