Chapter 15

Database

2.3 Database

- define a single-table database from given data storage requirements
- choose and specify suitable data types
- choose a suitable primary key for a database table
- perform a query-by-example from given search criteria

A database is an organized and persistent (permanent) collection of data.

The collected information could be in any number of formats (electronic, printed, graphic, audio, statistical, combinations). There are physical (paper/print) and electronic databases.

A database could be as simple as an alphabetical arrangement of names in an address book or as complex as a database that provides information in a combination of formats.

Examples:

- phone book
- address book
- Census Bureau data

Database Management System (DBMS)

Database management system is a mechanism for manipulating data with high level command. It hides low level details such are as how data are obtained.

Database management system also has ability to search record by queries and to create reports and view data.

Entity

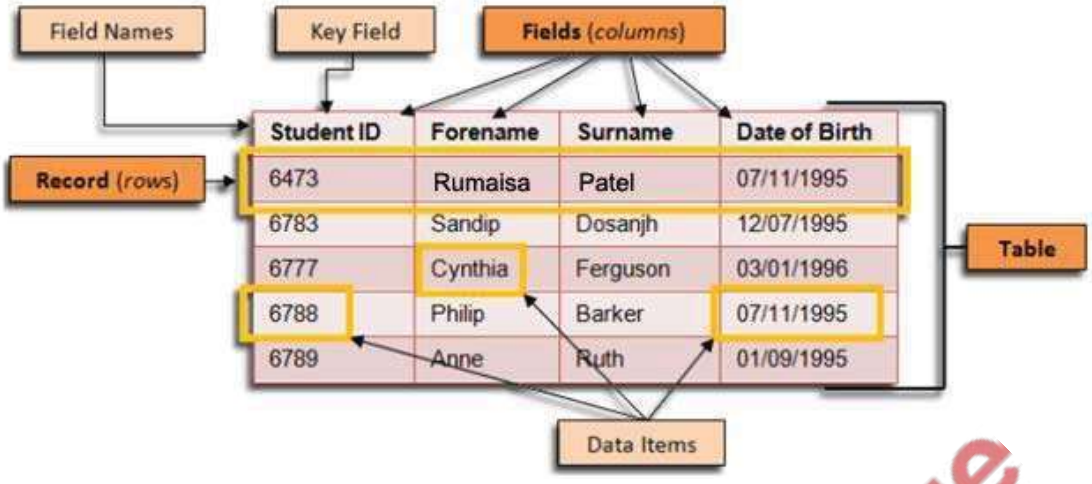
An entity is a "real world thing" about which data is held. Examples of entities include:

A customer	A product	A pupil	A supplier
A hotel room	A DVD	A flight	A holiday
A treatment	An address book	A book	A car
An order	An animal	A student	

An attribute is a feature of that entity. For example, a hotel room might have an attribute about whether it has a view or whether it is single or double. A student might have a date of birth and an address.

An entity is stored as a table in a database and an attribute becomes a field in a table.

All the data about a particular entity is stored in a single table. Each data item about the entity is a field.



Database record

Data in a database table is organised into rows **(records)** and columns **(fields)**. Each record in a relational database table corresponds to an entity. In the example table of 'Students' above there are 5 records. Each record corresponds to an individual student. Note that although there are two students called Philip Barker with the same date of birth, they have different Student IDs and are different students.

Database field

An attribute is a piece of information or a characteristic of an entity. Attributes of entities are represented in database tables by **fields** (columns). A field stores one item of data for a record. In the table above, each student is represented in the relational database by a record and the student attributes are stored in the following fields:

- Student ID
- Forename
- Surname
- Date of Birth

Fields have the following characteristics:

- Each field in a table has a unique name. Note, however, that the same field name can occur in other tables of the same relational database.
- Each field stores a single item of data - For example, a field called Date of Birth would store no more than one date of birth value.
- Each field has a particular data type – for example, text, Boolean, integer, date/time, etc.
- Each field can have its own validation rules - these ensure that data recorded in the field is of the right type and format.

Data types

Different data types are identified so that a computer can store and process the data appropriately. Data types include:

- text ()
- number (numeric) may include:
  - Auto number
  - Currency
- date/time
- Boolean (or Yes/No).

Primary Keys

Each table has a primary key. This is a field chosen so that it can uniquely identify each record. Sometimes an existing attribute can be used because it is unique but most of the time some sort of ID is created. Primary keys can be used to link to foreign keys in other tables. A foreign key is the primary key in a different table and it is not necessarily unique.

Example Question:

A picture gallery owner has decided to set up a database to keep information about the pictures he has for sale. The database table, PICTURE, will contain the following fields:

Title; Artist; Description; Catalogue Number; Size (area in square centimeters); Price; Arrived (date picture arrived at gallery); Sold (whether picture is already sold)

(a) (i) State what data type you would choose for each field.

Title: .....

Artist: .....

Description: .....

Catalogue Number: .....

Size: .....

Price: .....

Arrived: .....

Sold: .....[4]

(ii) State which field you would choose for the primary key

.....[1]

Query

The prime function of a relational database is to store data in an organised way so that users can interrogate (search) and manipulate (sort) the data. The interrogation of a database is called querying the database and a question used to interrogate the data is called a query.

