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

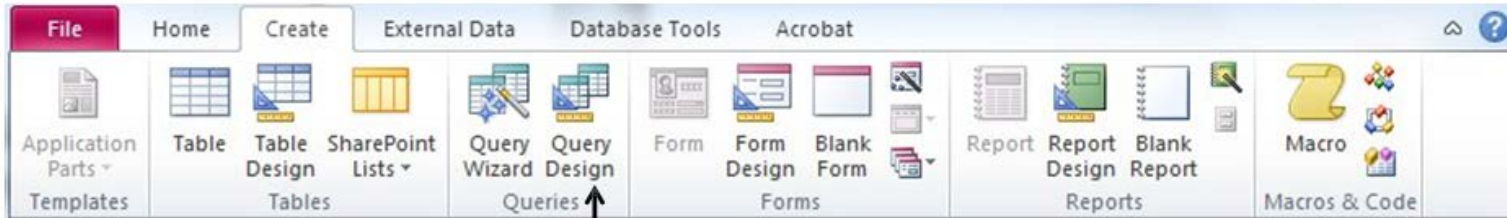- ▶ Looked at how to create tables, insert fields and data and create a relationship

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
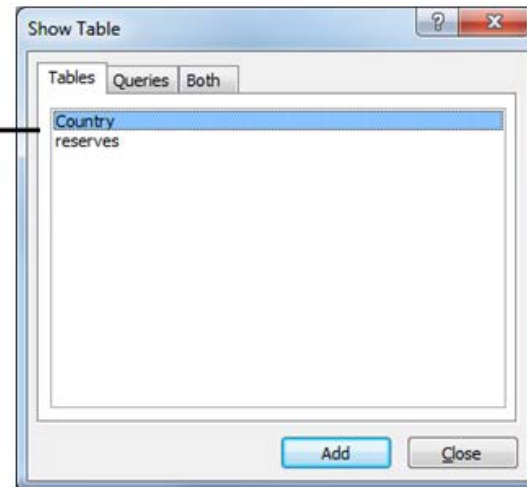4. **Present** the retrieved data to the user

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

QBE grid

Choosing fields

Adding criteria to the field

QBE queries

'Run' button

Query results

QBE queries - sorting

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

QBE queries - expressions

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

Expression Builder

Enter an Expression to define the calculated query field:
(Examples of expressions include [field1] + [field2] and [field1] < 5)

