COMP1022Q
Introduction to Computing with Excel VBA

Sorting and Filtering Using VBA

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What You Will Learn

- In this presentation we will look at these:
  - A reminder of sorting and filtering (without VBA)

  - Filtering using VBA
    - Applying AutoFilter using a single criterion
    - Applying AutoFilter using compound criteria
    - Showing top items using AutoFilter
    - Filtering using an advanced filter
  - Sorting using VBA
    - Basic sorting
    - Sorting using 3 columns
    - Sorting by rows
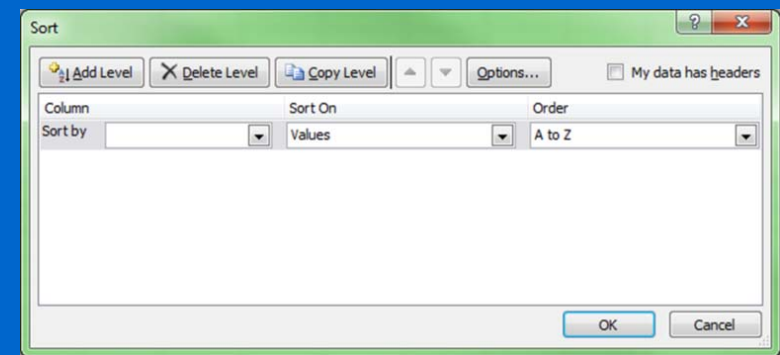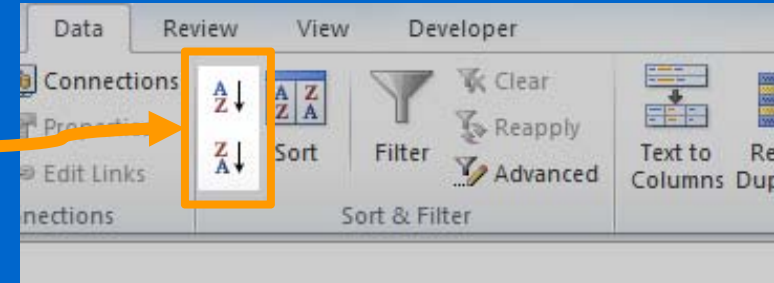
Sorting and Filtering in Excel

- Previously we looked at how to perform sorting and filtering of data in Excel using the 'Sort & Filter' commands in the 'Data' tab

- In this presentation we will see how to do data sorting and filtering through VBA programming

Quick Review of Sorting in Excel

- To sort data in Excel (without VBA) you can use the simple sort buttons in the Excel ribbon

- Alternatively you can sort data by setting up a customized sort using the sort window

- Using sorting in VBA programming is similar to using the sort window (without the clicking!)

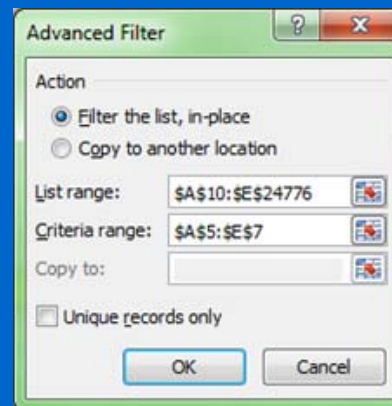- For example, you can set up a customized sort with a variety of options

Quick Review of Filtering in Excel

- Remember you can use two types of filter in Excel:

  - AutoFilter

	A	B	C
4	Number of Votes	Rating	Title
5	10	5.6	!Women Art Revolution
6	327	3.6	#1 Cheerleader Camp

  - Advanced Filter

  Advanced Filter

  Action
  - Filter the list, in-place
  - Copy to another location

  List range: $A$10:$E$24776
  Criteria range: $A$5:$E$7
  Copy to:
  - Unique records only

  OK   Cancel

- Both of the above can be achieved using VBA code, which will be shown in the next slides

VBA Method for Sorting

- You can use the *Sort* method in VBA to sort a range in various scenarios

- Below is the definition of the *Sort* method:

The sort keys, i.e. the columns/rows to be sorted

```
Sort( Key1 , Order1 , Key2 , Type , Order2 , _
      Key3 , Order3 , Header , OrderCustom , _
MatchCase , Orientation , SortMethod , _
DataOption1 , DataOption2 , DataOption3 )
```

- You can see the *Sort* method has many arguments (15!)
  - You don't need to worry about all of them
  - We will only use those which are helpful in our examples

VBA Method for AutoFilter

- You can use the *AutoFilter* method to filter a range using a particular column of data

- Here is the definition of the method:

The filter criteria

```
AutoFilter( Field , Criteria1 , Operator , Criteria2 ,
```

The column to be filtered

VisibleDropDown)

- After running the above method AutoFilter will be automatically enabled on the worksheet, i.e. an arrow ▼ is shown next to each column header

VBA Method for Advanced Filter

- The *AdvancedFilter* method helps you set up an advanced filter just as what you would do using the ribbon

- Below is the definition of the method:
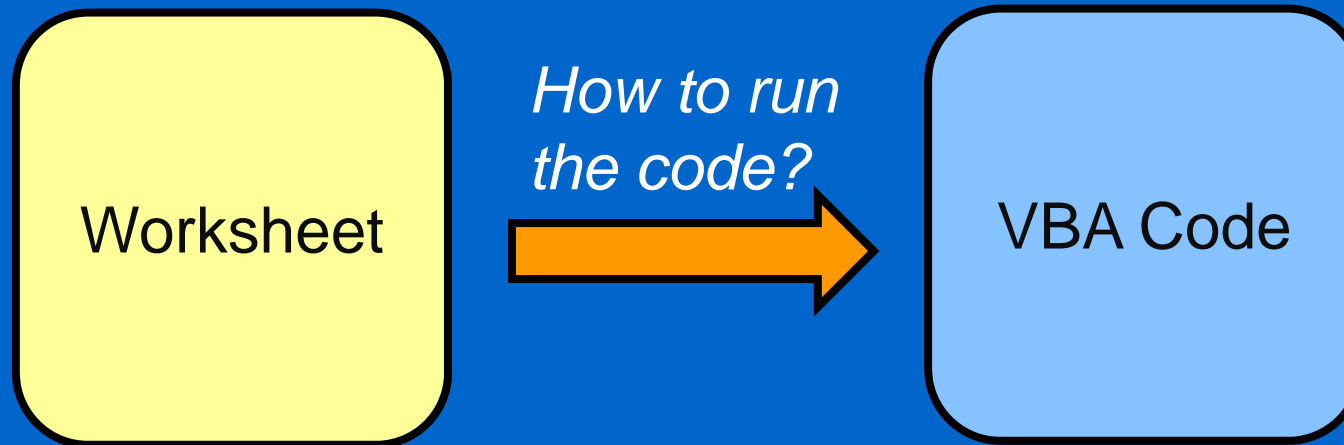
  `AdvancedFilter(`*Action*`,` *CriteriaRange*`,` `_`

  CopyToRange`,` *Unique*`)`

- We will show examples later

Running the Examples

- As usual, we need to think of an appropriate way to run the VBA code

```
Worksheet   →   How to run   →   VBA Code
                the code?
```

- The examples in this presentation use buttons to run the code

Running the Example VBA Code

- In the examples for this presentation one or more form buttons have been put on the worksheet

