

Databases 2 - Retrieving information

Lecture 19 - COMPSCI111/111G SS 2016

Today's lecture

- ▶ Recap of yesterday's lecture
- ▶ Using Queries to retrieve information from database
- ▶ Using Reports to retrieve information from a database

Recap

- ▶ Databases can use the relational model, where relationships exist between entities
- ▶ Relationships require tables, primary key and foreign key. Referential integrity is an important concept
- ▶ Looked at how to create tables, insert fields and data and create a relationship

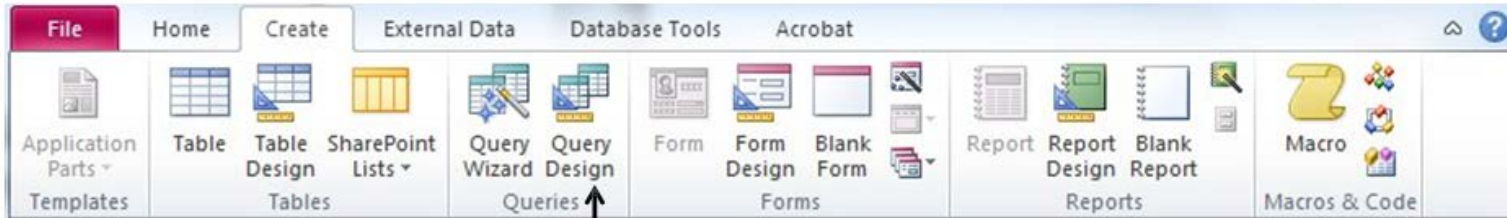
Aspects of a database

- ▶ Before we can create our database, we need to decide how to:
 1. Organize data in our database
 - ▶ Models, tables, relationships
 2. Enter data in our database
 - ▶ Datasheet view
 3. Retrieve data from our database
 4. Present the retrieved data to the user

Retrieving data - queries

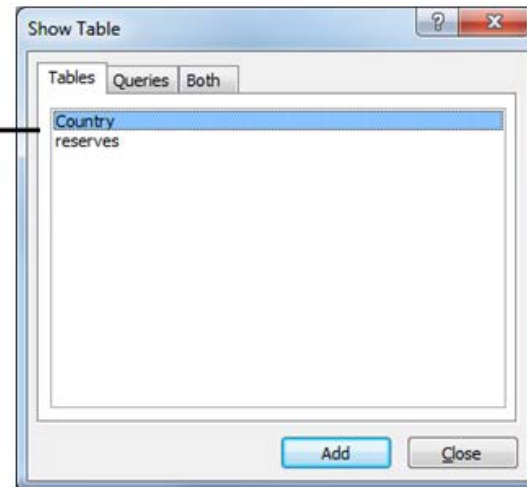
- ▶ Queries allow you to retrieve certain records from your database
- ▶ Two kinds of queries in Access:
 - ▶ Query by example (QBE):
 - ▶ Visual way of designing queries
 - ▶ Access converts your QBE queries into SQL
 - ▶ SQL (Structured Query Language):
 - ▶ Uses commands to retrieve data from databases
 - ▶ Developed by IBM in the late 1970's
- ▶ Access creates a table containing the results of the query

QBE queries



1. Select Query Design
from the Create Menu

2. Select tables to
use in query



QBE queries

The diagram shows a 1-to-many relationship between the **Country** table and the **reserves** table. The **Country** table has fields: Country (primary key), Land Area, Water Area, Coastline, and Forest Percent. The **reserves** table has fields: ID (primary key), Reserve, Country, Size_Km2, and Size_Acres.

Field:	Country	Reserve	Land Area	Water Area
Table:	Country	reserves	Country	Country
Sort:				
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:	"New Zealand"		>100000	
or:				

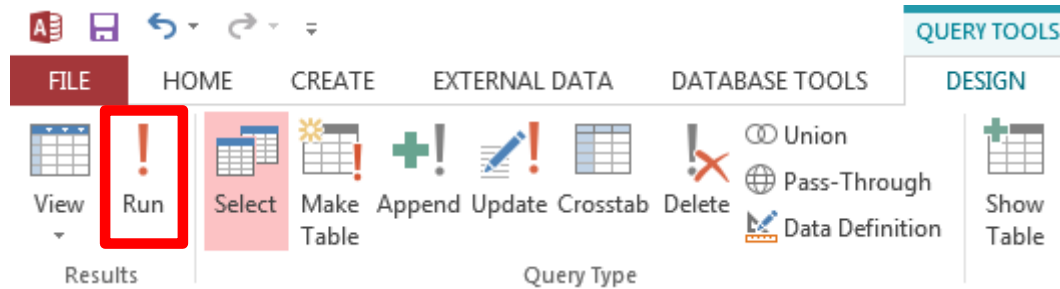
QBE grid

Choosing fields

Adding criteria to the field

QBE queries

**'Run'
button**



**Query
results**

The screenshot shows a window titled 'Query1' displaying the results of a query. The table has four columns: 'Country', 'Reserve', 'Land Area', and 'Water Area'. The data is as follows:

Country	Reserve	Land Area	Water Area
New Zealand	Arthurs Pass National Park	268,670	10
New Zealand	Mount Aspiring National Park	268,670	10
New Zealand	South Taupo Wetland	268,670	10
*			

The status bar at the bottom indicates 'Record: 4 of 4' and 'No Filter'.

