THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

Databases 2 – Retrieving information

Lecture 22 – COMPSCI111/111G SS 2018

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 helps to maintain consistency in our database
- Looked at how to create tables, insert fields and data and create a relationship

Enrolments

StudentID	Code	Date enrolled
5468975	COMPSCI101	01/01/2016
1258956	COMPSCI101	15/12/2015
1258956	COMPSCI107	15/12/2015

Students

ID	Name	Date of birth
5468975	Joe Cameron	19/08/1992
1258956	Steve Smith	17/05/1995
6697826	Tom Bloggs	30/06/1965

Courses

Code	Title	Semester
COMPSCI111	Practical Computing	SS 2016
COMPSCI101	Programming	S1 2016
COMPSCI107	Advanced Computing	S1 2016

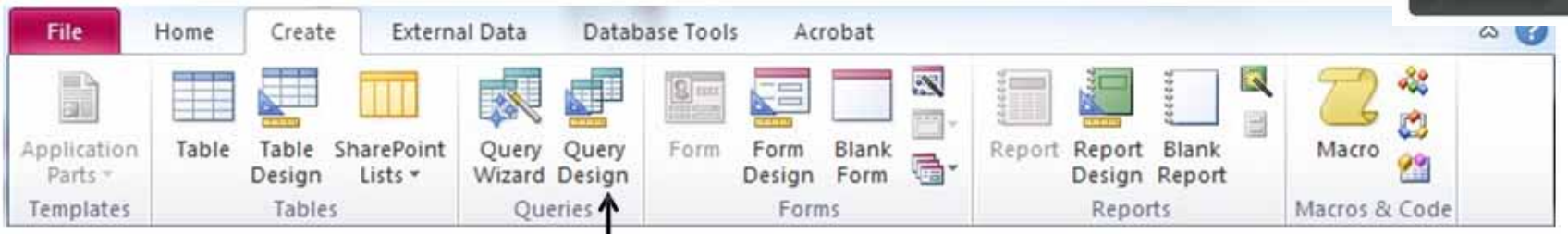
Aspects of a database

- 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

1. Retrieving data

- **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
- Access creates a table containing the results (if any) of the query