- These buttons are set up so that when they are clicked they run their corresponding VBA methods (macros)

- These VBA methods are defined in the VBA module called *Module1*

A VBA module containing the methods used in the example
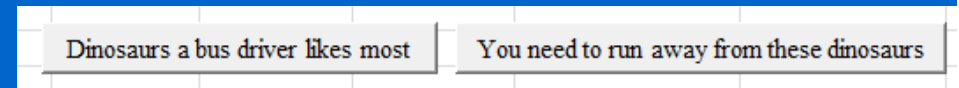
An example with two buttons
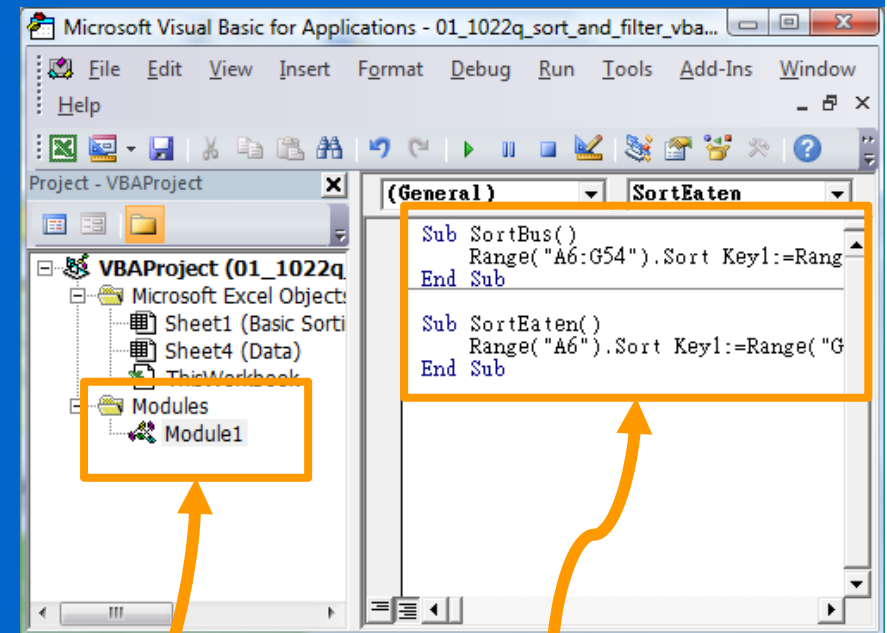
In this example you can see two VBA methods are used

Dinosaurs

- Dinosaurs are a group of extinct animals who lived many years ago
- They are very interesting, partly because of their scary appearance and huge size (for some of them)
- You can only find their fossils nowadays
- Nevertheless, dinosaur experts can analyze and estimate what they did and what they ate before
- Like modern animals, some dinosaurs are plant eaters (herbivores), some are meat eaters (carnivores) and some are both (omnivores)

Size of Dinosaurs

- We will use a data set containing dinosaur sizes for the following example

- Each row in the data set has the dinosaur name, diet, height, length and weight
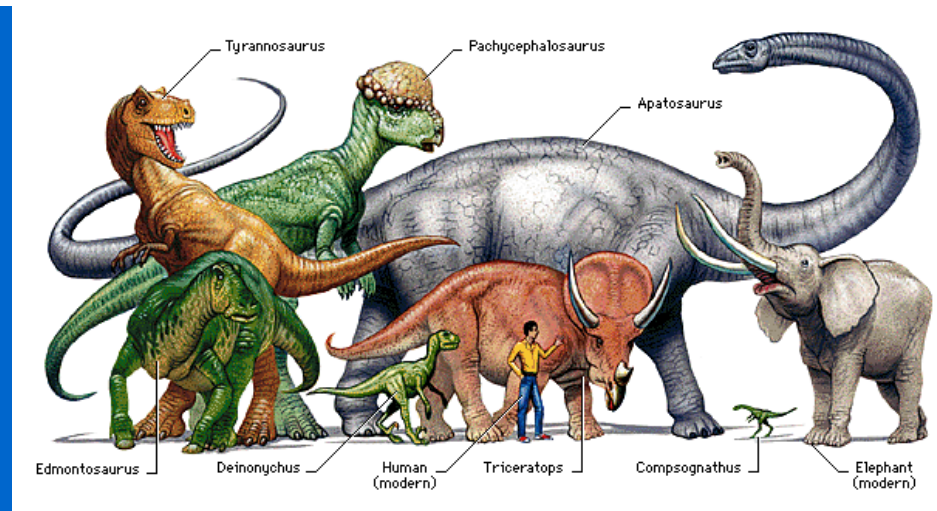
	A	B	C	D	E
6	**Dinosaur**	**Diet**	**Height (m)**	**Length (m)**	**Weight (kg)**
7	Albertosaurus	carnivore	3.5	9.0	1,500.0
8	Allosaurus	carnivore	5.0	12.0	2,000.0
9	Amargasaurus	herbivore	4.0	12.0	9,000.0
⋮					
53	Utahraptor	carnivore	2.0	6.0	1,000.0
54	Velociraptor	carnivore	1.0	1.8	15.0

More Useful Data on Dinosaurs

- Instead of looking at the exact numbers you can understand them better by comparing the numbers using modern objects

- We will look at:
    1. How many buses can a dinosaur crush?
    2. How many people can a dinosaur eat in one meal?

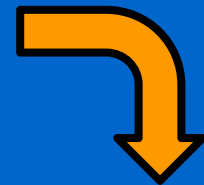|	A	B	C	D	E	F	G
						How many buses can it crush?	How many people can it eat in one meal?
6	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)		
7	Albertosaurus	carnivore	3.5	9.0	1,500.0	0.9	10.0
8	Allosaurus	carnivore	5.0	12.0	2,000.0	1.2	13.3
9	Amargasaurus	herbivore	4.0	12.0	9,000.0	1.2	0.0

Estimating the Data

- The last two columns, F and G, are not in the original dinosaur data set
- To calculate the values in these two columns we use Excel formulas based on the columns in the original data set

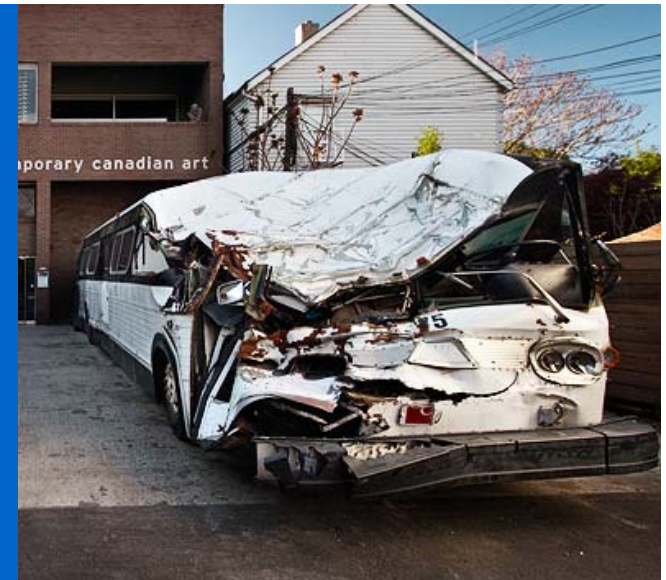|	A	B	C	D	E	F	G
						How many buses can it crush?	How many people can it eat in one meal?
6	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)		
7	Albertosaurus	carnivore	3.5	9.0	1,500.0	0.9	10.0
8	Allosaurus	carnivore	5.0	12.0	2,000.0	1.2	13.3
9	Amargasaurus	herbivore	4.0	12.0	9,000.0	1.2	0.0