QBE queries - sorting

- ▶ Results from QBE queries can be sorted in ascending and descending order

Country

- *
 - Country
 - Land Area
 - Water Area
 - Coastline
 - Forest Percent

Field:	Country	Land Area
Table:	Country	Country
Sort:		Ascending
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:		
or:		



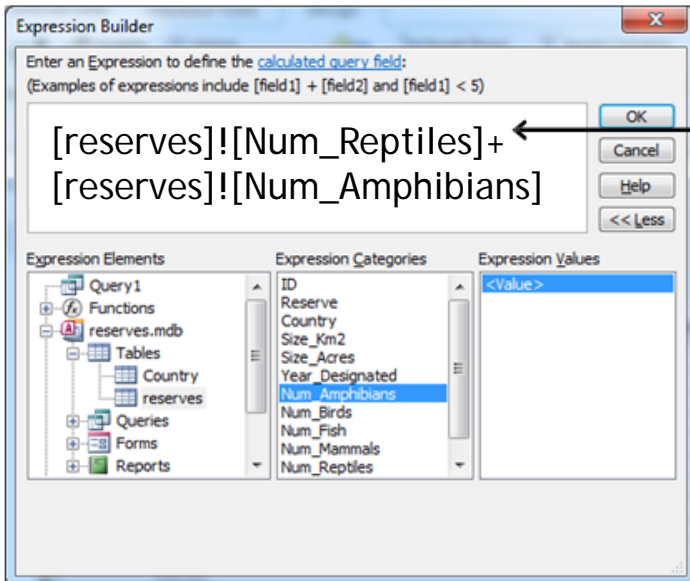
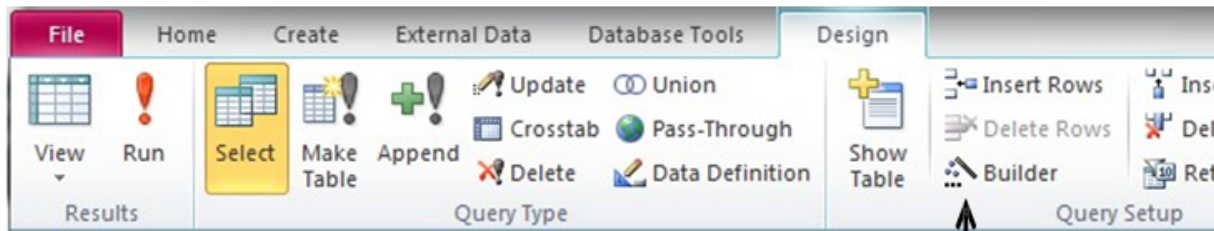
Query1

Country	Land Area
Australia	7,617,930
China	9,326,410
Japan	374,744
New Zealand	268,670
Panama	75,990
Singapore	638
Thailand	511,770
United States	9,158,960
*	

Record: 9 of 9

QBE queries - expressions

- Fields can be combined together to create an expression with the Expression Builder



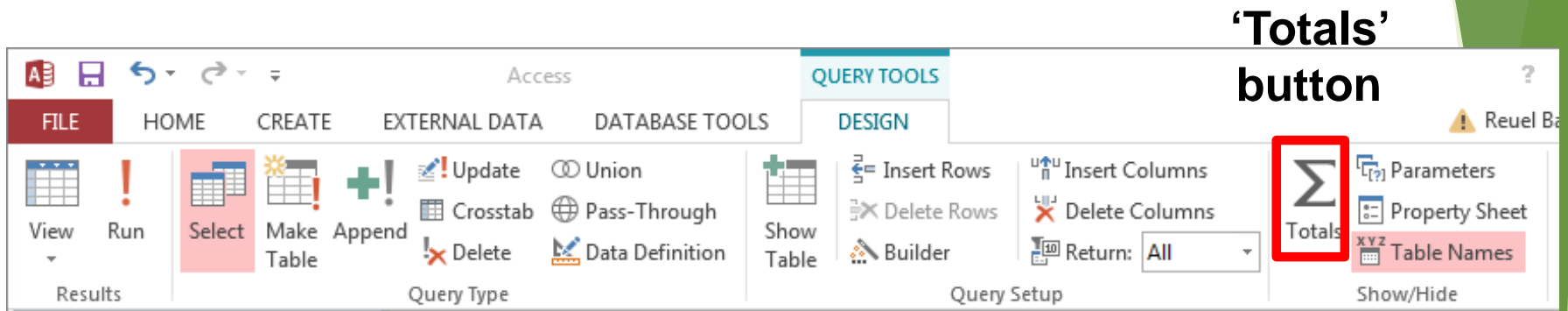
We can use the Access Expression Builder to create derived fields that are calculated when queries are made.