Query by Example (**QBE**) is a database **query** language for relational databases. It was devised by Moshé M. Zloof at IBM Research during the mid-1970s, in parallel to the development of SQL. It is the first graphical **query** language, using visual tables where the user would enter commands, **example** elements and conditions.

Databaseuser-interface in which the user fills out a form to retrieve data. The database makes the search on the basis of the example(s) provided by the user.

The query to find students in form 10B

A complex query looks for data in two or more fields and uses the logical operators OR, AND or NOT.

The following example uses a complex query to find all of the pupils in Form 10B who were born before 1995. This query uses the logical operator AND:

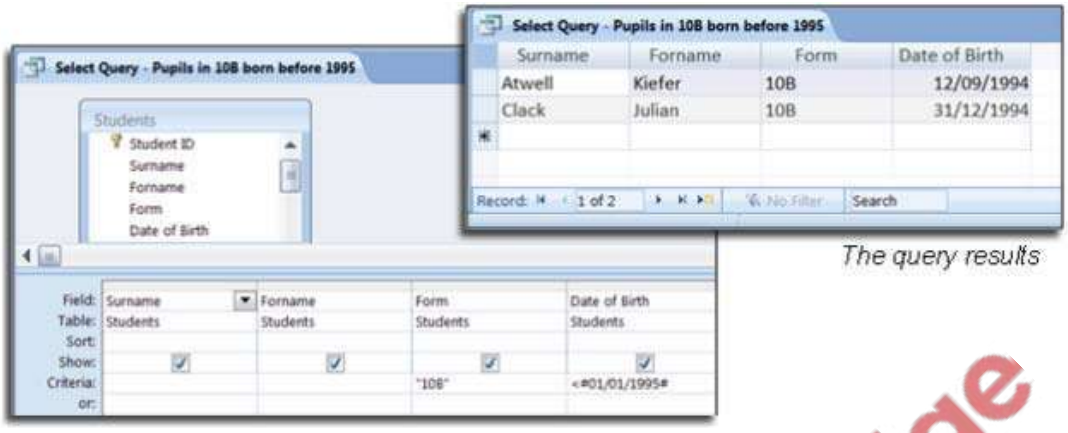
(Form = "10B") AND (Date of Birth < 01/01/1995).

Operators can be used to refine search results.

Operator	Meaning
=	Equals
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to
<>	Not equal to

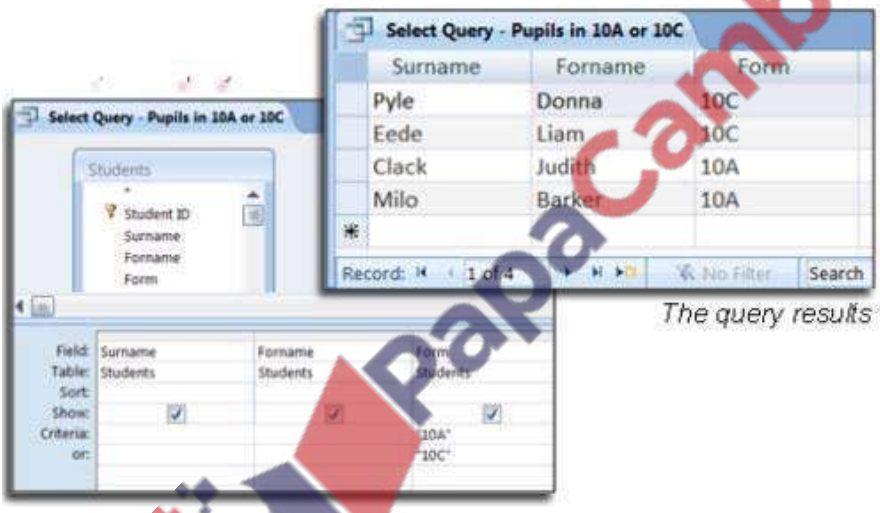
The query design is shown below. Note that this time there are two entries in the search criteria row Also note that this time the query has been given a meaningful name ***("Select Query –***

Pupils in 10B born before 1995"). This saves other database users from unnecessarily creating the same query.



The query results

Below is a new complex query that uses the logical operator OR to find pupils who are in Form 10A or Form 10C: (Form = "10A" OR "Form = "10C") this time, in the query definition there will be two criteria lines. The query and its results are shown below:



The query results

Wildcards in Queries

Wildcard characters can be used in database queries. For example you may want a list of all pupils born in November, or all of the pupils whose surname starts with a 'C'. Wildcard searches allow you to specify the part of the data that you know and leave the data handling software to fill in the blanks.

Surname Like "C*" would find all records where the surname begins with a C.

Quick Revision Questions:

Q 1) Define following terms:

Database: .....

.....

Entity: .....

.....

Table: .....

.....

Field/ Attribute: .....

.....

Record/Tupple: .....

.....

Primary Key: .....

.....

Query: .....

.....