[reserves]![Num_Reptiles]+
[reserves]![Num_Amphibians]
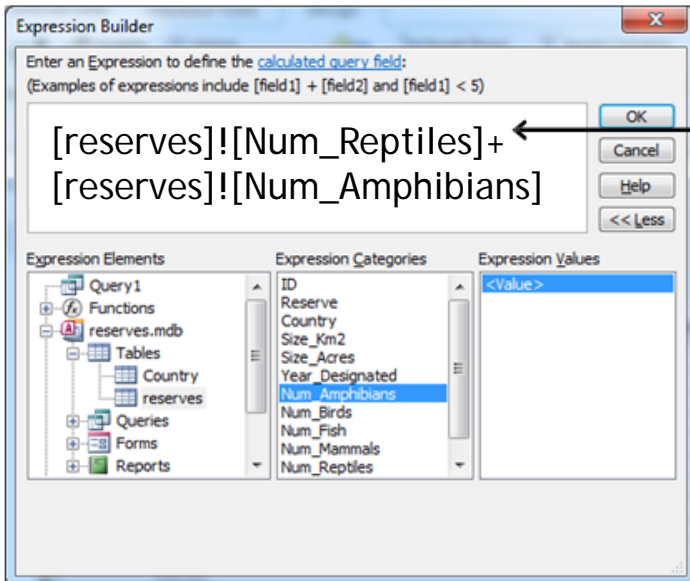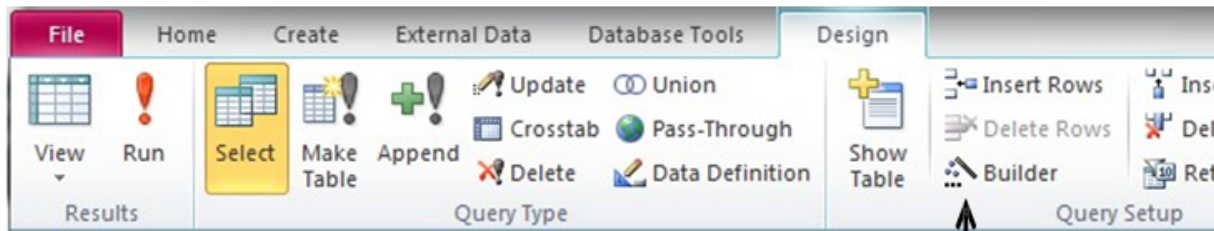
We can use the Access Expression Builder to create derived fields that are calculated when queries are made.
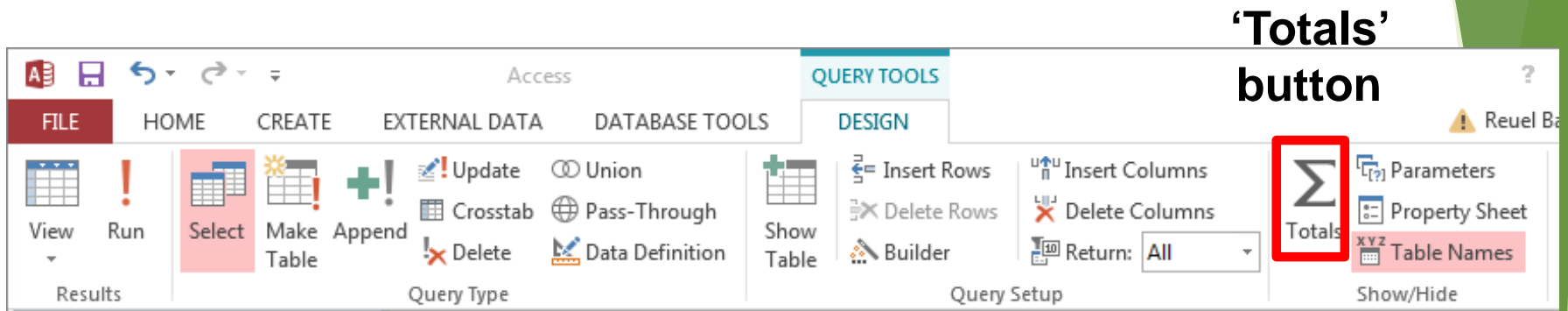
Results