Results

Reserve	Country	Expr1
Azumayama Forest	Japan	22
Mount Hakusan	Japan	19

QBE queries

- ▶ A Totals QBE query allows us to group data using functions such as Min, Max, Avg, Sum etc.



**'Totals'
button**

Field:		
Table:		
Total:		
Sort:		
Show:	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:		
or:		

QBE queries

Country

*

Country

Land Area

Water Area

Coastline

Forest Percent

Field:	Land Area	Land Area	Land Area
Table:	Country	Country	Country
Total:	Avg	Min	Max
Sort:			
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:			
or:			

Query1

AvgOfLand Area	MinOfLand Area	MaxOfLand Area
3416889	638	932641

Record: 1 of 1

No Filter

Search

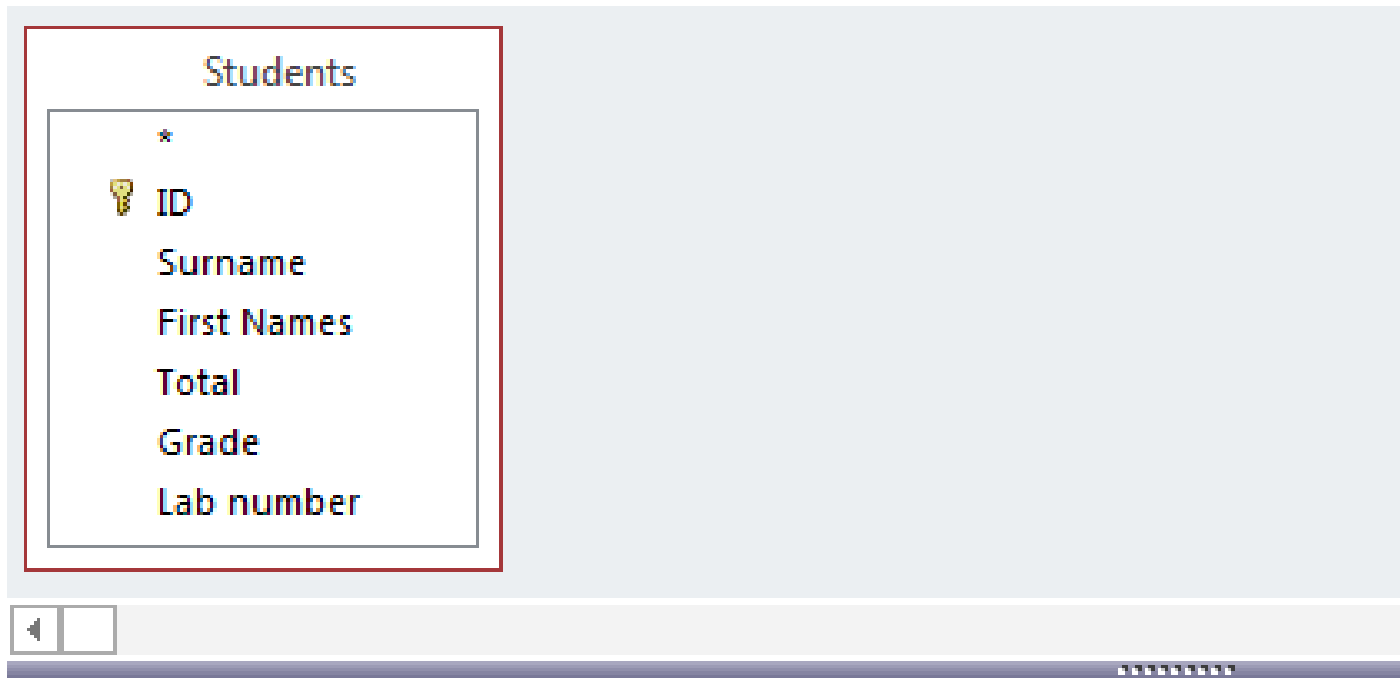
QBE Exercise

- ▶ Complete this QBE grid so that it will return the first names, surname and grade (in that order) of all students who have received an A+. Sort the results by surname in alphabetical order