Candidate Example Response Summer 2015 P22

6 A database, MARKS, was set up to record the test results for a class of students. Part of the database is shown below.

Student Name	Class ID	Maths	English	Science	History	Geography
Paul Smith	0017	70	55	65	62	59
Ravi Gupta	0009	29	34	38	41	44
Chin Hwee	0010	43	47	50	45	52
John Jones	0013	37	67	21	28	35
Diana Abur	0001	92	88	95	89	78
Rosanna King	0016	21	13	11	27	15

(a) Give the number of fields that are in each record.

.....[1]

(b) State which fields you would choose for the primary key.

.....

Give a reason for choosing this field.

.....

.....[2]

(c) The query-by-example grid below selects all students with more than 60 marks in History or more than 60 marks in Geography.

Field:	Student Name	History	Geography
Table:	MARKS	MARKS	MARKS
Sort:	Ascending		
Show:	☑	☐	☐
Criteria:		>60	
or:			>60

Show what would be output.

.....[2]

(d) Complete the query-by-example grid below to select and show the student names only of all students with less than 40 marks in both Maths and English. [3]

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

Question 6(a)

Example candidate response – high, middle, low

(a) Give the number of fields that are in each record.

7 [1]

Examiner comment

All but the weakest candidates could identify the number of fields in each record.

Total mark awarded = 1 out of 1

Question 6(b)

Example candidate response – high

(b) State which field you would choose for the primary key.

Class ID

Give a reason for choosing this field.

The Class ID of two students cannot be same as it always unique and so this field can be used to identify a record. [2]

Examiner comment – high

Most candidates could identify the field to choose for a primary key, this candidate gave a good explanation of their choice using appropriate database terminology.

Total mark awarded = 2 out of 2

Example candidate response – middle

(b) State which field you would choose for the primary key.

Class ID

Give a reason for choosing this field.

It is because it is a primary key as it provides with Class ID of students [2]

Examiner comment – middle

Most candidates could identify the field to choose for a primary key; sometimes the explanation did not provide enough information to gain a mark. This explanation just repeats the question and does not add any further information.

Total mark awarded = 1 out of 2

Example candidate response – low

(b) State which field you would choose for the primary key.

Student Name

Give a reason for choosing this field.

It is because it is the main field which gives the general information about student. [2]

Examiner comment – low

Weaker candidates sometimes incorrectly identified the Student Name field; this did not gain a mark.

Total mark awarded = 0 out of 2

Question 6(c)

Example candidate response – high

(c) The query-by-example grid below selects all students with more than 60 marks in History or more than 60 marks in Geography.

Field:	Student Name	History	Geography
Table:	MARKS	MARKS	MARKS
Sort:	Ascending		
Show:	☑	☐	☐
Criteria:		>60	
or:			>60

Show what would be output.

Diana Abur

Paul Smith [2]

Examiner comment – high

The answer should be the output, this is completely correct as it shows only the Student Names and they are in ascending order.

Total mark awarded = 2 out of 2

Example candidate response – middle

(c) The query-by-example grid below selects all students with more than 60 marks in History or more than 60 marks in Geography.

Field:	Student Name	History	Geography
Table:	MARKS	MARKS	MARKS
Sort:	Ascending		
Show:	☑	☐	☐
Criteria:		>60	
or:			>60

Show what would be output.

Paul Smith , Diana Abur

Examiner comment – middle

The content of the answer is correct as only the Student Names are shown, the order is incorrect as it is the order the names appear in the database table not in ascending order.

Total mark awarded = 1 out of 2

Example candidate response – low

(c) The query-by-example grid below selects all students with more than 60 marks in History or more than 60 marks in Geography.

Field:	Student Name	History	Geography
Table:	MARKS	MARKS	MARKS
Sort:	Ascending		
Show:	☑	☐	☐
Criteria:		>60	
or:			>60

Show what would be output.

(Paul Smith > 60 History) ,(Diana Abur > 60 History),
(Diana Abur > 60 Geography). [2]

Examiner comment – low

The candidate appears to know how the query-by-example shown should work, however the question asked has not been answered as the reasoning has been shown rather than the output.

Total mark awarded = 0 out of 2

Example candidate response – high

(d) Complete the query-by-example grid below to select and show the student names only of all students with less than 40 marks in both Maths and English.

Field:	Student Name	Maths	English
Table:	MARKS	MARKS	MARKS
Sort:	Ascending		
Show:	☑	☐	☐
Criteria:		< 40	< 40
or:			

[3]

Examiner comment – high

The candidate has selected the correct fields. The Sort row for the Student Name can be left blank or set to Ascending or Descending since there are no instructions about sorting. The show boxes are correctly left unchecked for Maths and English. The < 40 criteria for the Maths and English marks are on the same line as both are required.

Total mark awarded = 3 out of 3

Example candidate response – middle

(d) Complete the query-by-example grid below to select and show the student names only of all students with less than 40 marks in both Maths and English.

Field:	Student Name	Maths	English
Table:	MARKS	MARKS	MARKS
Sort:	Descending		
Show:	☑	☐	☐
Criteria:		< 40	
or:			< 40

[3]

Examiner comment – middle

The candidate has selected the correct fields. The Sort row for the Student Name can be left blank or set to Ascending or Descending since there are no instructions about sorting. The show boxes are correctly left unchecked for Maths and English. The < 40 criteria for the Maths and English marks are not on the same line; this is incorrect as both are required. There is no mark for the English column.