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

QBE queries

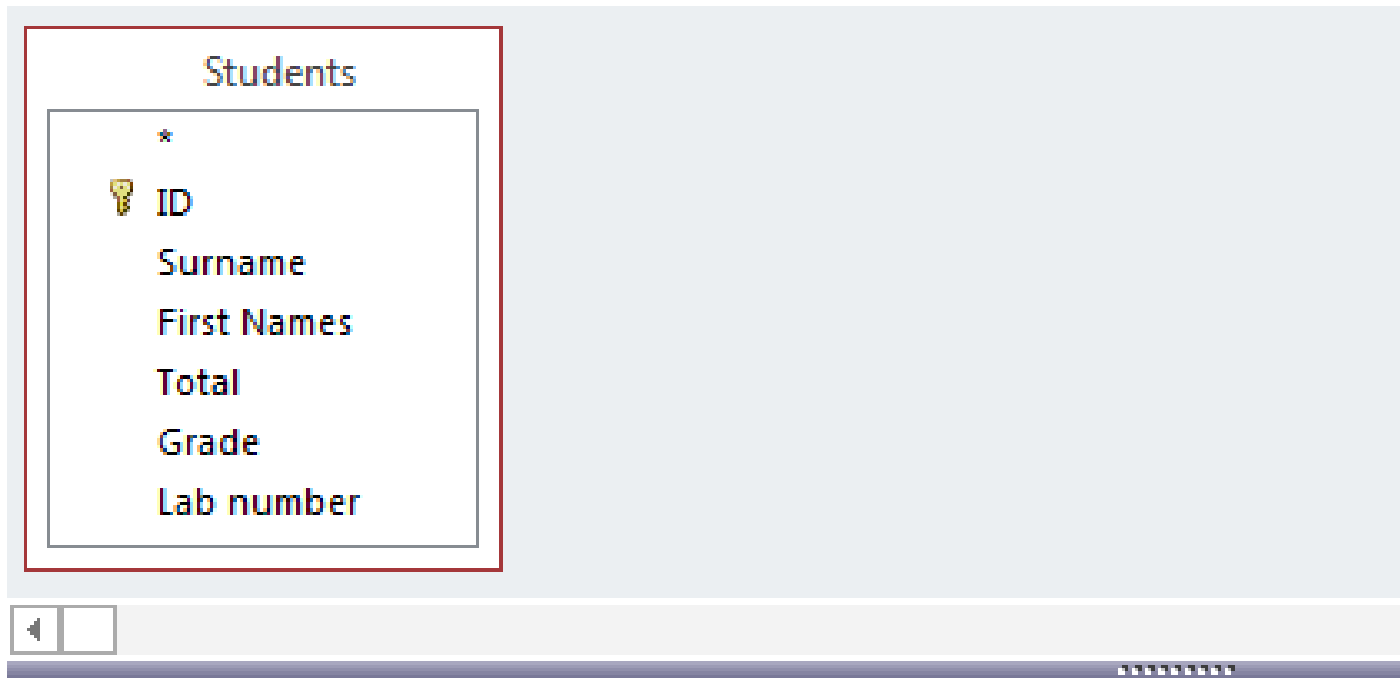# QBE Exercise

▶ 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

Students

*
🔑 ID
Surname
First Names
Total
Grade

Field:	▼		
Table:			
Sort:			
Show:	☐	☐	☐
Criteria:			
or:			

QBE Exercise

Field:	First Names	Surname	Grade	
Table:	Students	Students	Students	
Sort:		Ascending		
Show:	☑	☑	☑	
Criteria:			"A+"	
or:				

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

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;
```
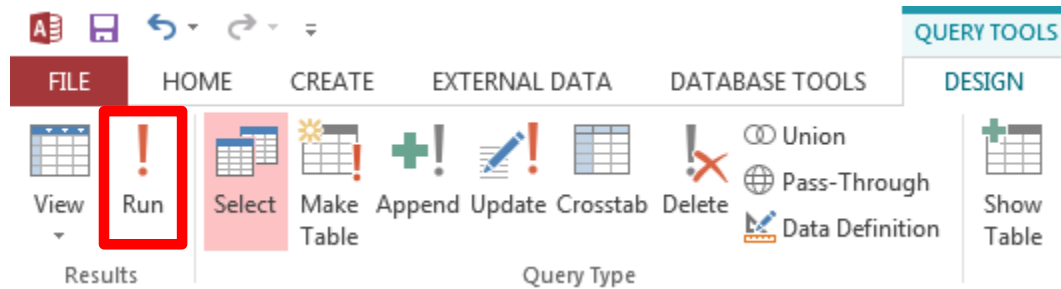
SQL queries

▶ We run a SQL query in the same way that we run a QBE query
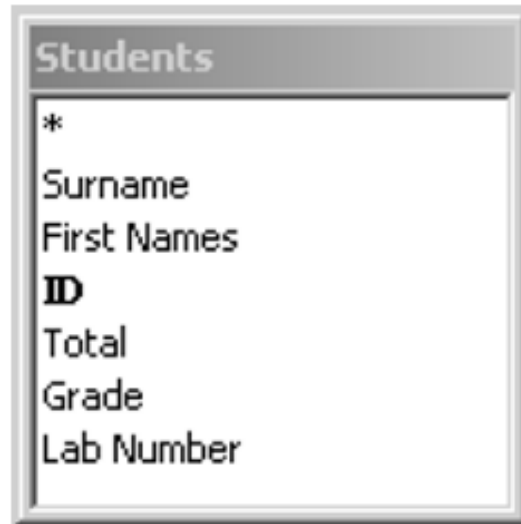
'Run' button

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

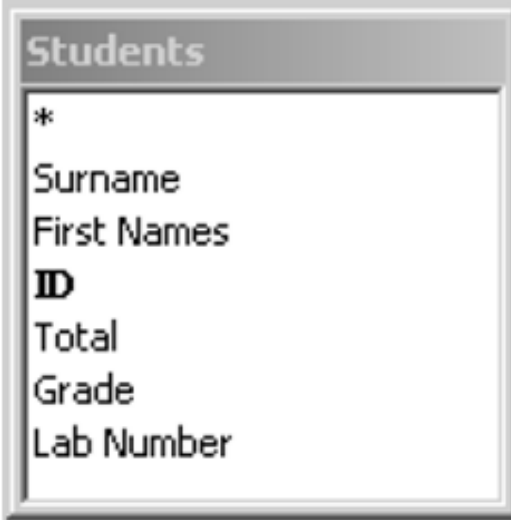**Students**