The screenshot shows a QBE interface. At the top, a table named "Students" is displayed with the following fields: ID (marked with a key icon), Surname, First Names, Total, and Grade. The table is currently empty. Below the table, a query grid is visible with the following structure:

Field:			
Table:			
Sort:			
Show:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Criteria:			
or:			

QBE Exercise

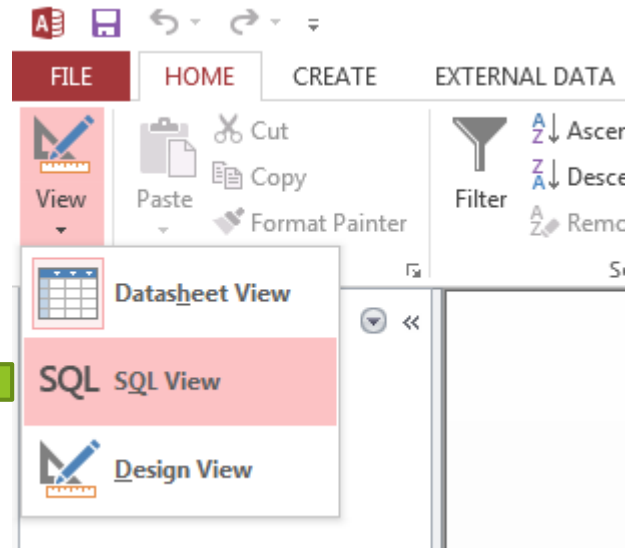


Field:	Table:	Sort:	Show:	Criteria:
First Names	Students		<input checked="" type="checkbox"/>	
Surname	Students	Ascending	<input checked="" type="checkbox"/>	
Grade	Students		<input checked="" type="checkbox"/>	"A+"
Lab number				

SQL introduction

- ▶ **Structured Query Language (SQL)** was developed by IBM in the 1970s and is commonly used today
- ▶ It uses text commands to perform operations on databases, such as inserting and removing records and running queries

QBE queries




```
Query1
SELECT Country.Country, reserves.Reserve, Country.[Land Area], Country.[Water Area]
FROM Country INNER JOIN reserves ON Country.Country = reserves.Country
WHERE (((Country.Country)="New Zealand") AND ((Country.[Land Area])>100000));
```


SQL queries

- ▶ Four clauses that can be part of a simple SQL query:
 - ▶ SELECT
 - ▶ FROM
 - ▶ WHERE
 - ▶ ORDER BY
- ▶ Construct a SQL query that will return the first names, surname, and grade (in that order) of all students who have received an A+. Sort the results by surname in alphabetical order


SQL queries - SELECT

- ▶ Selects fields from the tables that we want to display in our results table
- ▶ Syntax:
`SELECT [comma separated list]`
- ▶ `SELECT [First Names], Surname, Grade`
 - ▶ Note the square brackets around 'First Names' needed because of the space

Students	
*	
	ID
	Surname
	First Names
	Total
	Grade
	Lab number

SQL queries - FROM

- ▶ Specifies the table which holds the field(s) listed in the SELECT clause
- ▶ Syntax
FROM [comma separated list]
- ▶ SELECT [First Names], Surname, Grade
FROM Students


Students	
*	
	ID
	Surname
	First Names
	Total
	Grade
	Lab number

SQL queries - WHERE

- ▶ Optional; used to provide criteria that limit the records displayed in the results table
- ▶ Syntax
`WHERE [criteria], [criteria], ...`
- ▶ There are a range of criteria we can use:
 - ▶ Comparisons (=, >, <, <=, >=, <>)
 - ▶ e.g., `WHERE [Land Area] < 50000`
 - ▶ BETWEEN ... AND ...
 - ▶ e.g., `WHERE Price BETWEEN 10 AND 20`
 - ▶ LIKE (some pattern)
 - ▶ e.g., `WHERE [City] LIKE 'San *'`
 - ▶ AND, NOT, OR (combined with any of above)
 - ▶ e.g., `WHERE Country = 'New Zealand' AND City = 'Auckland'`
 - ▶ IS NULL, IS NOT NULL
 - ▶ e.g., `WHERE [Postal Code] IS NOT NULL`

SQL queries - WHERE

```
▶ SELECT [First Names], Surname, Grade
FROM Students
WHERE Grade = 'A+'
```

Students	
*	
	ID
	Surname
	First Names
	Total
	Grade
	Lab number

SQL queries - ORDER BY


- ▶ Optional; allows us to sort our data in ascending or descending order

- ▶ Syntax:

```
ORDER BY [name of field] [ASC/DESC]
```

- ▶

```
SELECT [First Names], Surname, Grade  
FROM Students  
WHERE Grade = 'A+'  
ORDER BY Surname ASC
```