Ctrl `

The estimation is based on the logic that a dinosaur needs to eat half of its weight in one meal (75 here is the weight of a man)

How many buses can it crush?	How many people can it eat in one meal?
=D7/10	=IF(B7="herbivore",0,E7/2/75)
=D8/10	=IF(B8="herbivore",0,E8/2/75)
=D9/10	=IF(B9="herbivore",0,E9/2/75)

Basic Sorting 1/5

- First we want to find the dinosaurs a bus driver likes most, i.e. sort the dinosaurs from the least to the most number of buses they can crush

- To run the *Sort* method you need to find the range to sort

- The range of the dinosaur data set is *A6:G54*

	A	B	C	D	E	F	G
6	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)	How many buses can it crush?	How many people can it eat in one meal?
7	Albertosaurus	carnivore	3.5	9.0	1,500.0	0.9	10.0
8	Allosaurus	carnivore	5.0	12.0	2,000.0	1.2	13.3
9	Amargasaurus	herbivore	4.0	12.0	9,000.0	1.2	0.0
⋮							
52	Tyrannosaurus	carnivore	5.6	12.0	7,000.0	1.2	46.7
53	Utahraptor	carnivore	2.0	6.0	1,000.0	0.6	6.7
54	Velociraptor	carnivore	1.0	1.8	15.0	0.2	0.1

Sort this column

Basic Sorting 2/5

- You can sort the dinosaurs using the *Sort* method, like this:

```
Range("A6:G54").Sort Key1:=Range("F6:F54") , _
                     Order1:=xlAscending , _
                     Header:=xlYes
```

Sort from the least to the most number of buses

Tell Excel the data has a header row

A parameter can be given to a function using the parameter name like this

The sort key, i.e., the column used for sorting
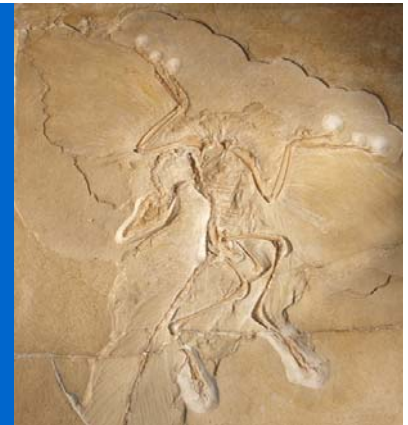
	A	B	C	D	E	F	G
	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)	How many buses can it crush?	How many people can it eat in one meal?
6	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)	How many buses can it crush?	How many people can it eat in one meal?
7	Albertosaurus	carnivore	3.5	9.0	1,500.0	0.9	10.0
8	Allosaurus	carnivore	5.0	12.0	2,000.0	1.2	13.3
9	Amargasaurus	herbivore	4.0	12.0	9,000.0	1.2	0.0
52	Tyrannosaurus	carnivore	5.6	12.0	7,000.0	1.2	46.7
53	Utahraptor	carnivore	2.0	6.0	1,000.0	0.6	6.7
54	Velociraptor	carnivore	1.0	1.8	15.0	0.2	0.1

Basic Sorting 3/5

- Here is the code shown in the previous slide
- It sorts the dinosaurs from the least to the most number of buses they can crush

```
Range("A6:G54").Sort Key1:=Range("F6:F54"), _
                     Order1:=xlAscending, _
                     Header:=xlYes
```

- Here is the result after running the code:

	A	B	C	D	E	F	G
						How many buses	How many people can it eat in
6	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)	can it crush?	one meal?
7	Archaeopteryx	carnivore	0.2	0.5	0.5	0.1	0.0
8	Microraptor	carnivore	0.3	0.8	2.0	0.1	0.0
9	Caudipteryx	omnivore	0.6	1.0	2.5	0.1	0.0

Basic Sorting 4/5

- Now we will make a new sort of the data

- A 'the most to the least number of people eaten by a dinosaur in one meal' sort can be done using this code:

```
Range("A6") .Sort Key1:=Range("G6") , _
                  Order1:=xlDescending, _
                  Header:=xlGuess
```

Excel can 'guess' if headers exist

The data set can be specified by a single cell

When only a single cell is specified, Excel will automatically sort the region of cells containing that cell

The sort key can be simply specified by a single cell only

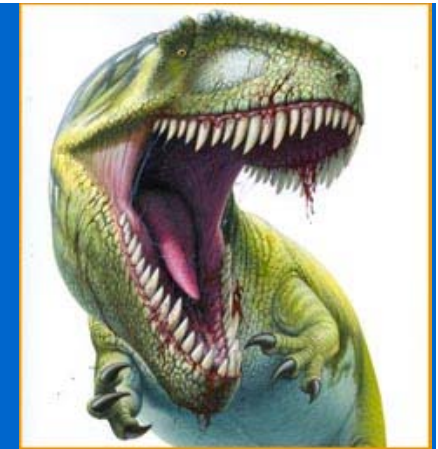|	A	B	C	D	E	F	G
						How many buses can it crush?	How many people can it eat in one meal?
6	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)		
7	Albertosaurus	carnivore	3.5	9.0	1,500.0	0.9	10.0
8	Allosaurus	carnivore	5.0	12.0	2,000.0	1.2	13.3
9	Amargasaurus	herbivore	4.0	12.0	9,000.0	1.2	0.0

Basic Sorting 5/5

- Here is the VBA code shown in the previous slide:

```
Range("A6").Sort Key1:=Range("G6"), _
                 Order1:=xlDescending, _
                 Header:=xlGuess
```

- The result is a sorted list of the most to the least number of people a dinosaur can eat in a meal after running the VBA code:

A class of students may not be enough for this guy

	A	B	C	D	E	F	How many people can it eat in one meal?
6	Dinosaur	Diet	Height (m)	Length (m)	Weight (kg)	How many buses can it crush?	
7	Giganotosaurus	carnivore	5.0	12.5	8,000.0	1.3	53.3
8	Tyrannosaurus	carnivore	5.6	12.0	7,000.0	1.2	46.7
9	Spinosaurus	carnivore	5.0	18.0	4,000.0	1.8	26.7

Dinosaurs and Their Origin

Triassic

Jurassic

Cretaceous

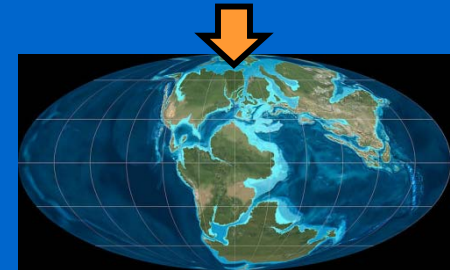- Dinosaurs lived from the Triassic period (250 million years ago), through the Jurassic period to the Cretaceous period (65 million years ago)