```
*
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
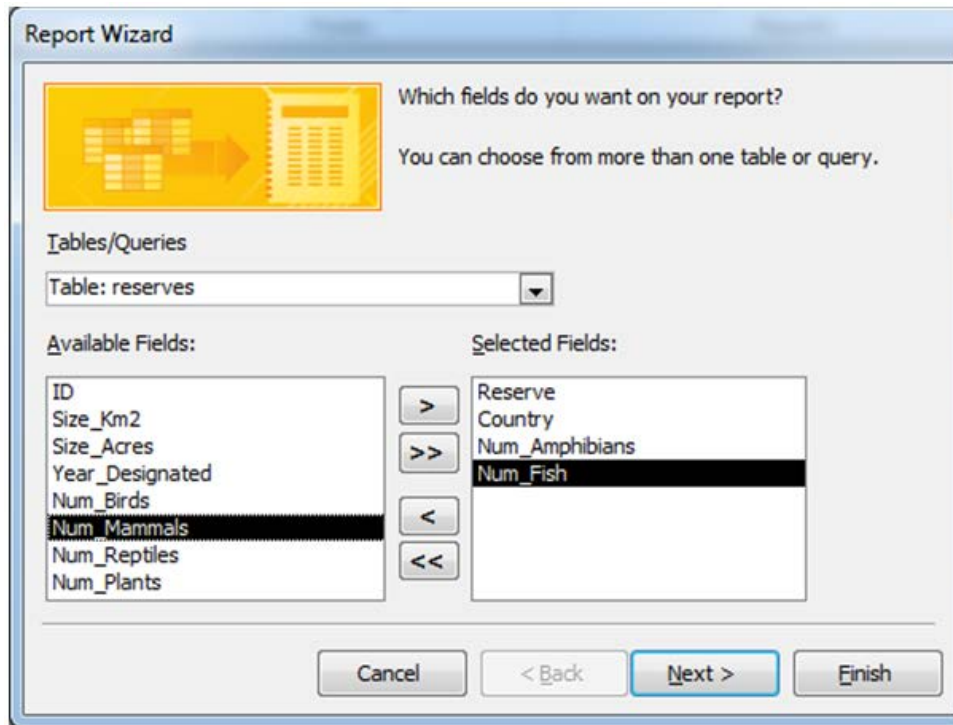 4. **Present** the retrieved data to the user

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)

