



## Databases 2 – Retrieving information

Lecture 22 – COMPSCI111/111G SS 2018

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## Today's lecture

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

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## 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

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

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

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

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## 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

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# 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

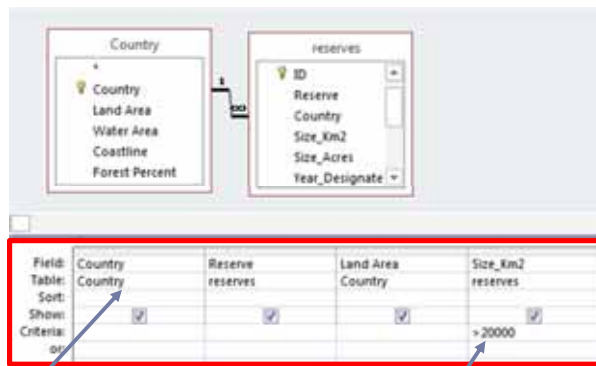


1. Select Query Design from the Create Menu

2. Select tables to use in query



# QBE queries



QBE grid

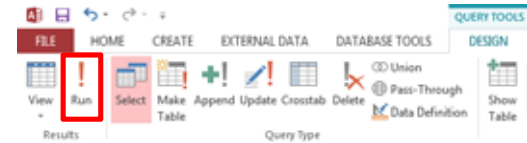
Choosing fields

Adding criteria to the field



# QBE queries

'Run' button



Query results

Country	Reserve	Land Area	Size_Km2
United States	Arctic National Wildlife Refuge, AK	9,158,960	78049.00
United States	Denali Biosphere Reserve, AK	9,158,960	24422.93
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	33685.32



## 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:		

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

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## QBE queries - expressions

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

Expression Builder

[reserves]![Num\_Reptiles]+  
[reserves]![Num\_Amphibians]

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

Reserve	Country	Expr1
Azumayama Forest	Japan	22
Mount Mikusaen	Japan	19

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## QBE queries - expressions

Country

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

reserves

- Country
- Size\_Ind
- Size\_Acres
- Year\_Designate
- Num\_Amphibia
- Num\_Birds
- Num\_Fish

Field:	Country	Reserve	Animals: [reserves]![Num_Reptiles]+[reserves]![Num_Amphibians]
Table:	Country	reserves	
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:			
or:			

Country	Reserve	Animals
Australia	Booderee National Park	8
Australia	Bookmark Biosphere Reserve	56
Australia	Christmas Island National Park	11
Australia	Coorong National Park	30
Australia	Croajingalong	4
Australia	Currawinya Lakes National Park	8

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## QBE queries

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

Access QUERY TOOLS DESIGN

FILE HOME CREATE EXTERNAL DATA DATABASE TOOLS QUERY TOOLS DESIGN

View Run Select Make Append Update Union Crosstab Pass-Through Show Table Builder Insert Rows Delete Rows Return All Parameters Property Sheet Table Names

Results Query Type Query Setup Show/Hide

**Totals** button

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

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## QBE queries

The screenshot shows a QBE interface with two tables: 'Country' and 'Reserve'. The 'Country' table has fields: Country, Land Area, Water Area, Coastline, Forest Percent. The 'Reserve' table has fields: Country, Size\_Km2, Year\_Designate, Num\_Amphibia, Num\_Birds, Num\_Fish. A query grid is shown below the tables with the following content:

Field:	Country	Animals: {reserves}{Num_Reptiles}+{reserves}{Num_Amphibians}
Table:	Country	
Total:	Group By	Sum
Sort:	Ascending	
Show:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Criteria:		

Below the grid is a resulting data table:

Country	Animals
Australia	913
China	353
Japan	91
New Zealand	3
Panama	305
Singapore	36
Thailand	62
United States	5621

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## 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

The screenshot shows a QBE interface for a 'Students' table. The table has fields: ID, Surname, First Names, Total, Grade. Below the table is an empty query grid:

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

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## 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

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## QBE queries

The screenshot shows a 'SQL View' window in a database application. The query text is:

```
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);
```

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## SQL queries

- ▶ Four clauses that can be 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

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## 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

Students						
*	ID	Surname	First Names	Total	Grade	Lab number

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## 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;

Students						
*	ID	Surname	First Names	Total	Grade	Lab number

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## 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

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## 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

- ▶ 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

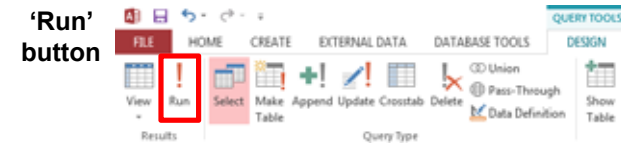
- ▶ You need to ensure that you put a semi-colon on the last clause of your SQL query:

```
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



First Names	Surname	Grade
Tom	Bloggs	A+

Record: 1 of 1 | No Filter | Search



## SQL exercise



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

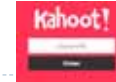
ID	Surname	First Name	Total Mark	Grade	Lab number
1	Smith	Dick	98	A+	1
2	Bloggs	Tom	89	A	1
3	Chan	Michael	45	D+	2
4	Wong	Susan	76	B+	2
5	Kim	Mary	82	A-	1
6	Patel	Amy	56	C	0
*	#####		0		0

ID
Surname
First Names
Total Mark
Grade
Lab number

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## 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;

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## Aspects of a database

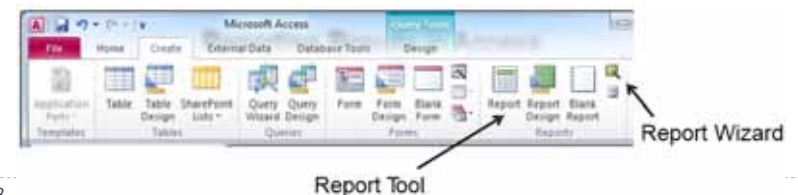
- Before we can create our database, we need to decide how to:
  - Organize** data in our database
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  - Enter** data in our database
    - Datasheet view
  - Retrieve** data from our database
    - QBE and SQL queries
  - Present** the retrieved data to the user

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## 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



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## The Report Wizard

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



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## The Report Wizard

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



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## The Report Wizard

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

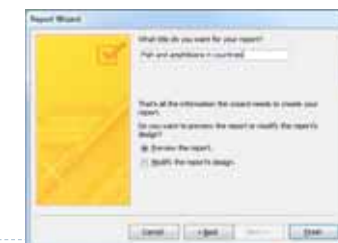


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## The Report Wizard

- ▶ 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'



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## 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	Name 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 Boodjamook Biosphere Reserve	6
	9 Koojakoo 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

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## 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: PLO\_22
- ▶ <https://coderunner2.auckland.ac.nz/moodle/mod/quiz/view.php?id=628>

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## 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	SH	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	SH	1/12/2008	\$25.00	2259	203
208	FRED	CAMPBELL	SH	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

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## 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

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