- We will run our sorting code on another data set that shows the continent and country of the discovery of the dinosaurs and the period that they lived in
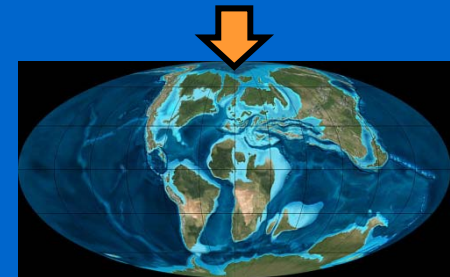
	A	B	C	D
6	**Dinosaur**	**Continent**	**Country**	**Period**
7	Aardonyx	Africa	South Africa	Lower Jurassic
8	Abelisaurus	South America	Argentina	Upper Cretaceous
9	Achelousaurus	North America	USA	Upper Cretaceous

Sorting Using Three Columns 1/3

- We want to see the dinosaurs grouped by their continent of discovery and then by their country

- We also want to sort the dinosaurs alphabetically

- To do the above we will use a three level sort of three different columns, in this order:

  1. Sort the continents, then

  2. Within each continent, sort the countries, then

  3. Within each country, sort the dinosaur names

  Continents

  Countries

  Names

- A three level sort is the most depth you can do using the VBA *Sort* method
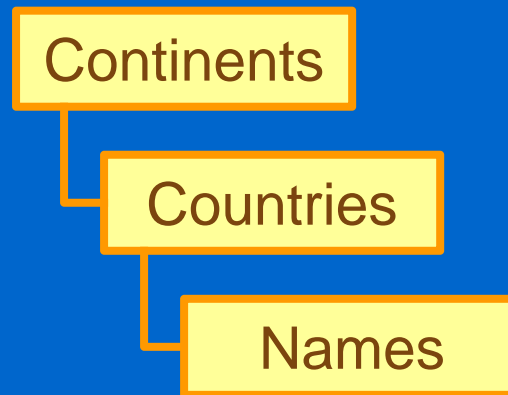
Sorting Using Three Columns 2/3

- In the previous sorting examples, only *Key1* (i.e. one column) was used, now we will use three

- We specify the sort using *Key1*, *Key2* and *Key3*, like this:

```
Range("A6").Sort   Key1:=Columns("B") , _
                   Key2:=Columns("C") , _
                   Key3:=Columns("A") , _
                   Header:=xlGuess
```

Specifying the sort keys by their column name

	A	B	C	D
	Key3	*Key1*	*Key2*	
6	**Dinosaur**	**Continent**	**Country**	**Period**
7	Aardonyx	Africa	South Africa	Lower Jurassic
8	Abelisaurus	South America	Argentina	Upper Cretaceous
9	Achelousaurus	North America	USA	Upper Cretaceous

Sorting Using Three Columns 3/3

- This is the result of running the sorting VBA in the previous slide

- After grouping the dinosaurs by country we know about 60 types of dinosaur have been discovered in China!

	A	B	C	D
6	**Dinosaur**	**Continent**	**Country**	**Period**
7	Brachiosaurus	Africa	Algeria	Upper Jurassic
8	Nigersaurus	Africa	Algeria	Lower Cretaceous
9	Aegyptosaurus	Africa	Egypt	Upper Cretaceous
10	Paralititan	Africa	Egypt	Upper Cretaceous

⋮

	A	B	C	D
53	Barapasaurus	Asia	India	Lower Jurassic
54	Dravidosaurus	Asia	India	Upper Cretaceous
55	Indosuchus	Asia	India	Upper Cretaceous
56	Isisaurus	Asia	India	Upper Cretaceous
57	Kotasaurus	Asia	India	Lower Jurassic

⋮

	A	B	C	D
110	Agilisaurus	Asia	Peoples Republic of China	Upper Jurassic
111	Alectrosaurus	Asia	Peoples Republic of China	Upper Cretaceous
112	Archaeoceratops	Asia	Peoples Republic of China	Lower Cretaceous
113	Archaeornithomimus	Asia	Peoples Republic of China	Upper Cretaceous
114	Avimimus	Asia	Peoples Republic of China	Upper Cretaceous

⋮

	A	B	C	D
178	Rhabdodon	Europe	Austria	Upper Cretaceous
179	Struthiosaurus	Europe	Austria	Upper Cretaceous
180	Iguanodon	Europe	Belgium	Lower Cretaceous
181	Avalonia	Europe	England	Upper Triassic
182	Baryonyx	Europe	England	Lower Cretaceous

⋮

	A	B	C	D
247	Acrocanthosaurus	North America	Canada	Lower Cretaceous
248	Albertaceratops	North America	Canada	Upper Cretaceous
249	Albertosaurus	North America	Canada	Upper Cretaceous
250	Anchiceratops	North America	Canada	Upper Cretaceous
251	Ankylosaurus	North America	Canada	Upper Cretaceous

Rambo

- Rambo is a series of action films starring Sylvester Stallone
- They are about a Vietnam war veteran who engages in numerous battles by himself
- A remarkable thing about Rambo is that he can shoot many bad guys but somehow he never gets seriously hurt
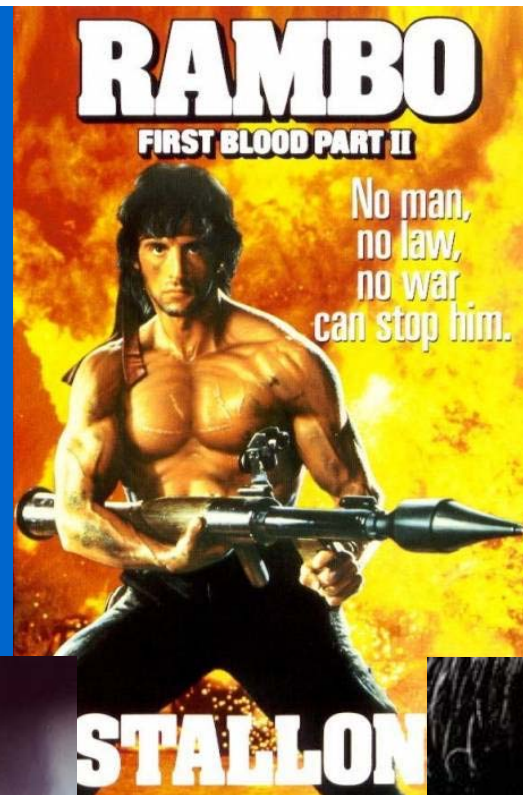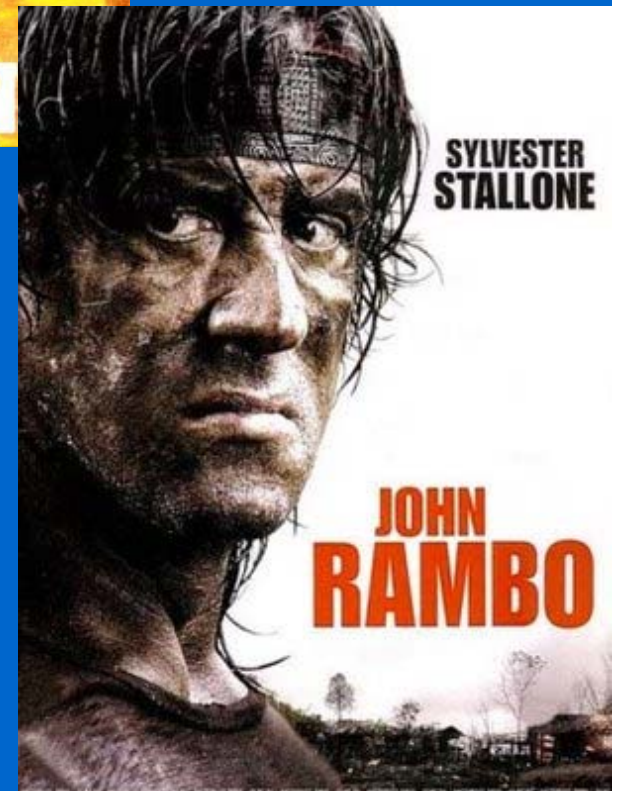
Rambo I:
First Blood