Report Tool
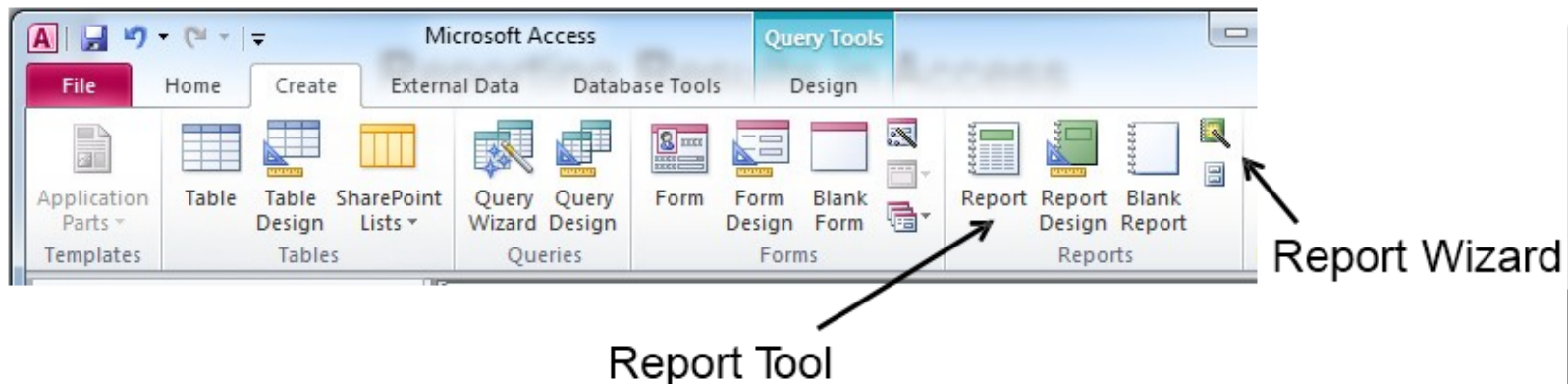
Report Wizard

The Report Wizard

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

The Report Wizard

▶ You can group records in the report using particular fields
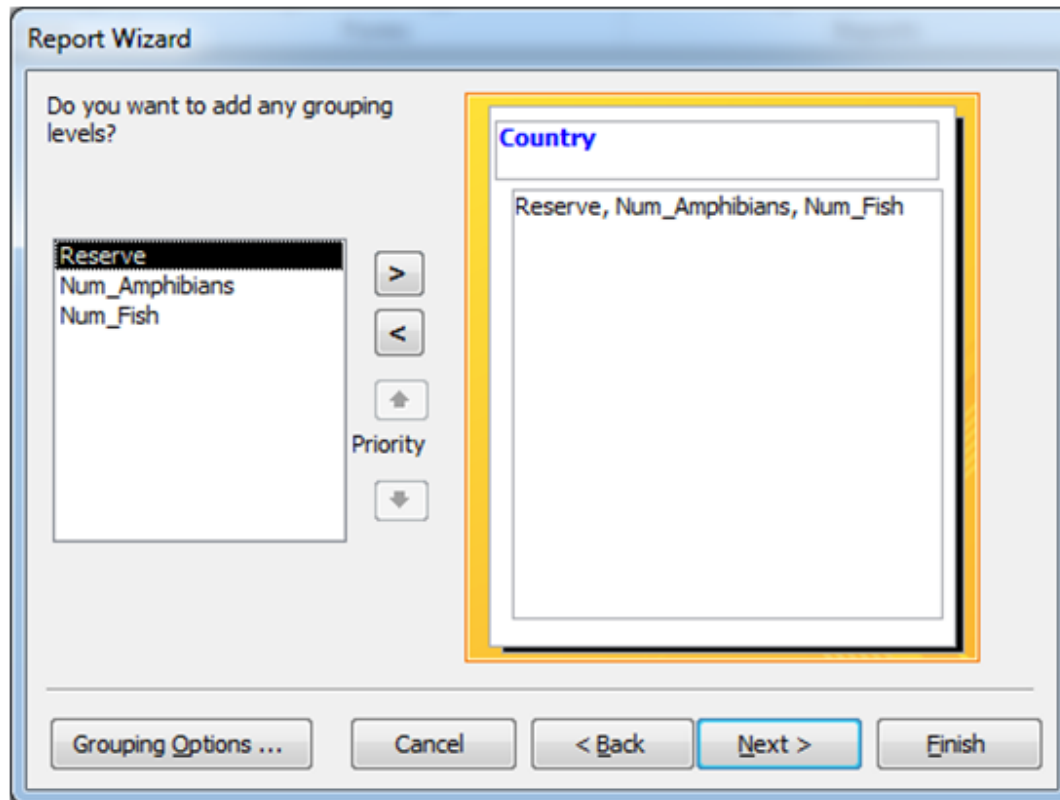
The Report Wizard