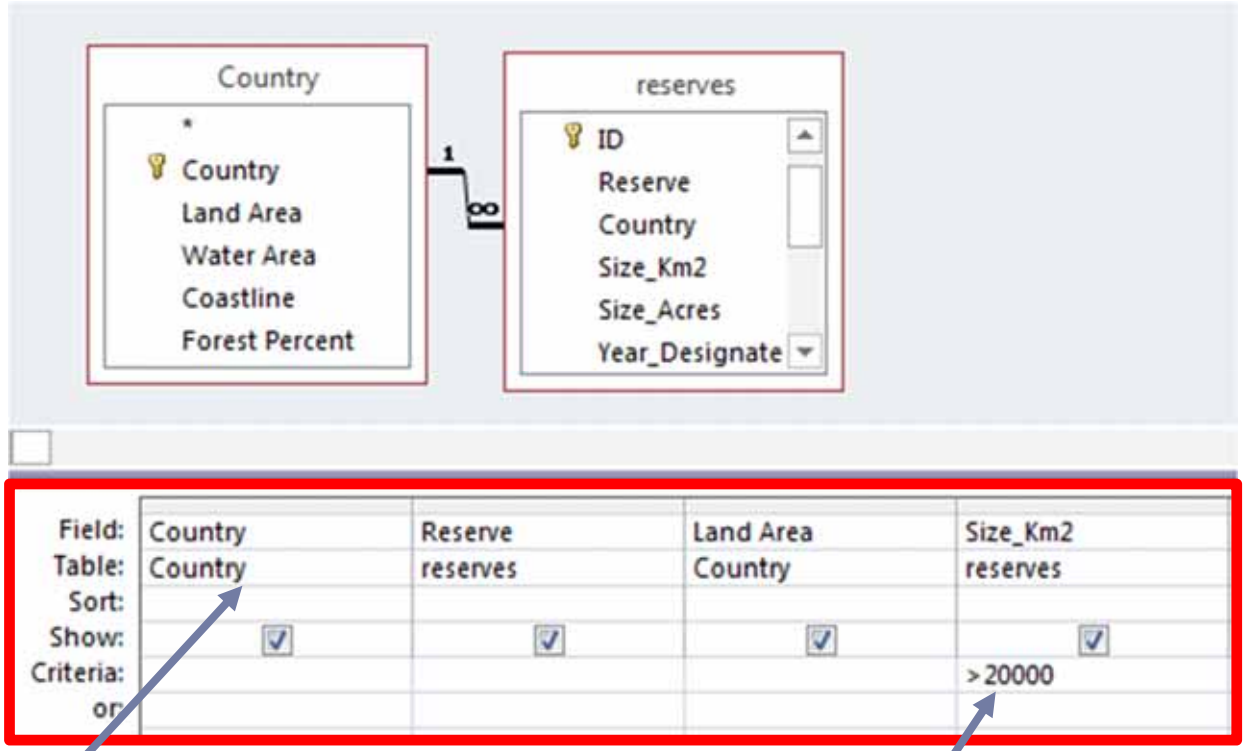
QBE queries



1. Select Query Design from the Create Menu

2. Select tables to use in query

QBE queries



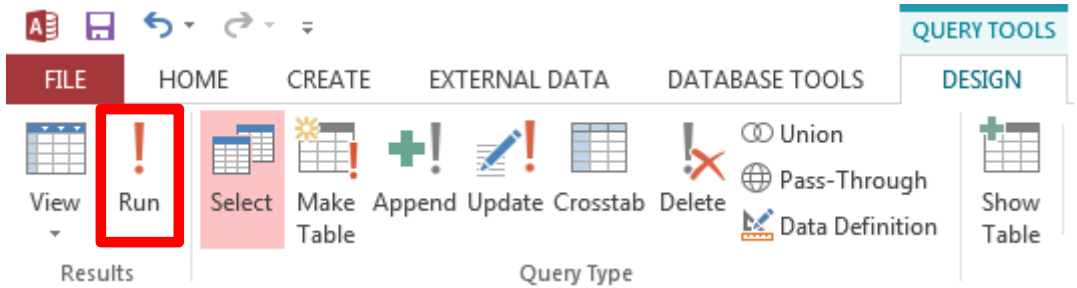
QBE grid

Choosing fields

Adding criteria to the field

QBE queries

'Run' button



Query results

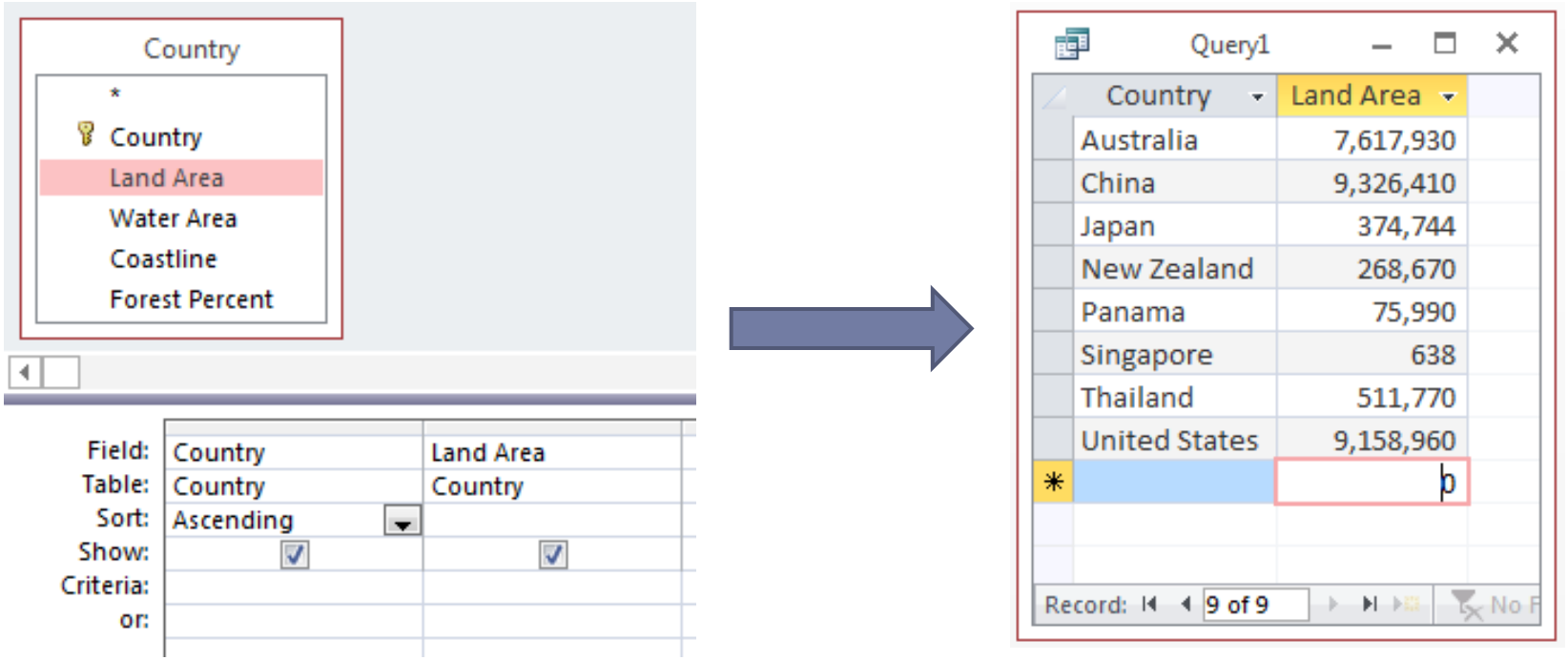
Query1

Country	Reserve	Land Area	Size_Km2
United States	Arctic National Wildlife Refuge, AK	9,158,960	78049.05
United States	Denali Biosphere Reserve, AK	9,158,960	24412.95
United States	Noatak Biosphere Reserve, AK	9,158,960	33427.76
United States	Noatak National Preserve, AK	9,158,960	26143.26
Australia	Unnamed Conservation Park of South Australia	7,617,930	21326
United States	Wrangell-St. Elias National Park and Preserve, A	9,158,960	33685.22

Record: 7 of 7 No Filter Search

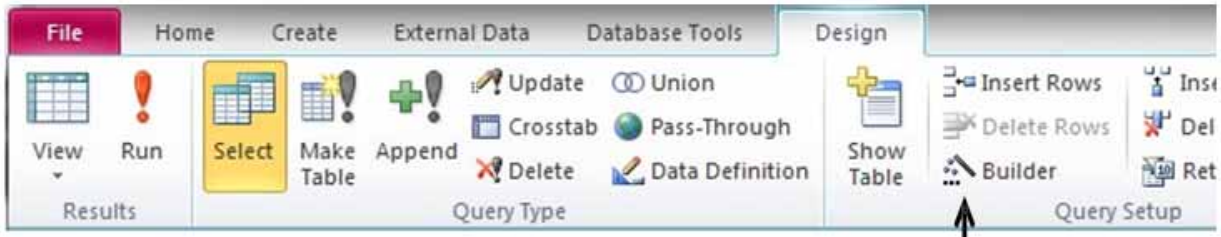
QBE queries - sorting

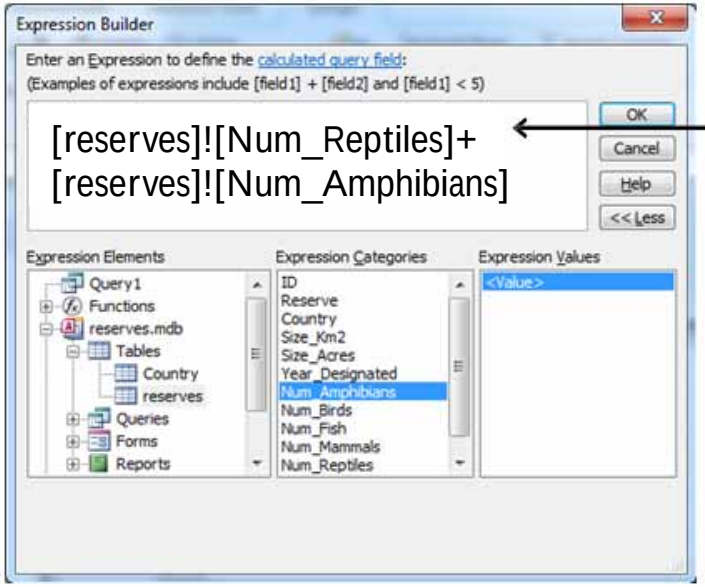
- Results from QBE queries can be sorted in ascending and descending order