Rambo II:
First Blood
Part II
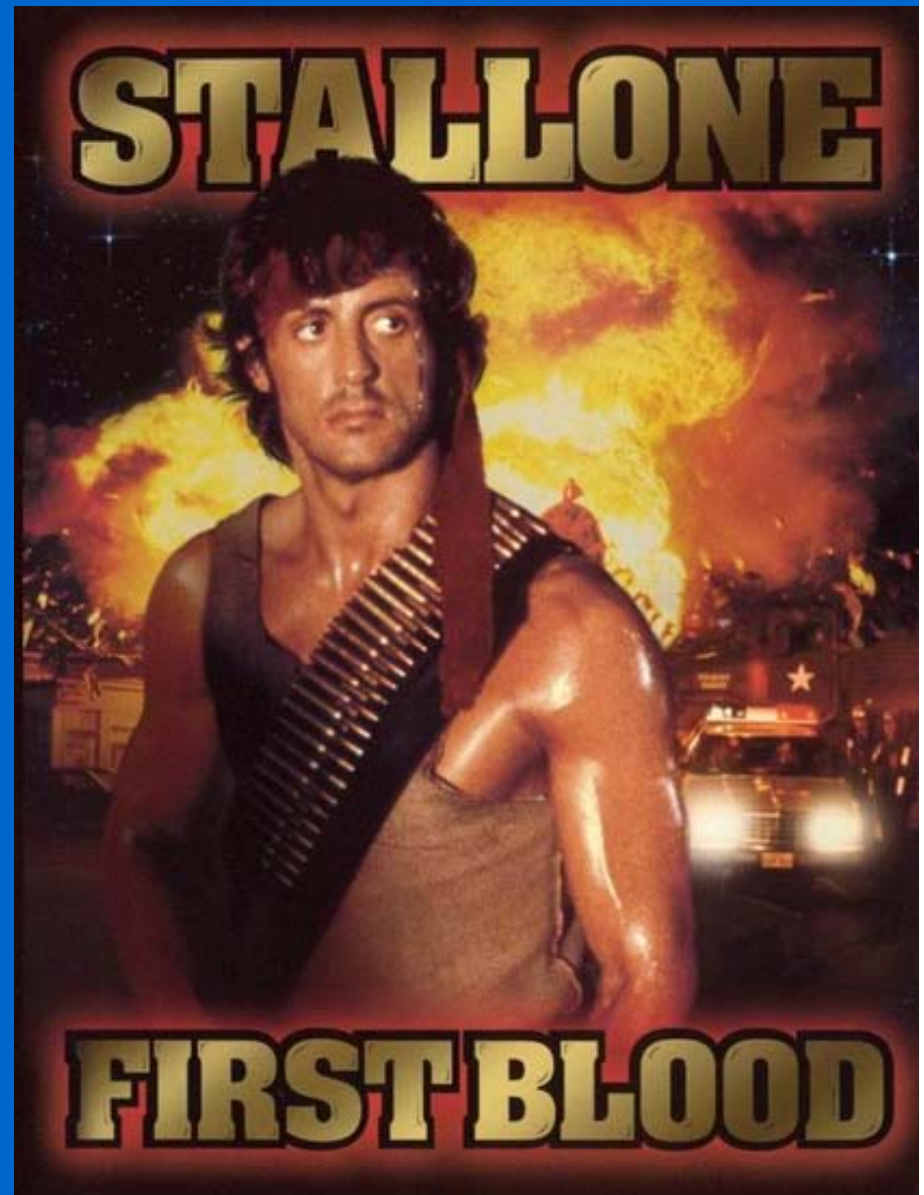
The
Four
Rambo
Films

Rambo III:
Rambo III

Rambo IV:
Rambo

Useful Statistics about Rambo

	I: "First Blood" (1982)	II: "Rambo: First Blood Part II" (1985)	III: "Rambo III" (1988)	IV: "Rambo" (2008)
Number of bad guys killed by Rambo with his shirt on	1	12	33	83
Number of bad guys killed by Rambo with his shirt off	0	46	45	0
Number of bad guys killed by Rambo with/without shirt	1	58	78	83
Number of bad guys killed by friends of Rambo acting on their own	0	10	17	40
Number of good guys killed by bad guys	0	1	37	113
Total number of people killed	1	69	132	236
Number of people killed per minute	0.01	0.72	1.3	2.59
Time at which the first person is killed (mins:secs)	29:31	33:34	41:09	3:22
Number of people killed per minute from that point until the end of the film (not including the ending credits)	0.02	1.18	2.39	3.04
Sequences in which Rambo is shot at without significant result	12	24	38	2
Number of sequences in which good guys are tortured by bad guys	2	5	7	3

Sorting by Rows 1/6

- Let's assume you are attracted to Rambo when he doesn't have many clothes on, and you like to see action when the heroes never die. Which is the best movie to watch?
  You can look at:

  1. The number of kills by Rambo when he didn't put his shirt on

  2. The number of times Rambo shows his super power, i.e. cannot be killed when he should have been

- Because the films are listed horizontally we need to sort the data in the horizontal direction

Sort in this direction

I: "First Blood" (1982)	II: "Rambo: First Blood Part II" (1985)	III: "Rambo III" (1988)	IV: "Rambo" (2008)

Sorting by Rows 2/6

- Can we use a range of a single cell to run the sorting code, i.e. sort the region containing the cell?
  - No, because we want to sort the films only, without the first column, i.e. without column A
  - And Excel does not support row headers

- The *Sort* method is therefore run from column B to column E, i.e. the range *B6:E17*

	A	B	C	D	E
			II: "Rambo: First Blood		
		I: "First Blood"	Part II"	III: "Rambo III"	IV: "Rambo"
6		(1982)	(1985)	(1988)	(2008)
7	Number of bad guys killed by Rambo with his shirt on	1	12	33	83
8	Number of bad guys killed by Rambo with his shirt off	0	46	45	0
9	Number of bad guys killed by Rambo with/without shirt	1	58	78	83
10	Number of bad guys killed by friends of Rambo acting on their own	0	10	17	40
11	Number of good guys killed by bad guys	0	1	37	113
12	Total number of people killed	1	69	132	236
13	Number of people killed per minute	0.01	0.72	1.3	2.59
14	Time at which the first person is killed (mins:secs)	29:31	33:34	41:09	3:22
15	Number of people killed per minute from that point until the end of the film (not including the ending credits)	0.02	1.18	2.39	3.04
16	Sequences in which Rambo is shot at without significant result	12	24	38	2
17	Number of sequences in which good guys are tortured by bad guys	2	5	7	3

Sorting by Rows 3/6

- Let's sort the number of kills by Rambo in descending order when he didn't put his shirt on, i.e. row 8, like this:

```
Range("B6:E17").Sort Key1:=Range("B8") , _
```