▶ 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
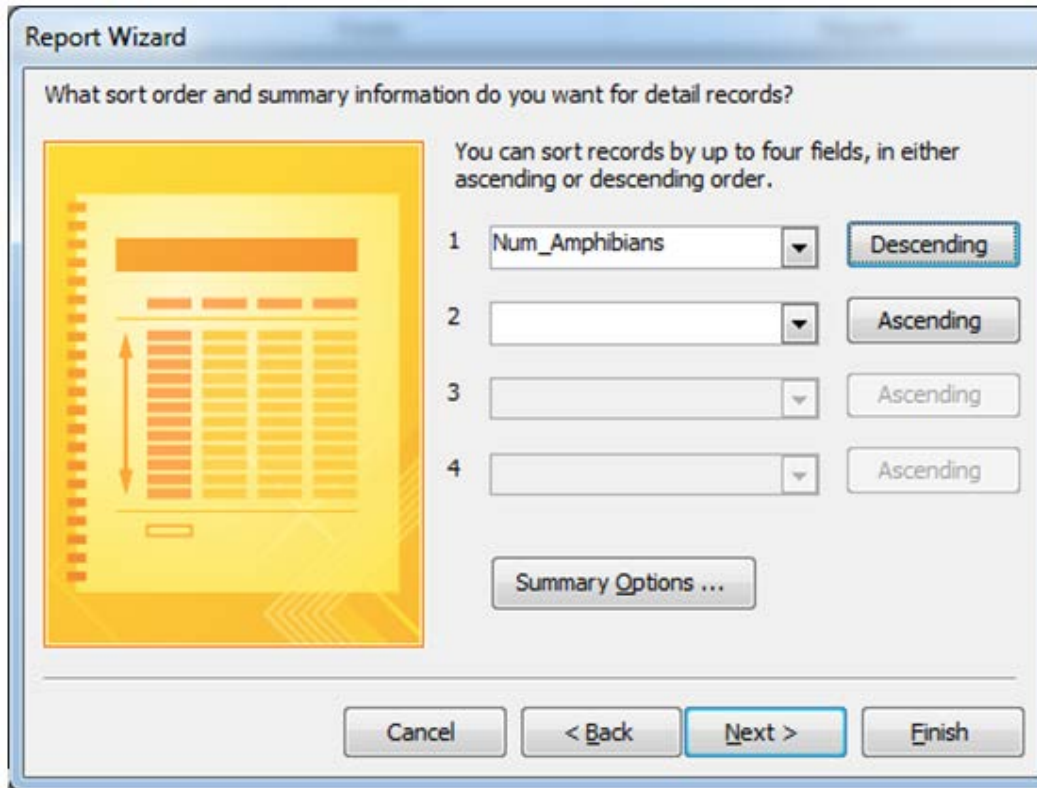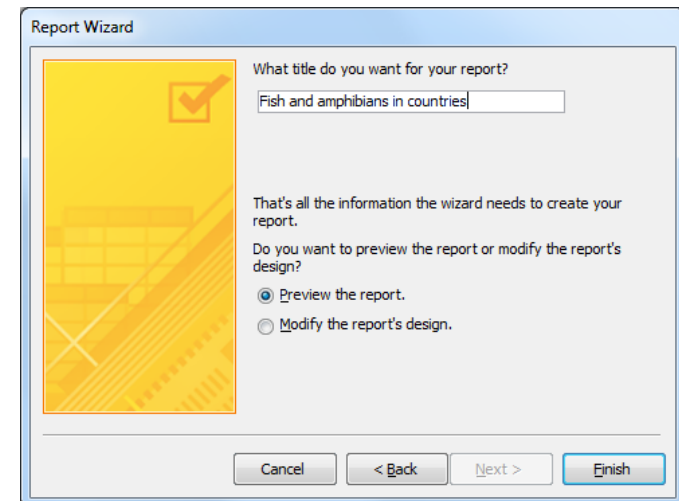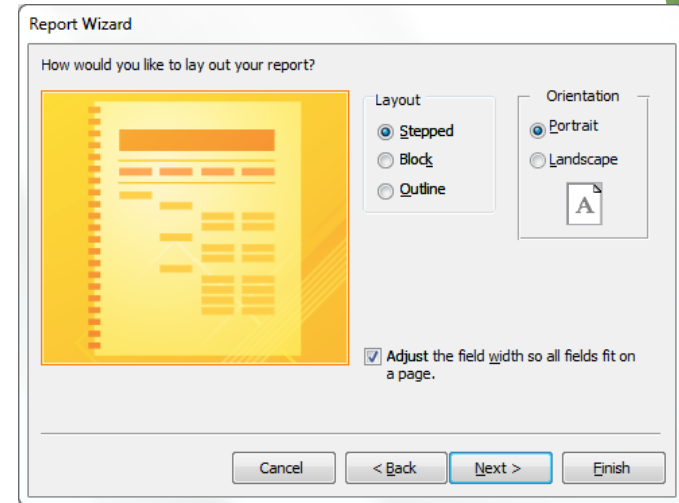
▶ The finished report, ready for printing

▶ 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	-02
	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