QBE queries - expressions

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



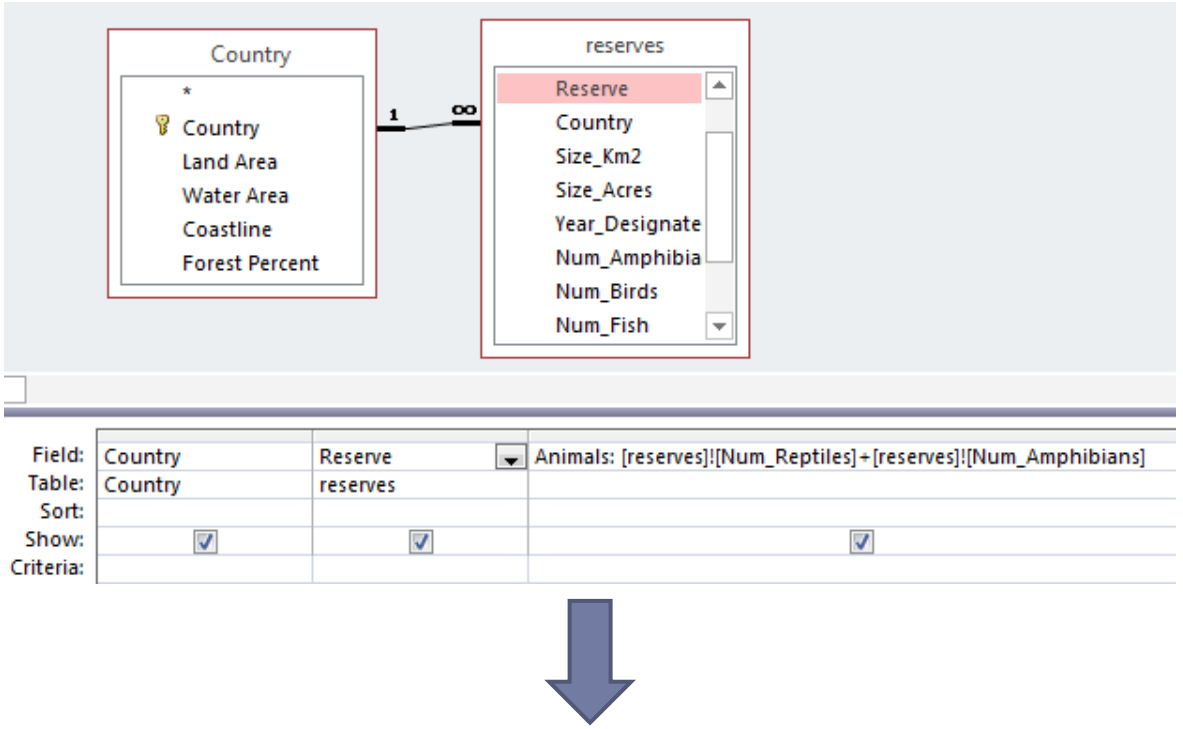


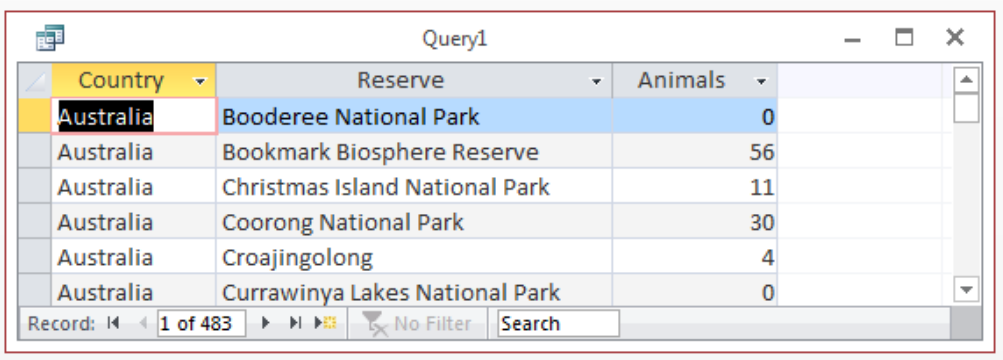
We can use the Access Expression Builder to create derived fields that are calculated when queries are made.