Students	
*	
	ID
	Surname
	First Names
	Total
	Grade
	Lab number

SQL queries

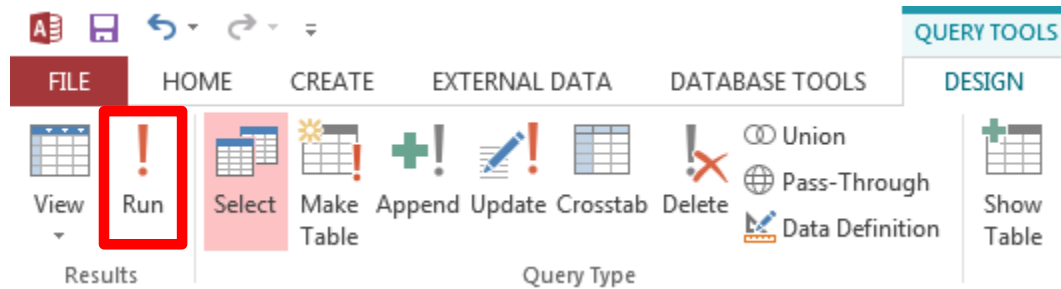
- ▶ You need to ensure that you put a semi-colon on the last clause of your SQL query:
- ▶

```
SELECT [First Names], Surname, Grade  
FROM Students  
WHERE Grade = 'A+'  
ORDER BY Surname ASC;
```

SQL queries

- ▶ We run a SQL query in the same way that we run a QBE query

**'Run'
button**

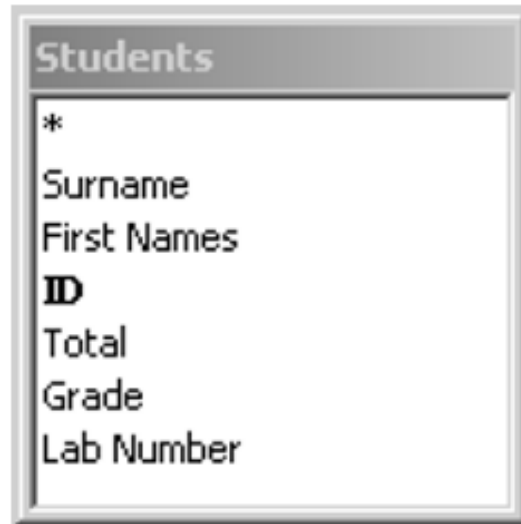


The image shows a Microsoft Access query window titled 'Query1'. The window displays a table with three columns: 'First Names', 'Surname', and 'Grade'. The first row contains the data: 'Tom', 'Bloggs', and 'A+'. The second row contains an asterisk (*). The status bar at the bottom indicates 'Record: 1 of 1' and 'No Filter'.

First Names	Surname	Grade
Tom	Bloggs	A+
*		

SQL exercise

- ▶ Write an SQL command that will *only* display the first name, surname and grade of students whose Total mark was greater than 70. Order the results table by ID number in ascending order

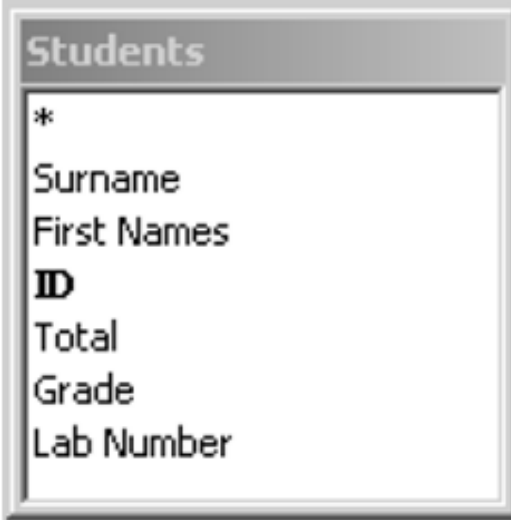


The image shows a screenshot of a database table named "Students". The table has the following columns:

Students
*
Surname
First Names
ID
Total
Grade
Lab Number

SQL exercise

▶ `SELECT [First Names], Surname, Grade
FROM Students
WHERE Total > 70
ORDER BY ID ASC;`