Total mark awarded = 2 out of 3

Example candidate response – low

(d) Complete the query-by-example grid below to select and show the student names only of all students with less than 40 marks in both Maths and English.

Field:	Student Name	Maths	English
Table:	Marks	Marks	Marks
Sort:	descending	descending	descending
Show:	☑	☑	☑
Criteria:		<40	
or:			<40

[3]

Examiner comment – low

The candidate has selected the correct fields. The Sort row for the Student Name can be left blank or set to Ascending or Descending since there are no instructions about sorting. The show boxes are incorrectly checked for Maths and English. The < 40 criteria for the Maths and English marks are not on the same line; this is incorrect as both are required. There is no mark for the Maths column and no mark for the English column.

Total mark awarded = 1 out of 3

30 Summer 2019 P22

6 A database table, FLIGHT, is used to keep a record of flights from a small airfield. Planes can carry passengers, freight or both. Some flights are marked as private and only carry passengers.

Flight number	Plane	Notes	Departure time	Passengers
FN101	Caravan 1	Private passenger flight	08:00	Y
CN101	Caravan 2	Freight only	08:30	N
CN102	Piper 1	Freight only	09:00	N
FN104	Piper 2	Passengers only	09:20	Y
FN105	Piper 1	Freight and passengers	10:00	Y
FN106	Caravan 1	Passengers only	10:30	Y
CN108	Caravan 2	Freight only	08:00	N
CN110	Lear	Private passenger flight	08:00	Y

(a) State the field that could have a Boolean data type.

Field ..... [1]

(b) A query-by-example has been written to display just the flight numbers of all planes leaving after 10:00 that only carry passengers.

Field:	Flight number	Passengers	Deparure time		
Table:	FLIGHT	FLIGHT	FLIGHT		
Sort:					
Show:	☐	☑			
Criteria:		=Y	= 10:00		
or:					

Explain why the query-by-example is incorrect, and write a correct query-by-example. [7]

Explanation .....

.....

.....

.....

.....

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

Example Candidate Response – high

6 A database table, FLIGHT, is used to keep a record of flights from a small airfield. Planes can carry passengers, freight or both. Some flights are marked as private and only carry passengers.

Flight number	Plane	Notes	Departure time	Passengers
FN101	Caravan 1	Private passenger flight	08:00	Y
CN101	Caravan 2	Freight only	08:30	N
CN102	Piper 1	Freight only	09:00	N
FN104	Piper 2	Passengers only	09:20	Y
FN105	Piper 1	Freight and passengers	10:00	Y
FN106	Caravan 1	Passengers only	10:30	Y
CN108	Caravan 2	Freight only	08:00	N
CN110	Lear	Private passenger flight	08:00	Y

(a) State the field that could have a Boolean data type.

Field Passengers (1) [1]

(b) A query-by-example has been written to display just the flight numbers of all planes leaving after 10:00 that only carry passengers.

Field:	Flight number	Passengers	Departure time	
Table:	FLIGHT	FLIGHT	FLIGHT	
Sort:				
Show:	☐	☑	☐	☐
Criteria:		= Y	= 10:00	
or:				

Explain why the query-by-example is incorrect, and write a correct query-by-example.

Explanation The flight number box has not been ticked which means the flight number will not be displayed. The passengers box has been ticked, however that is not to be displayed. The (2) criteria of the departure time is set to = 10:00, but it should be after 10:00, i.e. >10:00 and only passengers flights have not been specified

Field:	Flight number	Passengers	Departure time	Notes
Table:	FLIGHT	FLIGHT	FLIGHT	(3)
Sort:				
Show:	☑	☐	☐	☐
Criteria:		= Y	>10:00	= "Passengers only"
or:		= Y	>10:00	= "Private passenger flight"

[7]

Examiner Comments

(1) The candidate states the correct field.

Mark for (a) = 1 out of 1

(2) Three errors are identified by the candidate:

- the flight number is not displayed
- the passenger field is displayed when not required
- the criteria for time is incorrect.

(3) This query does not work due to the missing table in the notes field.

Mark for (b) = 6 out of 7

Total mark awarded = 7 out of 8

How the candidate could have improved their answer

The candidate could have completed the table row for each field.

Example Candidate Response – middle

6 A database table, FLIGHT, is used to keep a record of flights from a small airfield. Planes can carry passengers, freight or both. Some flights are marked as private and only carry passengers.

Flight number	Plane	Notes	Departure time	Passengers
FN101	Caravan 1	Private passenger flight	08:00	Y
CN101	Caravan 2	Freight only	08:30	N
CN102	Piper 1	Freight only	09:00	N
FN104	Piper 2	Passengers only	09:20	Y
FN105	Piper 1	Freight and passengers	10:00	Y
FN106	Caravan 1	Passengers only	10:30	Y
CN108	Caravan 2	Freight only	08:00	N
CN110	Lear	Private passenger flight	08:00	Y

(a) State the field that could have a Boolean data type.