Results

Reserve	Country	Expr1
Azumayama Forest	Japan	22
Mount Hakusan	Japan	19

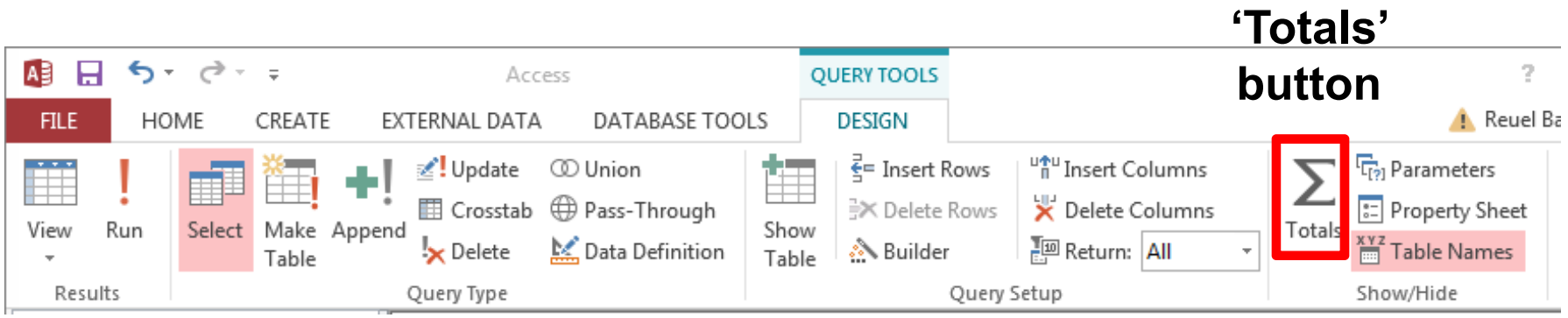
QBE queries - expressions

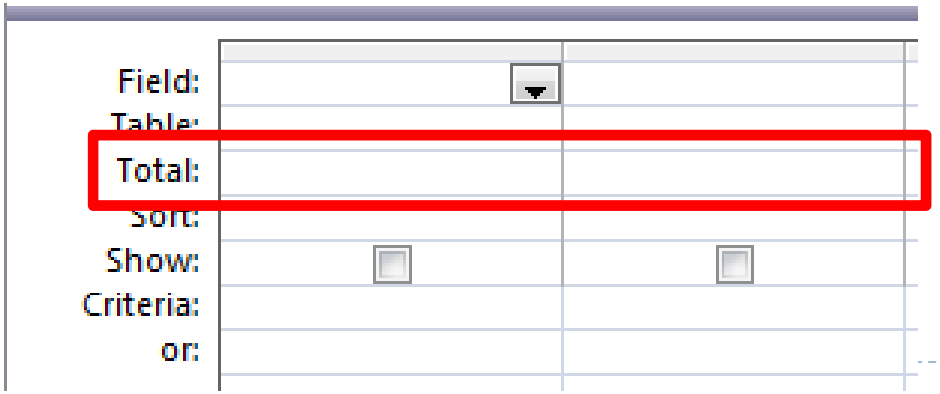




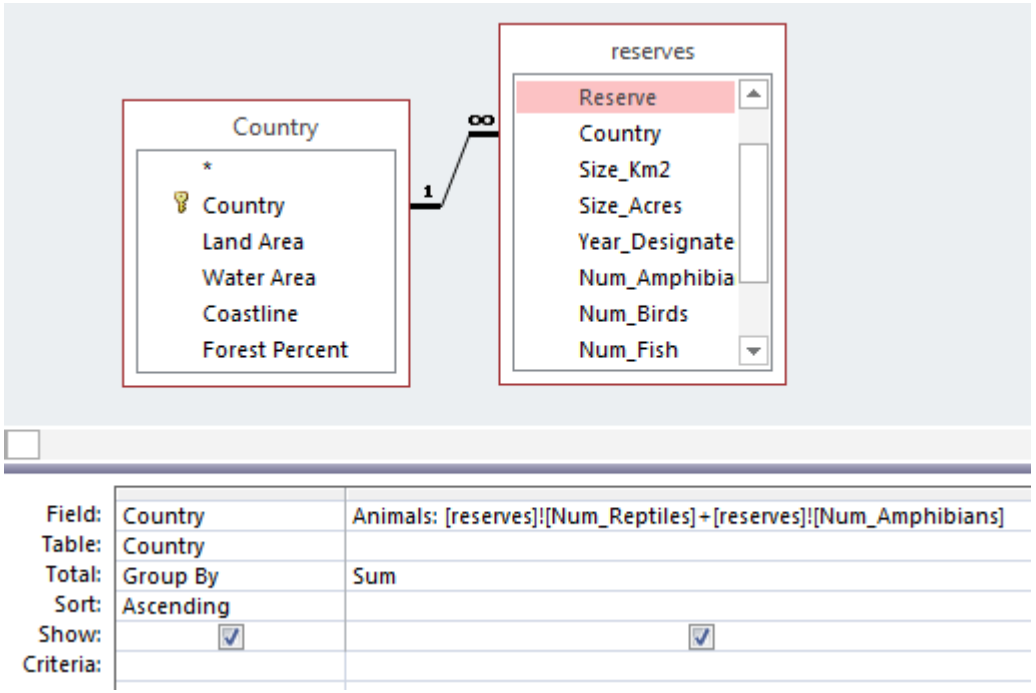
QBE queries

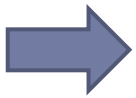
- A **Totals QBE query** allows us to group data using functions such as Min, Max, Avg, Sum etc.

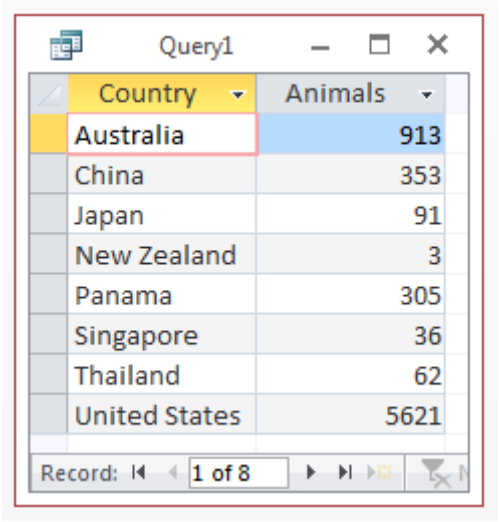




QBE queries

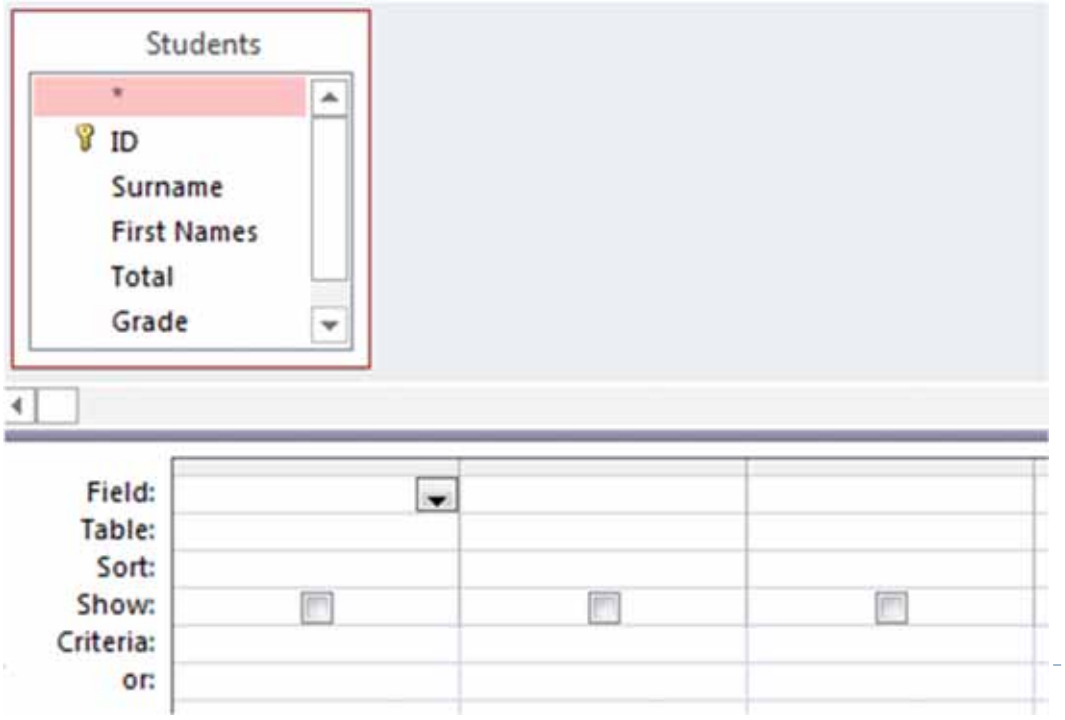

reserves
Country
*
Country
Land Area
Water Area
Coastline
Forest Percent
1
∞
Reserve
Country
Size_Km2
Size_Acres
Year_Designate
Num_Amphibia
Num_Birds
Num_Fish
Field: Country Animals: [reserves]![Num_Reptiles]+[reserves]![Num_Amphibians]
Table: Country
Total: Group By Sum
Sort: Ascending
Show:
Criteria:




Query1
Country
Animals
Australia 913
China 353
Japan 91
New Zealand 3
Panama 305
Singapore 36
Thailand 62
United States 5621
Record: 1 of 8

QBE Exercise

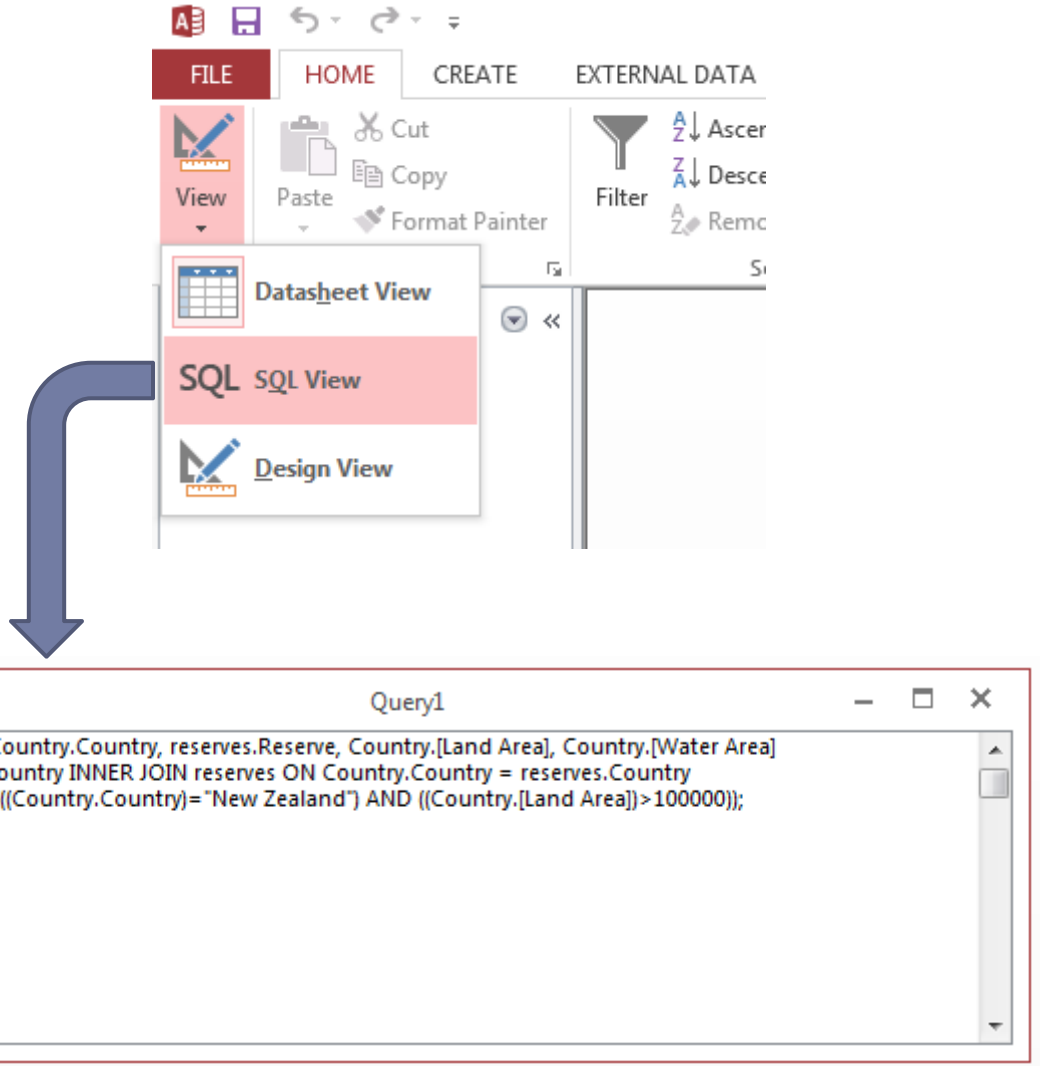
- Complete this QBE grid so that it will return the first name, surname and grade (in that order) of all students who have received an A+. Sort the results by surname in alphabetical order



2. 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


FILE
HOME
CREATE
EXTERNAL DATA
View
Paste
Cut
Copy
Format Painter
Filter
Datasheet View
SQL View
Design View
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

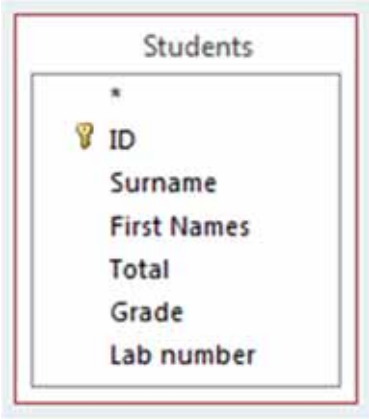
- Four clauses that can used in a simple SQL query:
  - SELECT
  - FROM
  - WHERE
  - ORDER BY
- **Example**: construct a SQL query that will return the first names, surname, and grade (in that order) of all students who have received an A+. Sort the results by surname in alphabetical order

SQL queries - SELECT

- Selects fields from the tables that we want to display in our results table
- Syntax:

```
SELECT [comma separated list of fields]
SELECT [First Names], Surname, Grade
```

  - Note the square brackets around 'First Names' needed because of the space in the field name

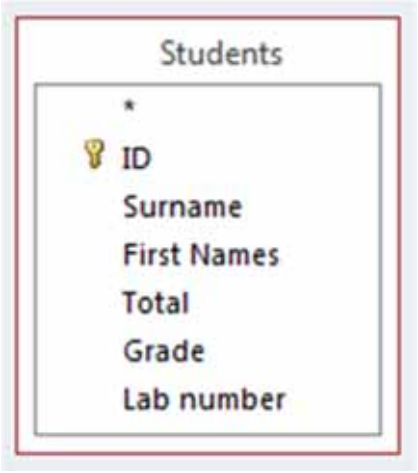


SQL queries - FROM

- Specifies the table which holds the field(s) listed in the SELECT clause
- Syntax

```
FROM [comma separated list of tables]
```

```
SELECT [First Names], Surname, Grade
FROM Students;
```