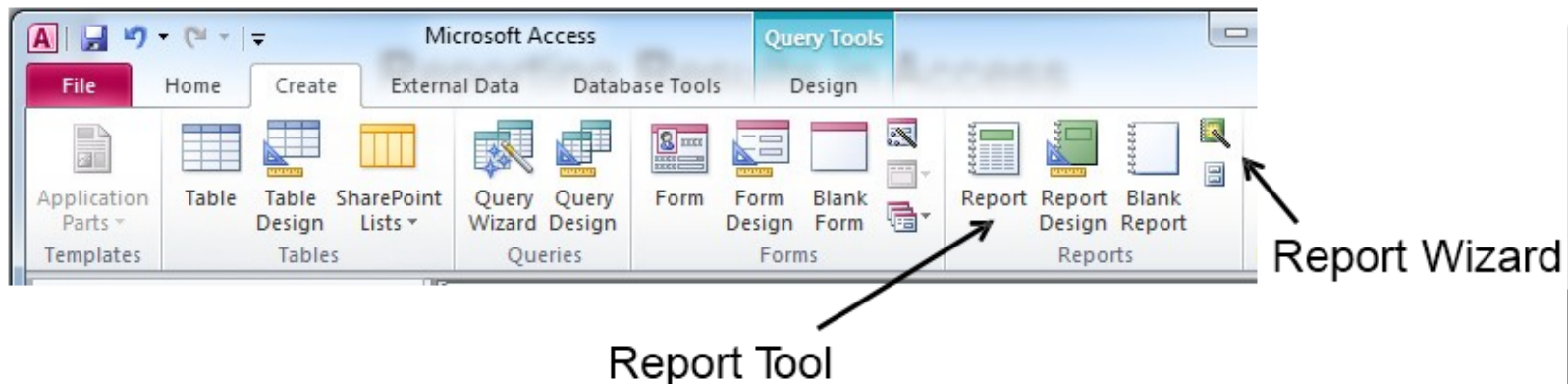
Students
*
Surname
First Names
ID
Total
Grade
Lab Number

Aspects of a database

- ▶ Before we can create our database, we need to decide how to:
 1. **Organize data in our database**
 - ▶ Models, tables, relationships
 2. **Enter data in our database**
 - ▶ Datasheet view
 3. **Retrieve data from our database**
 - ▶ QBE and SQL queries
 4. **Present the retrieved data to the user**

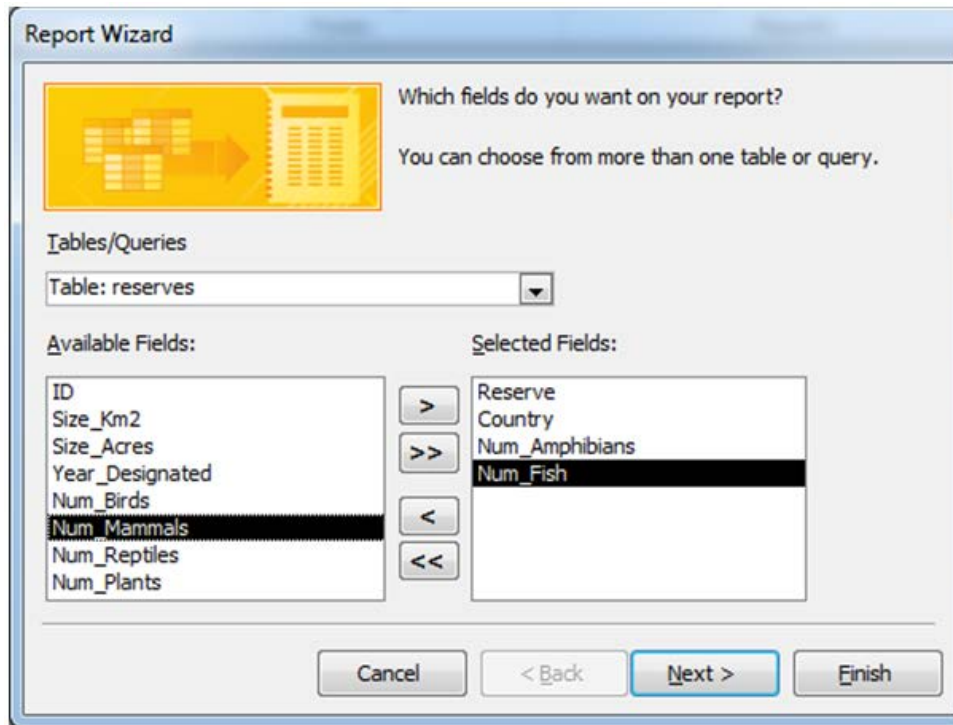
Reports

- ▶ Reports allow you to present the contents of a table, query etc. in a nicely formatted table
- ▶ There are two ways of creating Reports:
 - ▶ Report Tool (show entire table, some formatting control)
 - ▶ Report Wizard (table/field selection, grouping, sorting)



The Report Wizard

- ▶ Select the tables and fields you want to display in your report



Report Wizard

Which fields do you want on your report?
You can choose from more than one table or query.