The row to sort

```
Order1:=xlDescending, _
```

Sort the data by rows instead of columns

```
Orientation:=xlSortRows
```

The row to be sorted that contains the cell "B8"

⬛	A	B	C	D	E
6		I: "First Blood" (1982)	II: "Rambo: First Blood Part II" (1985)	III: "Rambo III" (1988)	IV: "Rambo" (2008)
7	Number of bad guys killed by Rambo with his shirt on	1	12	33	83
8	Number of bad guys killed by Rambo with his shirt off	0	46	45	0
9	Number of bad guys killed by Rambo with/without shirt	1	58	78	83

Sorting by Rows 4/6

- Here is the result after running the VBA code shown in the previous slide:

The most bad guys killed by Rambo without his shirt on is the second film in the series

	A	B II: "Rambo: First Blood Part II" (1985)	C III: "Rambo III" (1988)	D I: "First Blood" (1982)	E IV: "Rambo" (2008)
6					
7	Number of bad guys killed by Rambo with his shirt on	12	33	1	83
8	Number of bad guys killed by Rambo with his shirt off	46	45	0	0
9	Number of bad guys killed by Rambo with/without shirt	58	78	1	83

Sorting by Rows 5/6

- As another example, the number of times Rambo is shot at without any result can be sorted in descending order by the following code:

```
Range("B6:E17").Sort  Key1:=Rows("16") , _
           Order1:=xlDescending, _
           Orientation:=xlSortRows
```

The row to sort is specified by the row number 16 in this example

	A	B	C	D	E
		I: "First Blood" (1982)	II: "Rambo: First Blood Part II" (1985)	III: "Rambo III" (1988)	IV: "Rambo" (2008)
7	Number of bad guys killed by Rambo with his shirt on	1	12	33	83
8	Number of bad guys killed by Rambo with his shirt off	0	46	45	0
9	Number of bad guys killed by Rambo with/without shirt	1	58	78	83
10	Number of bad guys killed by friends of Rambo acting on their own	0	10	17	40
11	Number of good guys killed by bad guys	0	1	37	113
12	Total number of people killed	1	69	132	236
13	Number of people killed per minute	0.01	0.72	1.3	2.59
14	Time at which the first person is killed (mins:secs)	29:31	33:34	41:09	3:22
15	Number of people killed per minute from that point until the end of the film (not including the ending credits)	0.02	1.18	2.39	3.04
16	Sequences in which Rambo is shot at without significant result	12	24	38	2
17	Number of sequences in which good guys are tortured by bad guys	2	5	7	3

Sorting by Rows 6/6

- After running the VBA code in the previous slide you can see that Rambo III has the most number of times that Rambo was unscathed when he was shot at

He cannot even be shot down by military helicopters!

	A	B	C	D	E
6		III: "Rambo III" (1988)	II: "Rambo: First Blood Part II" (1985)	I: "First Blood" (1982)	IV: "Rambo" (2008)
14	Time at which the first person is killed (mins:secs)	41:09	33:34	29:31	3:22
15	Number of people killed per minute from that point until the end of the film (not including the ending credits)	2.39	1.18	0.02	3.04
16	Sequences in which Rambo is shot at without significant result	38	24	12	2
17	Number of sequences in which good guys are tortured by bad guys	7	5	2	3

Intentional Homicide

- Starting from this slide we will talk about the use of filters in VBA programming
- 'Intentional homicide' is defined as 'unlawful death deliberately inflicted on a person by another person'
- You can use the intentional homicide rate of a country to say how safe it is to stay in that country

Intentional Homicide Rate

- We will use a data set of the intentional homicide rate of each country, as well as the region of that country
- The homicide rate is the number of intentional homicide per 100,000 people of that country

	A	B	C	D
	Region	Sub-Region	Country	Intentional Homicide Rate per 100,000 Population
6	Region	Sub-Region	Country	Intentional Homicide Rate per 100,000 Population
7	Africa	Eastern Africa	Burundi	37.4
8	Africa	Eastern Africa	Comoros	11.9
9	Africa	Eastern Africa	Djibouti	3.4
⋮				
198	Oceania	Micronesia	Palau	0
199	Oceania	Polynesia	Samoa	1.1
200	Oceania	Polynesia	Tonga	1

Applying AutoFilter to a Column Using a Single Criterion 1/5

- For our first example we want to see 'safe' places in Asia

- We can apply two filters to the data set in order to see the desired places

1. A filter to be applied to the 'Region' column so that only data from 'Asia' is shown

2. A filter to be applied to the 'Rate' column so that an intentional homicide rate of under 1 is shown

	A	B	C	D
				Intentional Homicide Rate per 100,000 Population
6	Region	Sub-Region	Country	
7	Africa	Eastern Africa	Burundi	37.4
8	Africa	Eastern Africa	Comoros	11.9
9	Africa	Eastern Africa	Djibouti	3.4

Applying AutoFilter to a Column Using a Single Criterion 2/5

- First we apply a filter to the 'Region' column using VBA code:

```
Range("A6:D6") .AutoFilter Field:=1 , _
Criteria1:="Asia"
```

The header you want to apply the filter to

The filter is applied to the first column, i.e. the 'Region' column

To set the criterion you use the same syntax that you used before with the advanced filter

	A	B	C	D
6	Region	Sub-Region	Country	**Intentional Homicide Rate per 100,000 Population**
7	Africa	Eastern Africa	Burundi	37.4
8	Africa	Eastern Africa	Comoros	11.9
9	Africa	Eastern Africa	Djibouti	3.4

Applying AutoFilter to a Column Using a Single Criterion 3/5

- Here is the result after we apply the filter:

	A	B	C	D
6	Region 🔽	Sub-Region 🔽	Country 🔽	Intentional Homicide Rate per 100,000 Populati 🔽
97	Asia	Central Asia	Kazakhstan	12.7
98	Asia	Central Asia	Kyrgyzstan	6.4
99	Asia	Central Asia	Tajikistan	1.9
100	Asia	Central Asia	Turkmenistan	8.8
101	Asia	Central Asia	Uzbekistan	3.5

⋮

- As you can see from the above after you run the *AutoFilter* method you will see this icon 🔽 on the affected column

Applying AutoFilter to a Column Using a Single Criterion 4/5

- After we apply the filter to the 'Region' column we can further filter the data by using another filter on the 'Rate' column, like this:

```
Range("A6:D6").AutoFilter Field:=4 , _
Criteria1:="<1"
```

The filter is applied to the fourth column, i.e. the 'Rate' column

The criterion here is 'less than 1' for the 'Rate' column

C	D
Country	Intentional Homicide Rate per 100,000 Populati
Kazakhstan	12.7
Kyrgyzstan	6.4
Tajikistan	1.9

- The *AutoFilter* method accumulates the filters – in other words, the previously set filter is *NOT* removed

Applying AutoFilter to a Column Using a Single Criterion 5/5

- After applying two filters we can see there are only three countries/regions satisfying the 'safe country' criteria:

	A	B	C	D
6	Region ▼	Sub-Region ▼	Country ▼	Intentional Homicide Rate per 100,000 Populati ▼
104	Asia	Eastern Asia	HKSAR	0.5
105	Asia	Eastern Asia	Japan	0.5
144	Asia	Western Asia	United Arab Emirates	0.5

- You can see both the 'Region' column and 'Rate' column have the filtered icon 🔽 shown

- The result shows that Hong Kong is one of the safest place to live in :)

Applying AutoFilter to a Column Using Compound Criteria 1/3

- In the previous example each column has only one single criterion, e.g. *Region = 'Asia'*

- Using the *AutoFilter* method we can specify up to two criteria for each column

- For example, we can use a compound criteria to see the intentional homicide rate of Central America and South America, i.e.

