9. Databases

Single-table database

- **Database:** structured collection of data so it can be searched, sorted, filtered and analysed quickly.
- Databases use tables to store data.
- Tables have **records** of data represented by *rows*.
- Each record is divided into **fields**, represented by *columns*.
- The first row contains the field names: heading for data stored in that field.
- Each field has a data type which defines what data can be entered into that field.
- When a table is created, **validation** rules can be assigned to different fields.
- A validation rule controls what data can be entered into that field.

A Database Table Containing Customer Details

CustomerID	FirstName	LastName	DOB	PhoneNumber
1	Andrea	Bycroft	05031976	0746762883
2	Melissa	Langler	22012001	0756372892
3	Amy	George	22111988	0746372821

- In the example, each row represents data stored about a single customer (the customer's record).
- There are 3 records in the customer table.
- Each record is divided into fields (CustomerID, FirstName, LastName, DOB and Phone Number).
- There are 5 fields in the customer table.

Data types

Data Type	Explanation	Example
Text/Alphanumeric	Words/ characters (letters/punctuation/spaces/ numbers), when no calculation is required	NG321AE
Character	Single characters (any alphanumeric value; lowercase/uppercase), when no calculation is required	A
Number: Integer & Real	When comparisons and calculations may be required - Integer: only whole numbers - Real: numbers including decimal numbers	 15 30.99
Boolean	One of 2 possible choices/options.	True/False

Date/Time	Only dates or times - Format for date/time is usually assigned	180855
Currency	given in dollars/rupees	$175

Primary key

- Unique identifier: Each entry in this field is a unique identifier
- It does not contain any duplicate data items. (Duplicate data items would be blocked if they were entered into the primary key field).
- Used to identify individual records.

Purpose of primary key: uniquely identifies a record

Why a particular field is ideal for primary key

- Unique identifier // unique for each record
- It does not contain any duplicate data items

Structured Query Language (SQL) Scripts

- Records in a database can be searched and data can be manipulated using Structured Query Language (SQL)
- SQL statements can be written to query the data in the database and extract useful information

Main structure of SQL statements:

`SELECT`	lists the fields to be displayed
`FROM`	identifies the table/tables containing the data you wish to search
`WHERE`	identifies the search criteria to filter the results - Comparison operators are used to create filter criteria in the `WHERE` line - Logical operators are used to include multiple criteria in the `WHERE` line

`ORDER BY`

- Fourth line that can be added to the SQL statement
- `ORDER BY` command is followed by `ASC` or `DESC`
  - `ASC`: results of the query will be sorted in ascending order
  - `DESC`: results of the query are sorted in descending order

- **`SUM:`** used to add numerical data
- **`COUNT:`** used to count items of data

Examples

A Database Table Containing Movie Details

MovieID	Name	Genre	Certificate	Rating
M23	Moana	Family	U	8.1
M8	Shaun of the Dead	Comedy	18	8.7
M56	Die Hard	Action	18	8.4
M34	Big	Family	PG	8.5

```
SELECT Name, Rating
FROM Movie
WHERE Rating>8.4;
```

Results:

Name	Rating
Shaun of the Dead	8.7
Big	8

- The two fields - Name and Rating have been extracted from the Movie table and then the records have been filtered by Rating
- > comparison operator is used to search for records where the rating is greater than 8.4

```
SELECT Name,Rating
FROM Movie
WHERE Genre=”Family” AND Certificate=”U”;
```

Results:

Name	Rating
Moana	8.1

- The two fields Name and Rating have been extracted from the Movie table and the records have been filtered by both Genre and Certificate

- AND logical operator is used to include multiple criteria

```
SELECT Name,Genre, Certificate, Rating
FROM Movie
ORDER BY Name ASC
```

Results:

Name	Genre	Certificate	Rating
Big	Family	PG	8.5
Die Hard	Action	18	8.4
Moana	Family	U	8.1
Shaun of the Dead	Comedy	18	8.7

- The query has returned four fields and all records because there were no WHERE criteria. The records are sorted by Name alphabetically

Database of stock

ProductID	ProductName	Price	QuantityInStock
1	Sausages	1.99	3
2	Chips	2.99	2
3	Beans	2.50	5
4	Bananas	2.10	12
5	Avocado	1.00	3

```
SELECT SUM(QuantityInStock)
FROM ProductTable;
```

- This query will add up all of the numbers in the QuantityInStock field
- The result of this query would be 25

```
SELECT COUNT(*)
FROM ProductTable
WHERE Price>2;
```

- This query will count all the records with a price greater than 2
- The result of this query would be 3
- This is because there are 3 products with price greater than £2 (Chips, Beans, Bananas)

Exam questions

Questions

A pet supplier uses the database table, STOCK, to keep records of its products for pets.