Tables/Queries
Table: reserves

Available Fields:

- ID
- Size_Km2
- Size_Acres
- Year_Designated
- Num_Birds
- Num_Mammals
- Num_Reptiles
- Num_Plants

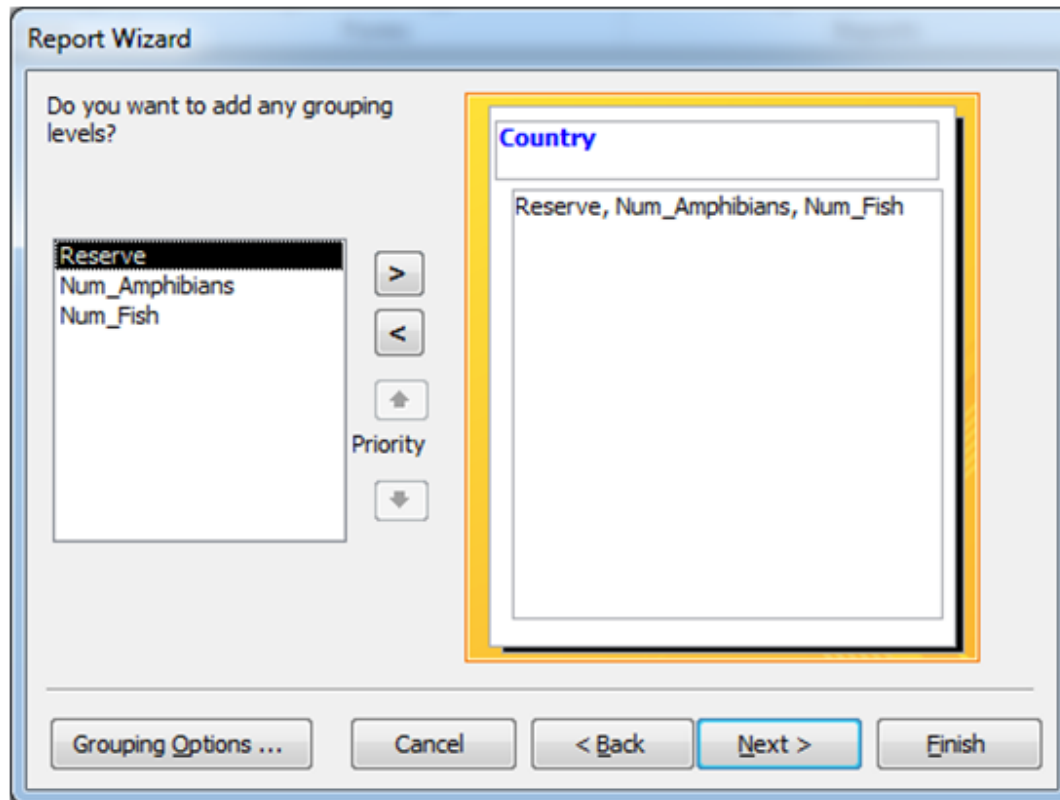
Selected Fields:

- Reserve
- Country
- Num_Amphibians
- Num_Fish

Buttons: Cancel, < Back, Next >, Finish

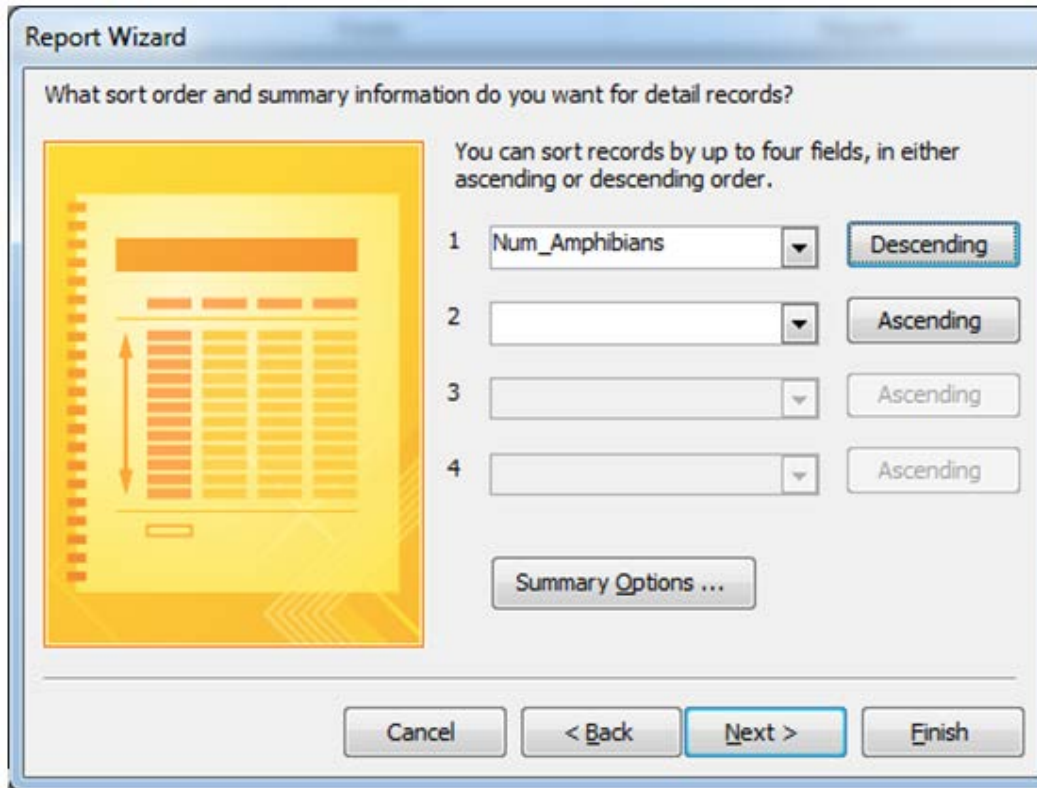
The Report Wizard

- ▶ You can group records in the report using particular fields



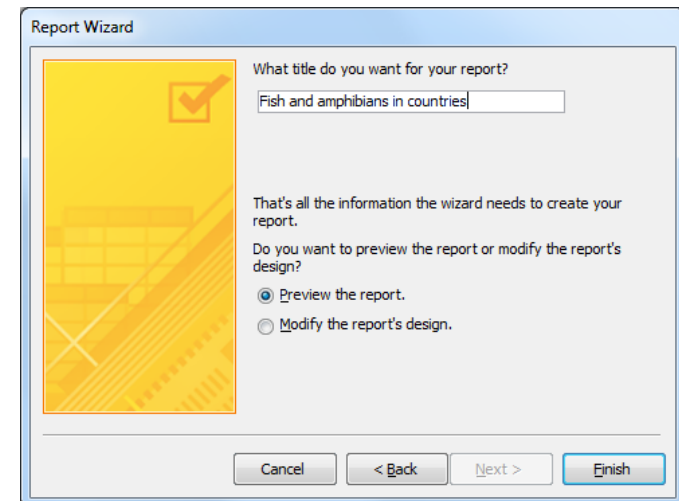
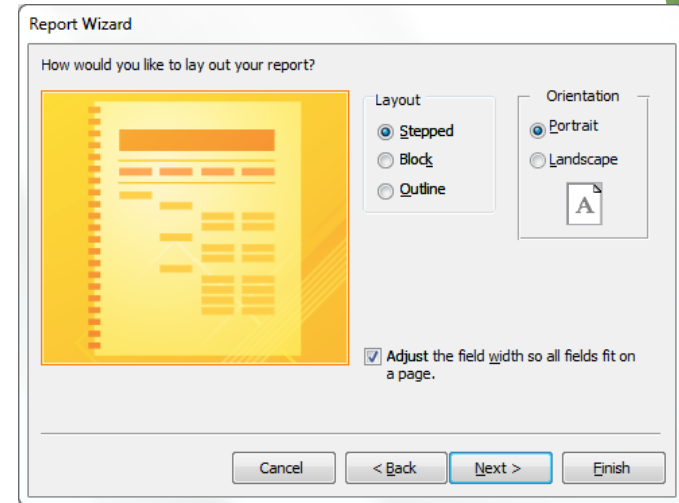
The Report Wizard

- ▶ You can sort records in the report by one or more fields



The Report Wizard

- ▶ You can set certain aspects of your report's formatting in the Wizard
- ▶ The final step involves giving the report a name and clicking on 'Finish'



The Report Wizard

- ▶ The finished report, ready for printing
- ▶ You can continue to modify the report's formatting at this point

Fish and amphibians in countries' reserves		
Country	Num_Amphibians Reserve	Num_Fish
Australia		
	27 Kakadu National Park	0
	23 Girraween National Park	3
	21 Shoalwater and Corio Bays Area Ramsar Site	0
	12 Fitzgerald River National Park	3
	11 Grampians National Park	12
	11 Purnululu National Park	20
	9 Bookmark Biosphere Reserve	6
	9 Kosciusko National Park	11
	9 Wilson's Promontory National Park	31
	8 Prince Regent River Nature Reserve	20
	7 Coorong National Park	0
	6 Flinders Chase National Park	0
	6 Lavinia Nature Reserve	8
	6 Hattah-Kulkyne NP and Murray-Kulkyne Park	16
	5 Uluru - Kata Tjuta National Par	0
	5 Yathong Nature Reserve	0

Summary

1. **Organize data in our database**
 - ▶ Models, tables, relationships
2. **Enter data in our database**
 - ▶ Datasheet view
3. **Retrieve data from our database**
 - ▶ QBE and SQL queries
4. **Present the retrieved data to the user**
 - ▶ Report Wizard