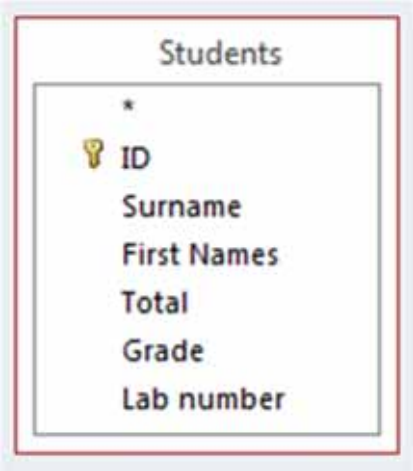


SQL queries - WHERE

- 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

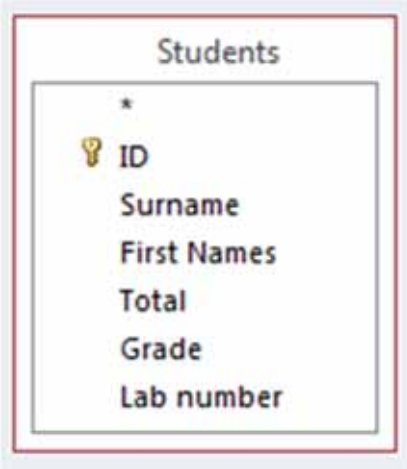
```
SELECT [First Names], Surname, Grade
FROM Students
WHERE Grade = "A+";
```