Field ...Passengers... 1 [1]

(b) A query-by-example has been written to display just the flight numbers of all planes leaving after 10:00 that only carry passengers.

Field:	Flight number	Passengers	Departure time	
Table:	FLIGHT	FLIGHT	FLIGHT	
Sort:				
Show:	☐	☑	☐	☐
Criteria:		= Y	= 10:00	
or:				

Explain why the query-by-example is incorrect, and write a correct query-by-example.

Explanation ...because the flight number is not displayed as according to the criteria, instead Passengers is shown. Furthermore, the Departure time time should be greater than or equal to 10:00 (not equal to 10:00). Instead of Passengers, Notes should be used as the field. 2

Field:	Flight number	~~Passen~~ Departure time	~~Passengers~~ Notes	3
Table:	FLIGHT	FLIGHT	FLIGHT	
Sort:				
Show:	☑	☐	☐	☐
Criteria:		> = 10:00	= "only Passengers"	
or:				

[7]

Examiner Comments

1 The correct field is chosen by the candidate.

Mark for (a) = 1 out of 1

2 Two errors are identified correctly by the candidate:

- not displaying the flight number
- displaying whether passengers are carried on the flight.

3 The field, table and show rows are correct; the criteria are both incorrect.

Mark for (b) = 4 out of 7

Total mark awarded = 5 out of 8

How the candidate could have improved their answer

The candidate could have completed both the criteria rows, using the correct criteria, > (greater than), for the departure time field and "Passengers only" and "Private passenger flight" for the notes field.

Example Candidate Response – low

6 A database table, FLIGHT, is used to keep a record of flights from a small airfield. Planes can carry passengers, freight or both. Some flights are marked as private and only carry passengers.

Flight number	Plane	Notes	Departure time	Passengers
FN101	Caravan 1	Private passenger flight	08:00	Y
CN101	Caravan 2	Freight only	08:30	N
CN102	Piper 1	Freight only	09:00	N
FN104	Piper 2	Passengers only	09:20	Y
FN105	Piper 1	Freight and passengers	10:00	Y
FN106	Caravan 1	Passengers only	10:30	Y
CN108	Caravan 2	Freight only	08:00	N
CN110	Lear	Private passenger flight	08:00	Y

(a) State the field that could have a Boolean data type.

Field ..... Passengers. (1) ..... [1]

(b) A query-by-example has been written to display just the flight numbers of all planes leaving after 10:00 that only carry passengers.

Field:	Flight number	Passengers	Departure time	
Table:	FLIGHT	FLIGHT	FLIGHT	
Sort:				
Show:	☐	☑	☐	☐
Criteria:		= Y	= 10:00	
or:				

Explain why the query-by-example is incorrect, and write a correct query-by-example.

Explanation ..It is incorrect because it is not showing flight number (2) and Departure time mast be 10:00 or after but it only shows 10:00.

Field:	Flight number	Passenger	Departure time (3)	
Table:	FLIGHT	FLIGHT	FLIGHT	
Sort:				
Show:	☑	☐	☐	☐
Criteria:		=Y	>= 10:00	
or:				

[7]

Examiner Comments

(1) The correct field is identified by the candidate.

Mark for (a) = 1 out of 1

(2) One error – not showing the flight number – is identified correctly by the candidate. However, the statement about the departure time is incorrect.

(3) The show row is correct. However, there is a field missing and the criteria row is incorrect.

Mark for (b) = 2 out of 7

Total mark awarded = 3 out of 8

How the candidate could have improved their answer

The candidate could have identified more than one error correctly and used the required fields and correctly completed both criteria rows.

Common mistakes candidates made in this question

Candidates didn't always realise that flights that carried only passengers were required and included flights that carried passengers and freight.

Examination Questions
14.9 Specimen paper 2016 P2

7 A database ELEMENTS was set up to show the properties of certain chemical elements. Part of the database is shown below.

Name of element	Element symbol	Atomic number	Atomic weight	Melting point (C)	Boiling point (C)	State at room temp
oxygen	O	8	16	–218	–183	gas
iron	Fe	26	56	1538	2861	solid
mercury	Hg	80	201	–38	356	liquid
bromine	Br	35	80	–7	59	liquid
osmium	Os	76	190	3033	5012	solid
caesium	Cs	55	133	28	671	solid
gallium	Ga	31	70	30	2204	solid
argon	Ar	18	40	–189	–186	gas
silver	Ag	47	108	961	2162	solid

(a) How many fields are in each record?

..... [1]

(b) The following search condition was entered:

(Melting point (C) < 40) AND (Atomic weight > 100)

Using Element symbol only, which records would be output?

.....

..... [2]

(c) Which field would be best suited as primary key?

.....[1]

14.10 Summer 2015 P21& 23

7 A database, PROPERTY, was set up to show the prices of properties for sale and the features of each property. Part of the database is shown below.