Sub-Region = 'Central America' **OR**
Sub-Region = 'South America'

Applying AutoFilter to a Column Using Compound Criteria 2/3

- The compound criteria mentioned in the previous slide can be created using the following code:

```
Range("A6:D6").AutoFilter  Field:=2 , _
                   Criteria1:="Central America" , _
           Operator:=xlOr , _
           Criteria2:="South America"
```

The filter is applied to the second column, i.e. the 'Sub-Region' column

The two criteria are combined using a logical OR

The two criteria are specified by two arguments

	A	B	Cou
6	**Region**	**Sub-Region**	**Cou**
7	Africa	Eastern Africa	Buru
8	Africa	Eastern Africa	Com
9	Africa	Eastern Africa	Djibo

Applying AutoFilter to a Column Using Compound Criteria 3/3

- This is the result after applying the compound criteria

- We can see the murder rates for all countries in Central and South America

After doing the filtering, the filter icon ▾ *is displayed at the top of the column we have filtered*

	A	B	C	D
6	Region ▾	Sub-Region	▾ Country	**Intentional Homicide Rate per 100,000 Populati** ▾
75	Americas	Central America	Belize	22.8
76	Americas	Central America	Costa Rica	8
77	Americas	Central America	El Salvador	63.8
78	Americas	Central America	Guatemala	41.1
79	Americas	Central America	Honduras	20.5
80	Americas	Central America	Mexico	11.2
81	Americas	Central America	Nicaragua	17.5
82	Americas	Central America	Panama	12.4
83	Americas	South America	Argentina	5
84	Americas	South America	Bolivia	3.7
85	Americas	South America	Brazil	29.2
86	Americas	South America	Chile	5.8
87	Americas	South America	Colombia	52.5
88	Americas	South America	Ecuador	28.4
89	Americas	South America	Guyana	18.7
90	Americas	South America	Paraguay	16.1
91	Americas	South America	Peru	3.3
92	Americas	South America	Suriname	11.3
93	Americas	South America	Uruguay	4.7
94	Americas	South America	Venezuela	31.9

Showing Top Items Using AutoFilter 1/6

- Suppose we want to know the most unsafe places in the world, i.e. places with the worst homicide rate

- You could sort the entire data set

- Alternatively, you can use AutoFilter

- A 'top 10 items' operator in AutoFilter can display a certain number of rows (does not need to be 10) which has the highest value in a particular column

Showing Top Items
Using AutoFilter 2/6

- In the previous AutoFilter examples, the *AutoFilter* method is run on the data headers only, i.e. the range *A6:D6* in the intentional homicide rate data set

	A	B	C	D
6	Region	Sub-Region	Country	Intentional Homicide Rate per 100,000 Population
7	Africa	Eastern Africa	Burundi	37.4
8	Africa	Eastern Africa	Comoros	11.9
9	Africa	Eastern Africa	Djibouti	3.4

*The range in previous examples includes only the headers*

- However, this does not work if the operator is 'top 10 items'

Showing Top Items
Using AutoFilter 3/6

- Because of a 'bug' in Excel, when applying the 'top 10 items' operator the range **MUST NOT** be just the headers

- Otherwise you will get the error shown on the right

- Therefore, instead of using this:

```
Range("A6:D6").AutoFilter • • •
```

we need to use one of the ranges shown on the next slide
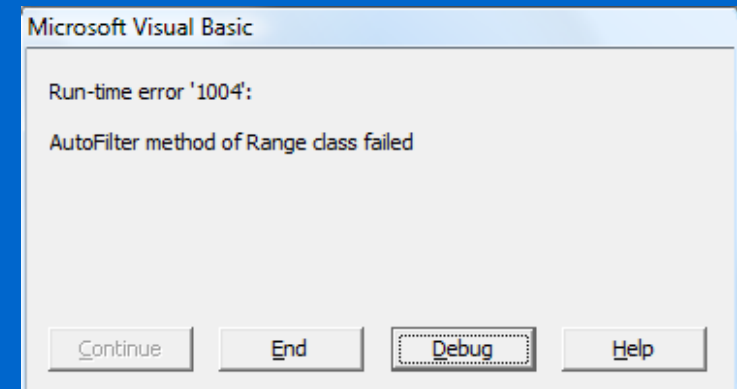
Showing Top Items Using AutoFilter 4/6

- To avoid the error shown on the previous slide, you can use one of the following ranges
  - A single cell within the data table:

    `Range("A6").AutoFilter` • • •

  - The headers with at least one row of data:

    `Range("A6:D7").AutoFilter` • • •

  - The entire data table:

    `Range("A6:D200").AutoFilter` • • •

For these two ranges Excel will automatically filter the region containing the range

Showing Top Items Using AutoFilter 5/6

- You can list the top 5 most unsafe places using the following VBA code:

```
Range("A6").AutoFilter Field:=4 , _
Criteria1:="5" , _
Operator:=xlTop10Items
```

The filter is applied to the fourth column, i.e. the 'Rate' column

- *When the operator is 'top 10 items' this argument becomes the number of items you want to show*
- *In this example, the number of items to show is 5*

The filter operator to apply to the data is 'top 10 items'

Showing Top Items Using AutoFilter 6/6

The Togo world cup team bus was shot at in South Africa, which resulted in three being killed

- Here is the result after running the VBA code, showing the 5 most unsafe places in the world

6	Region ▼	Sub-Region ▼	Country ▼	Intentional Homicide Rate per 100,000 Populati ▼
42	Africa	Southern Africa	South Africa	68
47	Africa	Western Africa	Cote d'Ivoire	50.8
77	Americas	Central America	El Salvador	63.8
78	Americas	Central America	Guatemala	41.1
87	Americas	South America	Colombia	52.5

- You may want to think again if you need to go to these places!

The filter icon ⬛ is displayed in the 'Rate' column

Financial Times EMBA Ranking

- The Financial Times EMBA ranking is a ranking of business schools offering the EMBA (Executive Master of Business Administration) across the world

- The ranking includes lots of data such as the salary increase after taking the program, and how many international students are in the program

- The top EMBA in 2010 is the Kellogg-HKUST EMBA program, offered by the HKUST business school