SQL queries – ORDER BY

- 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;
```



SQL queries

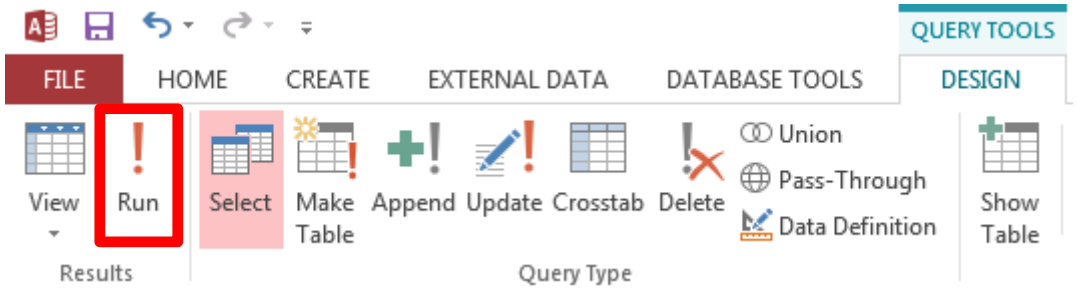
- You need to ensure that you put a semi-colon on the last clause of your SQL query:

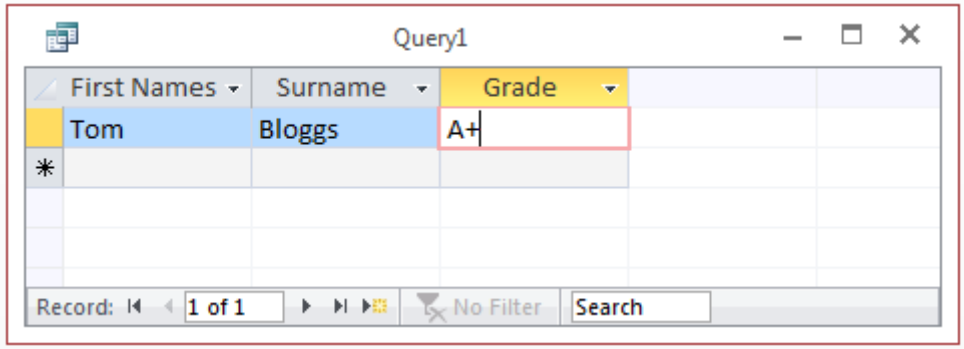
```
SELECT [First Names], Surname, Grade
FROM Students
WHERE Grade = "A+"
ORDER BY Surname ASC;
```

SQL queries

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

'Run' button

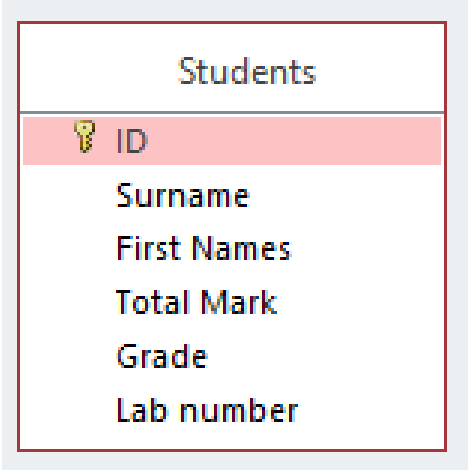




SQL exercise

- Which of the following SQL commands will display …. of students?

ID	Surna	First Na	Total Mark	Grade	Lab number
1	Smith	Dick	98	A+	1
2	Bloggs	Tom	89	A	1
3	Chan	Michael	45	D+	2
4	Wong	Susan	76	B+	2
5	Kim	Mary	82	A-	1
6	Patel	Amy	56	C	0
#####			0		0



SQL exercise

- Which of the following SQL commands will *only* display the first names of students whose Total mark was greater than 70? Order the results table by total mark in descending order

Dick
Tom
Mary
Susan

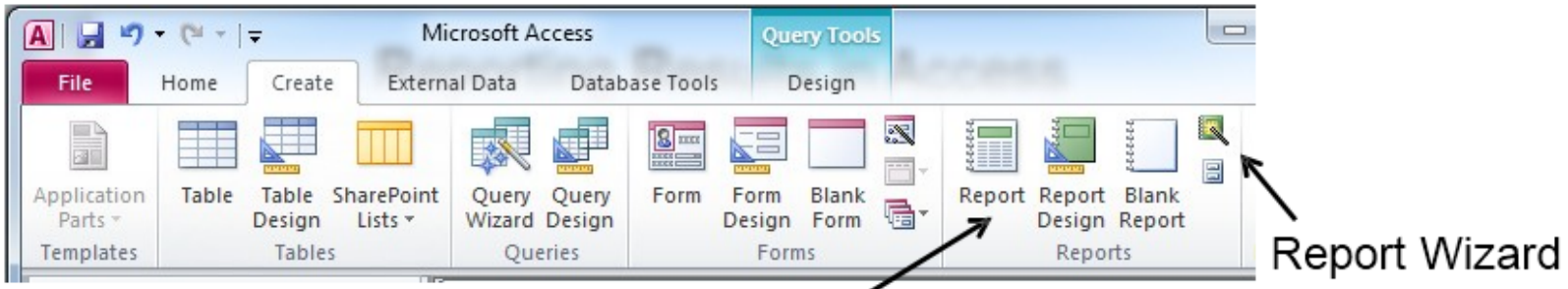
- 1: SELECT [First Names] FROM Students WHERE Mark > 70 ORDER by [Total Mark];
- 2: SELECT [First Names] FROM Students WHERE [Total Mark]>70 ORDER BY [Total Mark] DESC;
- 3: SELECT [Total Mark] DESC FROM Students WHERE [Total Mark]>70;

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

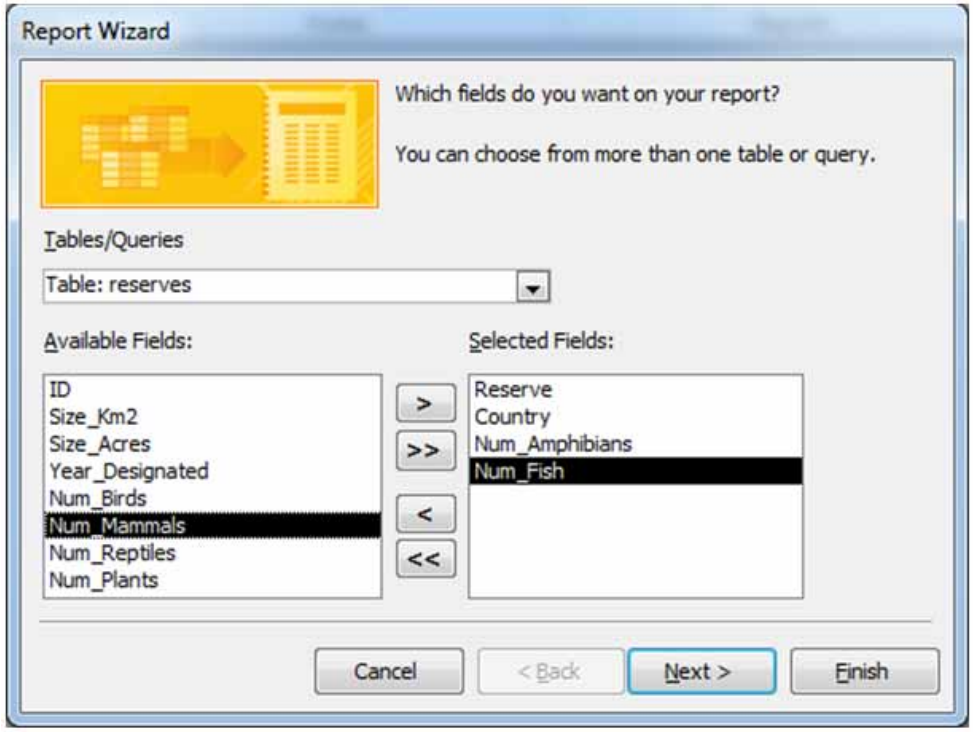
3. Presenting data

- **Reports** allow you to present the contents of a table or query 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)
    - We will look at the Report Wizard



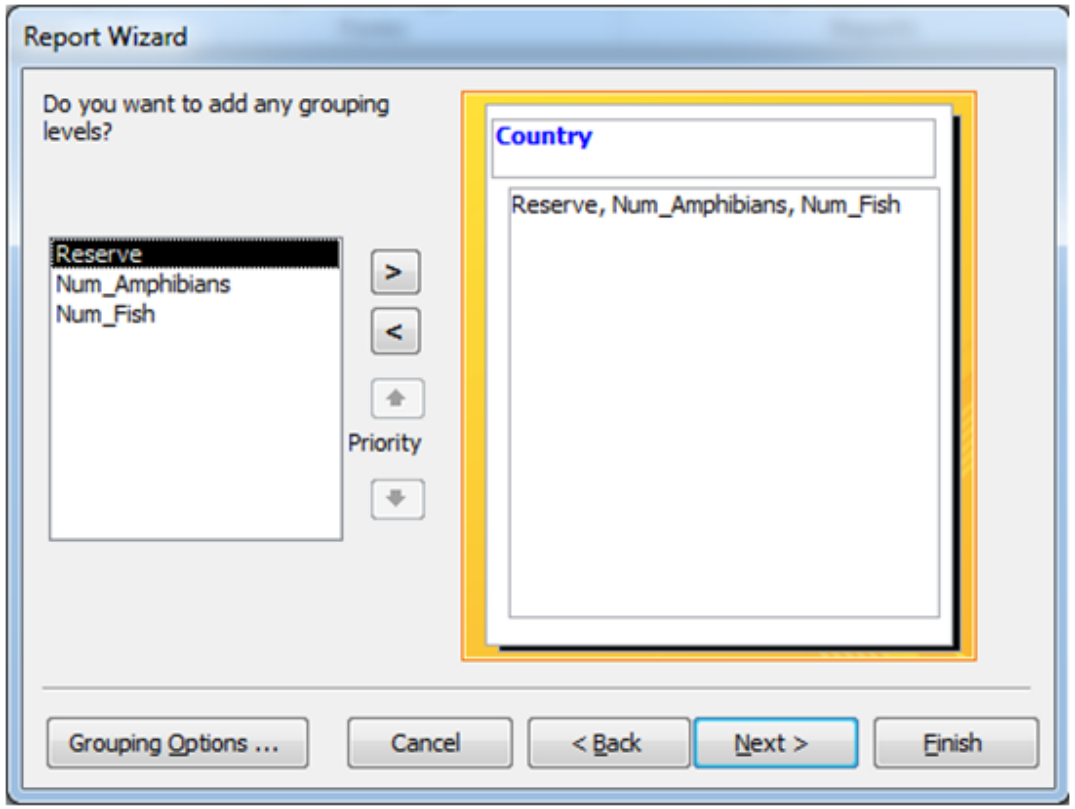
The Report Wizard

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