Property Type	Brochure No	Number of Bedrooms	Number of Bathrooms	Garden	Garage	Price in $
Bungalow	B17	7	4	Yes	Yes	750,000
Apartment	A09	2	1	No	No	100,000
House	H10	4	2	Yes	No	450,000
House	H13	3	2	Yes	No	399000
Apartment	A01	2	2	No	Yes	95000
Apartment	A16	1	1	No	No	150000
House	H23	3	1	No	Yes	250000
House	H46	2	1	Yes	Yes	175000

(a) Give the number of fields that are in each record.

.....[1]

(b) State which field you would choose for the primary key.

.....

Give a reason for choosing this field.

.....

.....[2]

(c) State the data type you would choose for each of the following fields.

Garage .....

Number of Bedrooms .....

Price in $ .....[3]

(d) The query-by-example grid below selects all houses with more than 1 bathroom and more than 2 bedrooms.

Field:	Property Type	Number of Bedrooms	Number of Bathrooms	Price in $	Brochure No
Table:	PROPERTY	PROPERTY	PROPERTY	PROPERTY	PROPERTY
Sort:				Ascending	
Show:	☐	☐	☐	☑	☑
Criteria:	= 'House'	>2	>1		
or:					

Show what would be output.

.....

.....[2]

(e) Complete the query-by-example grid below to select and show the brochure number, property type and price of all properties with a garage below $200,000.

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

[4]

Examiner Report Question 7
(a) Many candidates correctly identified the number of fields in each record.
(b) Most candidates correctly identified the field to choose for the primary key. Better candidates gave a correct reason for their choice.
(c) Nearly all candidates correctly stated at least one data type.
(d) Most candidates correctly showed only the Price in $ and the Brochure No, as identified by the query-by-example grid. Better candidates showed attention to detail, by correctly putting the prices in ascending order and the Price in $ field before the Brochure No field as indicated by the query-by-example grid.
(e) Most candidates correctly identified the fields to include in the query-by-example grid and identified those that were to be shown. A common error was to incorrectly set the criterion for the garage, when the data type had been set as a Boolean field in part (c).

14.11 Summer 2015 P22

6 A database, MARKS, was set up to record the test results for a class of students. Part of the database is shown below.

Student Name	Class ID	Maths	English	Science	History	Geography
Paul Smith	0017	70	55	65	62	59
Ravi Gupta	0009	29	34	38	41	44
Chin Hwee	0010	43	47	50	45	52
John Jones	0013	37	67	21	28	35
Diana Abur	0001	92	88	95	89	78
Rosanna King	0016	21	13	11	27	15

(a) Give the number of fields that are in each record.

.....[1]

(b) State which fields you would choose for the primary key.

.....

Give a reason for choosing this field.

.....

.....[2]

(c) The query-by-example grid below selects all students with more than 60 marks in History or more than 60 marks in Geography.

Field:	Student Name	History	Geography
Table:	MARKS	MARKS	MARKS
Sort:	Ascending		
Show:	✓	☐	☐
Criteria:		>60	
or:			>60

Show what would be output.

.....

.....[2]

(d) Complete the query-by-example grid below to select and show the student names only of all students with less than 40 marks in both Maths and English. [3]

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

Examiner's comments on Question 6

(a) Many candidates correctly identified the number of fields in each record.

(b) Most candidates correctly identified the field to choose for the primary key. Better candidates gave a correct reason for their choice.

(c) Better candidates correctly showed only the student names as identified by the query-by-example grid. Some of these candidates correctly ordered the names in ascending order.

(d) Most candidates correctly identified the fields to include in the query-by-example grid and identified those that were to be shown. A common error was to set the Maths or English criteria to OR rather than AND, where both criteria are on the same row.

14.12 Winter 2015 P21 & 22

6 A picture gallery owner has decided to set up a database to keep information about the pictures he has for sale. The database table, PICTURE, will contain the following fields:
Title; Artist; Description; Catalogue Number; Size (area in square centimetres); Price; Arrived (date picture arrived at gallery); Sold (whether picture is already sold)

(a) (i) State what data type you would choose for each field.

Title .....

Artist .....

Description .....

Catalogue Number .....

Size .....

Price .....

Arrived .....

Sold .....[4]

(ii) State which field you would choose for the primary key.

.....[1]

(b) Give a validation check that you can perform on each of these fields. Each validation check must be different.

Catalogue Number .....

Size .....

Price .....

Arrived .....[4]

(c) Complete the query-by-example grid below to select and show the Catalogue Number, Title and Price of all unsold pictures by the artist 'Twister'.

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

[5]

Examiners' Comments Question 6

(a) (i) Most candidates correctly identified the correct data type for some of the fields. Candidates who did less well throughout, incorrectly used data types from programming rather than database management.
(ii) Most candidates correctly identified the field to choose for the primary key.
(b) Many candidates correctly identified at least one suitable validation check. Candidates with stronger responses throughout identified four different checks; a few candidates incorrectly repeated a validation check.
(c) Many candidates correctly identified the fields to include in the query-by-example grid; stronger responses identified those fields that were to be shown. A common error was to not include the table name.

14.13 Winter 2015 P23

5 A motor boat hire company decides to set up a database to keep information about boats that are available for hire. The database table, BOAT, will contain the following fields:

Boat Name; Model; Engine Power (in hp); Number of Seats; Life Raft (whether there is a life raft kept on the boat); Day Price (price for a day's hire).