Financial Times EMBA Ranking 2010

	Rank	School Name	Country	Programme Name	Salary Increase (%)
11	Rank	School Name	Country	Programme Name	Salary Increase (%)
12	1	Kellogg / Hong Kong UST Business School	China	Kellogg-HKUST EMBA	68.8
13	2	Columbia/London Business School	U.S.A. / U.K.	EMBA Global Americas & Europe	108.6
14	3	Trium: HEC Paris / LSE / New York University: Stern	France / U.K. / U.S.A.	Trium EMBA	70.6
15	4	Insead	France / Singapore / U.A.E.	Insead Gemba	74.8
16	5	University of Chicago: Booth	U.S.A. / U.K. / Singapore	EMBA	82.9
17	6	London Business School	U.K.	EMBA	90.5
18	7	IE Business School	Spain	EMBA	144.0
19	8	University of Pennsylvania: Wharton	U.S.A.	Wharton MBA for Executives	68.2
20	9	Duke University: Fuqua	U.S.A.	MBA - Global Executive	54.8
21	10	Chinese University of Hong Kong	China	EMBA	64.4
22	10	City University: Cass	U.K.	EMBA	100.2
23	12	IMD	Switzerland	EMBA	70.8
24	13	UC Berkeley / Columbia	U.S.A.	Berkeley-Columbia EMBA	62.8
25	14	Kellogg / WHU-Otto Beisheim School	Germany	Kellogg-WHU EMBA	74.8
26	15	Columbia Business School	U.S.A.	EMBA	65.3
27	15	ESCP Europe	France / U.K. / Germany / Spain / Italy	European EMBA	83.5
28	17	New York University: Stern	U.S.A.	NYU Stern EMBA	64.6
29	18	Washington University: Olin	U.S.A. / China	Washington-Fudan EMBA	55.6
30	18	Ceibs	China	International EMBA	81.3
31	20	Northwestern University: Kellogg	U.S.A.	EMBA	54.4
32	21	Purdue / Tias / CEU / Gisma	U.S.A. / Netherlands / Hungary / Germany	International Masters in Management	62.2
33	22	OneMBA: CUHK/RSM/UNC/FGV São Paulo/Egade	China / Netherlands / U.S.A. / Brazil / Mexico	OneMBA	54.3
34	23	Kellogg / York University: Schulich	Canada	Kellogg-Schulich EMBA	50.3
35	24	Rotterdam School of Management, Erasmus University	Netherlands	EMBA	74.6
36	24	Cornell University: Johnson	U.S.A.	EMBA	69.0
37	26	Iese Business School	Spain	EMBA	77.6

The salary increase is the percentage increase in the average salary of students after entering the EMBA program compared to before
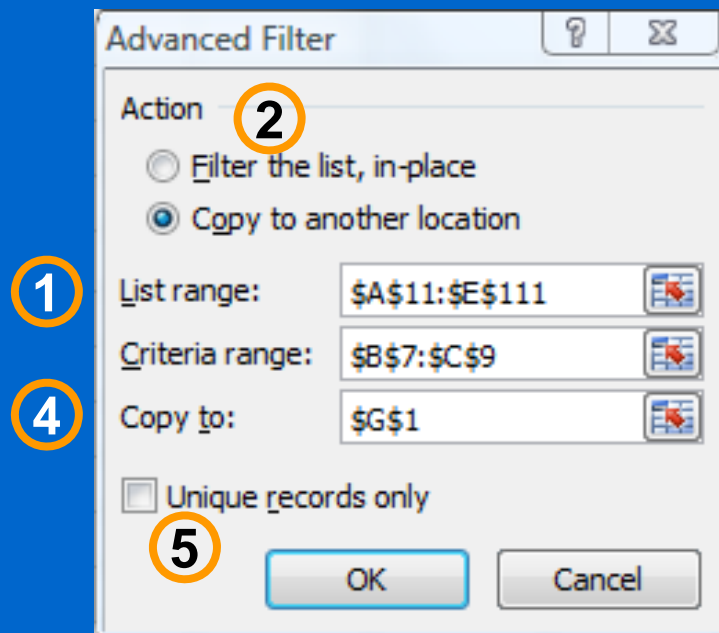
Filtering Using an Advanced Filter 1/5

- Let's say you are interested in studying in one of the EMBA (business masters degree) programs

- You want to choose an EMBA program offered in China because it is close

- For programs not offered in China you will still be happy to take them *if* your salary will double after finishing the program

- You can use an advanced filter to find the programs which are interesting to you

Filtering Using an Advanced Filter 2/5

- Using VBA code, you can use the *AdvancedFilter* method to create the advanced filter

- The parameters of the method are the same as the inputs to the advanced filter window in Excel

① *Range* .AdvancedFilter(*Action* , _ ②

CriteriaRange , _ ③

CopyToRange , _ ④

Unique) ⑤

Filtering Using an Advanced Filter 3/5

- Here are the criteria:
  - The programs are offered in China, OR
  - The programs have an average of 100% increase in salary

- The advanced filter criteria needs to be set up like this:

Filter data with the country column containing the text 'China'

Country	Salary Increase (%)
China	
	>100

The salary increase column is bigger than 100

Setting Up the Criteria

Country	Salary Increase (%)
China	
	>100

- You could set up the criteria manually (type the data into the Excel cells) or do that via VBA, like this:

Let's say we put the criteria starting from cell B7

```
Range("B7") = "Country"
Range("C7") = "Salary Increase (%)"
Range("B8") = "*China*"
Range("C9") = ">100"
```

- In the examples given on the course web site, we use the 'manual' approach

Filtering Using an Advanced Filter 4/5

- Here is the VBA code to set up the advanced filter:

```
Range("A11:E111") .AdvancedFilter _
    Action:=xlFilterCopy , _
    CriteriaRange:=Range("B7:C9") , _
    CopyToRange:=Worksheets("Result").Range("A1")
```

The filtered result will be put in a separate location

The result is 'copied to' another worksheet (this is something you can't do unless you use VBA)

	A	B	C	D	E
6		Criteria:			
7		Country		Salary Increase (%)	
8		*China*			
9			>100		
10					
11	Rank	School Name	Country	Programme Name	Salary Increase (%)
12	1	Kellogg / Hong Kong UST Business School	China	Kellogg-HKUST EMBA	68.8
13	2	Columbia/London Business School	U.S.A. / U.K.	EMBA Global Americas & Europe	108.6
14	3	Trium: HEC Paris / LSE / New York University: Stern	France / U.K. / U.S.A.	Trium EMBA	70.6
15	4	Insead	France / Singapore / U.A.E.	Insead Gemba	74.8
16	5	University of Chicago: Booth	U.S.A. / U.K. / Singapore	EMBA	82.9

Filtering Using an Advanced Filter 5/5

- Here is the result, shown in the 'Result' worksheet, after running the VBA code:

	A	B	C	D	E
1	Rank	School Name	Country	Programme Name	Salary Increase (%)
2	1	Kellogg / Hong Kong UST Business School	China	Kellogg-HKUST EMBA	68.8
3	2	Columbia/London Business School	U.S.A. / U.K.	EMBA Global Americas & Europe	108.6
4	7	IE Business School	Spain	EMBA	144.0
5	10	Chinese University of Hong Kong	China	EMBA	64.4
6	10	City University: Cass	U.K.	EMBA	100.2
7	18	Washington University: Olin	U.S.A. / China	Washington-Fudan EMBA	55.6
8	18	Ceibs	China	International EMBA	81.3
9	22	OneMBA: CUHK/RSM/UNC/FGV São Paulo/Egade	China / Netherlands / U.S.A. / Brazil / Mexico	OneMBA	54.3
10	28	Arizona State University: Carey	China	Carey / SNAI EMBA	63.3
11	29	University of Western Ontario: Ivey	Canada / China	EMBA	69.7
12	39	Tongji University/ENPC	China	Shanghai International MBA (Simba)	78.0
13	84	Euromed Management	France / China	World Med Part-time MBA	54.4
32					

Filtering Using Advanced Filter | Result

- One interesting thing not shown in the data is the cost; the HKUST EMBA program costs HK$1,165,000 now!!