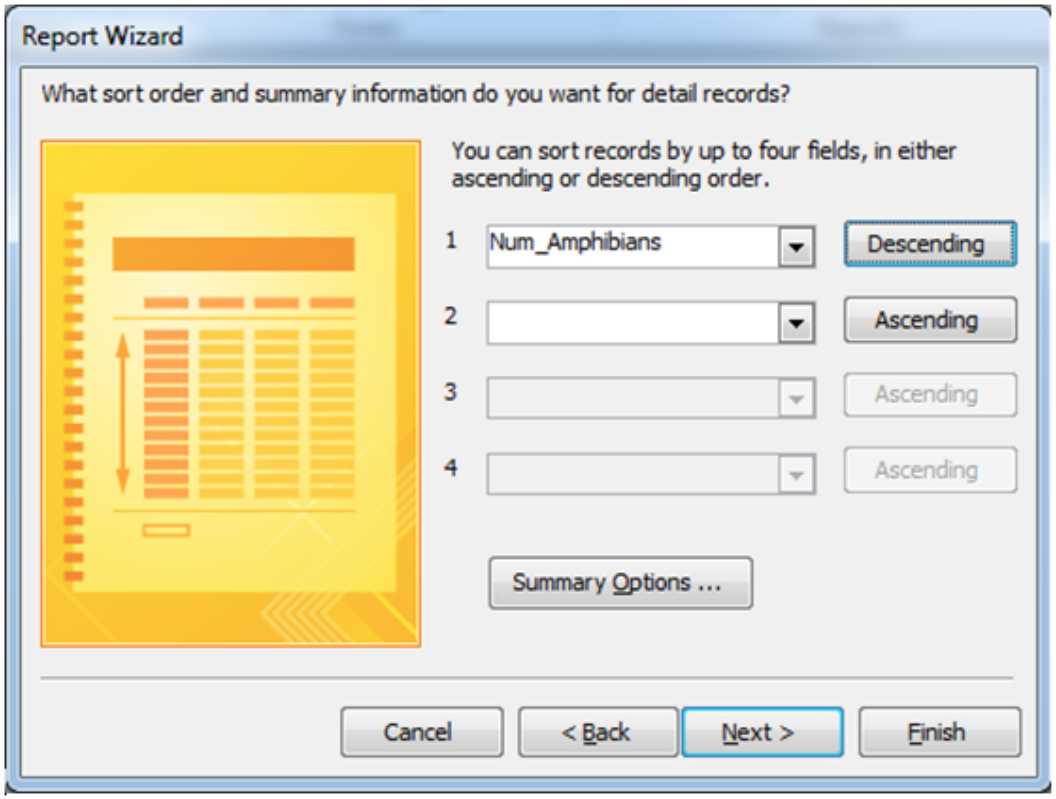
The Report Wizard

- You can group records in the report using particular fields



The Report Wizard

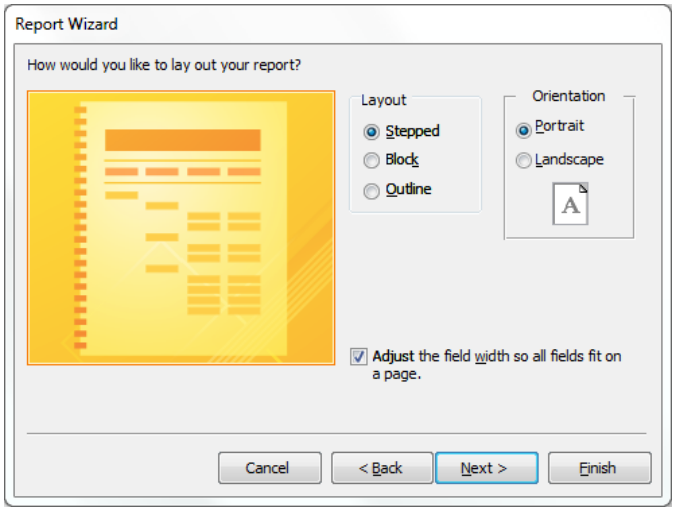
- You can sort records in the report by one or more fields

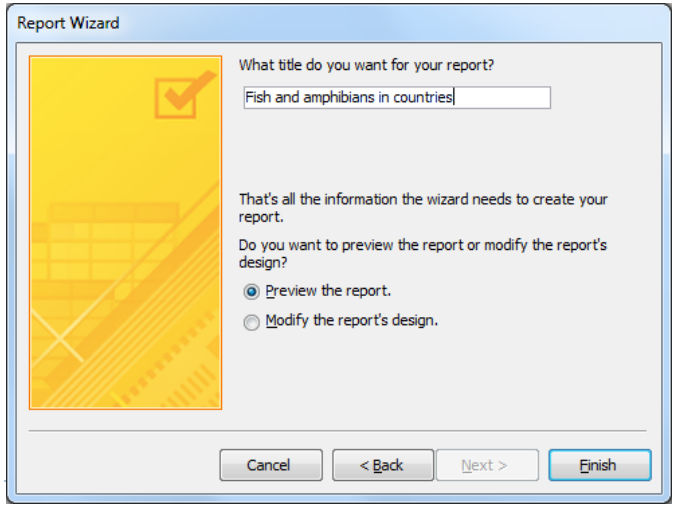


The Report Wizard

- 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

- Post-Lecture-Quiz: PLQ_22
  - https://coderunner2.auckland.ac.nz/moodle/mod/quiz/view.php?id=628

Practical in-class Exercise

Employees

EMPLOYEE_ID	FIRST_NAME	LAST_NAME	DEPT_CODE	HIRE_DATE	CREDIT_LIMIT	PHONE_NUMBER	MANAGER_ID
201	SUSAN	BROWN	EXE	1/06/1998	$30.00	3484	
203	MARTHA	WOODS	SHP	2/02/2009	$25.00	7591	201
204	ELLEN	OWENS	SAL	1/07/2008	$15.00	6830	202
205	HENRY	PERKINS	SAL	1/03/2006	$25.00	5286	202
206	CAROL	ROSE	ACT				
207	DAN	SMITH	SHP	1/12/2008	$25.00	2259	203
208	FRED	CAMPBELL	SHP	1/04/2008	$25.00	1752	203
209	PAULA	JACOBS	MKT	17/03/1999	$15.00	3357	201
210	NANCY	HOFFMAN	SAL	16/02/2007	$25.00	2974	203

Practical in-class Exercise

- Open the Employees table
- Try the following:
  - List the employee ID, first name, last name and credit limits of the employees with a credit limit over $20.00. Sort them by the size of the credit limit

Query1

employee_id	first_name	last_name	credit_limit
210	NANCY	HOFFMAN	$25.00
208	FRED	CAMPBELL	$25.00
207	DAN	SMITH	$25.00
205	HENRY	PERKINS	$25.00
203	MARTHA	WOODS	$25.00
201	SUSAN	BROWN	$30.00

  - List the employee ID, first name, last name and credit limits of the employees with the last names starts with B:

Query2

employee_id	first_name	last_name	credit_limit
201	SUSAN	BROWN	$30.00