(a) Give the data type you would choose for each field.

Boat Name .....

Model .....

Engine Power .....

Number of Seats .....

Life Raft .....

Day Price .....[3]

(b) State a validation check that you can perform on each of these fields. Each validation check must be different.

Boat Name .....

Model .....

Number of Seats .....

Day Price .....[4]

(c) Complete the query-by-example grid below to select and show the Boat Name, Model and Day Price of a day's hire for all boats with 4 seats and an Engine Power of more than 100 hp.

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

[5]

14.14 Summer 2016 P21 &P23

6 A database, STAFFPHONE, was set up to show the telephone extension numbers for members of staff working in a department store.

Name	Department	Extension number
Jane Smith	Toys	129
Sue Wong	Books	124
David Chow	Toys	129
Amy Tang	Household	123
Joe Higgs	Books	124
Jane Smith	Shoes	125
Adel Abur	Shoes	125
Peter Patel	Toys	129

(a) Explain why none of the fields in the database can be used as a primary key.

.....

.....

.....[2]

(b) State a field that could be added as a primary key.

.....

Give a reason for choosing this field.

.....

..... [2]

(c) Use the query-by-example grid below to provide a list of all members of staff, in alphabetical order, grouped by department. [5]

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

14.15 Summer 2016 P22

7 A database, SOFASELECT, was set up to show the prices of suites, sofas and chairs for sale from an online furniture warehouse. Part of the database is shown below.

Description	Brochure Number	Number of Seats	Number of Pieces	Material	Colour	Price in $
Sofa	SF17	2	1	Leather	Red	950
Sofa	SF19	3	1	Vinyl	Black	1,000
Suite	SU10	4	3	Velvet	Green	1,500
Suite	SU23	5	3	Leather	Brown	950
Recliner chair	RC01	1	1	Leather	Cream	600
Chair	CH16	1	1	Vinyl	Red	250
Recliner sofa	RS23	4	1	Leather	Cream	1,200
Chair	CH10	1	1	Velvet	Red	175

(a) How many fields are in each record?

.....[1]

(b) State which field you would choose for the primary key.

.....

Give a reason for choosing this field.

.....

.....[2]

(c) State the data type you would choose for each of the following fields.

Number of Seats .....

Price in $ .....[2]

(d) The query-by-example grid below selects all the furniture in cream leather.

Field:	Description	Material	Colour	Price in $	Brochure Number
Table:	SOFASELECT	SOFASELECT	SOFASELECT	SOFASELECT	SOFASELECT
Sort:				Descending	
Show:	☑	☐	☐	☑	☑
Criteria:		= 'Leather'	= 'Cream'		
or:					

Show the output from the query-by-example.

.....

.....[3]

(e) Complete the query-by-example grid below to select and show the brochure number, material, colour and price of all the furniture with 3 or more seats.

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

[5]

14.16 Winter 2016 P21-23

6 A database, THEATRETOURS, was set up to show the tour dates, towns, number of seats and prices in local currency for a Shakespeare play.

Town	Tour Date	Number of Seats	Price Local Currency
Wigan	18/08/2016	120	15.00
Dumfries	20/08/2016	160	12.50
Turin	25/08/2016	200	17.00
Macon	27/08/2016	75	18.00
Bordeaux	29/08/2016	170	20.00
Algiers	01/09/2016	125	1350.00
Windhoek	05/09/2016	65	90.00
Windhoek	06/09/2016	65	90.00
Port Elizabeth	10/09/2016	200	110.00

(a) Explain why none of the fields in the database can be used as a primary key.

.....

.....

.....[2]

(b) State a field that could be added as a primary key.....

Give a reason for choosing this field.....

.....[2]

(c) Use the query-by-example grid below to provide a list of tour dates and seat prices in alphabetical order of town. [4]

Field					
Table					
Sort					
Show:					
Criteria					
or					

14.17 Winter 2016 P22

5 A database, PLAYPRODUCTION, was set up to show the performance dates, prices and number of seats available at a theatre specialising in Shakespeare productions.

Play	**Performance Date**	**Number Seats Stalls**	**Number Seats Circle**	**Price Stalls Seats $**	**Price Circle Seats $**
As You Like It	01/07/2016	120	90	20.00	30.00
As You Like It	02/07/2016	85	45	30.00	40.00
As You Like It	09/07/2016	31	4	30.00	40.00
Macbeth	14/07/2016	101	56	25.00	35.00
Macbeth	15/07/2016	50	34	25.00	35.00
Macbeth	16/07/2016	12	5	35.00	50.00
Julius Caesar	22/07/2016	67	111	20.00	20.00
Julius Caesar	23/07/2016	21	24	15.00	15.00
A Comedy of Errors	30/07/2016	45	36	35.00	45.00

(a) Give the number of fields that are in each record.

..... [1]

(b) State the data type you would choose for each of the following fields.

Play .....

Number Seats Stalls .....

Price Stalls Seats $ ..... [3]

(c) The query-by-example grid below selects all the productions with more than 100 seats left in either the stalls or the circle.