The fields are:

Field name	Description
ProductID	code to identify the product
ProductName	name of product
ProductDescription	information about the product
Animal	type of animal the product is for, e.g. cat, bird, horse
ProductType	type of product, e.g. food, toy, medicine
InStock	whether the product is in stock or **not**

Complete the query-by-example grid to output the products intended for a cat that are in stock. Display only the primary key and the name of the products. The output should be sorted by the primary key.

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

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Field:	ProductID	ProductName	Animal	InStock	
Table:	STOCK	STOCK	STOCK	STOCK	
Sort:	Ascending				
Show:	☑	☑	☐	☐	☐
Criteria:			="cat"	=Yes	
or:					

Question 2

6 A database table, PLANT, is used to keep a record of plants sold by a nursery. The table has these fields:

- NAME – name of plant
- FLOWER – whether the plant flowers (True) or not (False)
- POSITION – shade, partial shade or sun
- SIZE – small, medium or large
- PRICE – price in $
- NUMBERSOLD – how many sold

A query-by-example grid has been completed to display only the price, name and number sold of small plants that do not flower.

Field:	NAME	PRICE	NUMBERSOLD	SIZE	FLOWER	POSITION
Table:	PLANT					
Sort:						
Show:	☑	☑	☑	☐	☐	☐
Criteria:						= "shade"
or:						

Identify errors in the query-by-example grid

- Table row is not completed
- POSITION column not required // POSITION criteria not required
- No criteria set in the size column
- No criteria set in the flower column

Question 3

A computer game shop records its stock levels in a database table called GAMES. The fields used in the stock table are shown.

Name	Description
GameID	primary key
GameName	the name of each game
AgeRestriction	the minimum age at which a person is allowed to play each game
GamePrice	the selling price for each game
NumberStock	the quantity of each game currently in stock
OnOrder	whether or **not** each game is on order from the suppliers
DateLastOrdered	the date the most recent order for each game was placed
GameDescription	a summary of the contents and purpose of each game

Complete the query-by-example grid to output all the games that have no stock and that are on order with the supplier. Display only the GameID, GameName and GamePrice fields in alphabetical order of the name of the game.

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

Field:	GameID	GameName	GamePrice	NumberStock	OnOrder
Table:	GAMES	GAMES	GAMES	GAMES	GAMES
Sort:		Ascending			
Show:	☑	☑	☑	☐	☐
Criteria:				=0	="Y"
or:					

Question 4

Species	Description	NumberBirds	Breeding	Young
Edwards	blue-black with white tail	5	Yes	0
Japanese green	dark green with pale grey tail	2	Yes	2
Reeves	golden, white and red scaled plumage	4	Yes	1
Crawfords Kalij	glossy blue-black plumage	4	No	0
Crested fireback	blue-black with black tail	3	No	0
True silver	white laced top half and black lower half	7	Yes	1
Siamese fireback	grey plumage with crimson legs and feet	5	No	0
Mikado	iridescent plumage with white striped wings	3	Yes	4
Red junglefowl	many colours	2	Yes	0
Himalayan monal	many colours with metallic green crest	3	Yes	2
White eared	white with ear tufts	5	Yes	3
Brown eared	brown with ear tufts	9	Yes	1
Ring necked	long tail with white ring neck	2	Yes	2
Golden	rainbow coloured	3	Yes	4

`Species` **could be used as the primary key. Explain why the sanctuary might decide not to use it as the primary key.**

Long names that could be easily misspelt // species or description could be duplicated

A new field `SpeciesID` is added to the database table. This field contains a six-character code, for example Ph0001. Give a reason why this field would be a better primary key.
Easy to validate // always unique

Complete SQL statement to display all the species of pheasant where the birds are breeding and there were no young born this year

```
SELECT Species
FROM PheasantList
WHERE Breeding AND Young = 0
```

No need to say “WHERE Breeding = TRUE”