Field:	Play	Performance Date	Number Seats Stalls	Number Seats Circle
Table:	PLAYPRODUCTION	PLAYPRODUCTION	PLAYPRODUCTION	PLAYPRODUCTION
Sort:	Ascending			
Show:	☑	☑	☐	☐
Criteria:			> 100	
or:				> 100

Show what would be output from the query-by-example.

.....

.....

..... [3]

(d) Complete the query-by-example grid below to select all the productions with at least six seats left in the circle and show the Play, Performance Date and Price Circle Seats $ in Performance Date order. [5]

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

14.18 March 2017 P21 (India)

6 A database table, DEVICE, has been set up to record the electronic equipment used in a small business.

Device ID	Device Type	User	Purchase Date	Purchase Price ($)	Portable
3	Desktop	Alan Swales	14/02/2017	1350.00	N
4	Laptop	Chantel Law	01/02/2016	1460.00	Y
5	Tablet	Abdula Saud	31/12/2016	1000.00	Y
6	Desktop	Abdula Saud	14/03/2017	1000.00	N
7	Laptop	Alan Swales	15/03/2016	1700.00	Y
8	Tablet	TaonaJaji	16/12/2016	470.00	Y

(a) The query-by-example grid below selects certain records.

Field:	User	Portable	Purchase Price ($)
Table:	DEVICE	DEVICE	DEVICE
Sort:	Ascending		
Show:	✓	☐	☐
Criteria:		Y	>1000
or:			

Show what would be the output from the query-by-example.

.....

.....

.....[2]

(b) Complete the query-by-example grid below to select all Desktop devices that were either purchased before 31/12/2016 or cost under $1000. Only show the Device ID and DeviceType.

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

14.19 Summer 2017 P21

7 A television (TV) store has a database table, TVSTOCK, for its new range of televisions. The table stores the screen size of each TV, whether it will show 3D, whether the screen is curved or flat, if the internet is available on the TV, if it has a built-in hard disk drive and the price. Part of the database table is shown below.

TVID	ScreenSize	3D	CurvedFlat	Internet	HDD	Price
TV80CVINT	80	YES	CV	YES	YES	$7,000.00
TV65CVINT	65	YES	CV	YES	YES	$5,000.00
TV60CVINT	60	YES	CV	YES	YES	$4,500.00
TV60FTINT	60	YES	FT	YES	YES	$4,000.00
TV55CVINT	55	YES	CV	YES	NO	$3,000.00
TV55FTINT	55	YES	FT	YES	NO	$3,500.00
TV55FTNIN	55	YES	FT	NO	NO	$3,000.00
TV50CVINT	50	YES	CV	YES	NO	$2,500.00
TV50FTINT	50	YES	FT	YES	NO	$2,000.00
TV50FTNIN	50	YES	FT	NO	NO	$1,750.00
TV42FTINT	42	YES	FT	YES	NO	$1,500.00
TV37FTINT	37	NO	FT	YES	NO	$1,200.00
TV20FTNIN	20	NO	FT	NO	NO	$800.00
TV15FTNIN	15	NO	FT	NO	NO	$400.00

(a) State the type of the field **TVID** and give a reason for your choice.

.....

..... [1]

(b) Complete the table with the most appropriate data type for each field. [3]

Field name	Data type
ScreenSize	
3D	
CurvedFlat	
Internet	
HDD	
Price	

(c) Use the query-by-example grid below to provide a list of all of the curved screen TVs that have a built-in hard disk drive. Make sure the list only displays the TVID, the price and the screen size in ascending order of price. [5]

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

14.20Summer 2017 P22

5 A database table, SHEEP, is used to keep a record of the sheep on a farm. Each sheep has a unique ear tag, EARnnnn; n is a single digit. The farmer keeps a record of the date of birth, the gender and the current weight of each sheep in kilograms.

(a) Identify the **four** fields required for the database. Give each field a suitable name and data type. Provide a sample of data that you could expect to see in the field. [8]

Field 1 name.....

Data type .....

Data sample .....

Field 2 name.....

Data type .....

Data sample .....

Field 3 name.....

Data type .....

Data sample .....

Field 4 name.....

Data type .....

Data sample .....

(b) State the field that you would choose as the primary key.

.....[1]

(c) Using the query-by-example grid below, write a query to identify the ear tags of all male sheep weighing over 10 kilograms. Only display the ear tags. [3]

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

14.21 Winter 2017 P21

6 A wildlife park has a database table, called LIVESTOCK, to classify and record its animal species. Part of the database table is shown.

Species	Classification	Diet	Legs
Giraffe	Mammal	Herbivore	4
Elephant	Mammal	Herbivore	4
Crocodile	Reptile	Carnivore	4
Ostrich	Bird	Omnivore	2
Gorilla	Mammal	Herbivore	2
Bear	Mammal	Omnivore	4
Rhinoceros	Mammal	Herbivore	4
Hippopotamus	Mammal	Herbivore	4
Flamingo	Bird	Omnivore	2
Lion	Mammal	Carnivore	4
Turtle	Reptile	Omnivore	4
Penguin	Bird	Carnivore	2

(a) Suggest another appropriate field that could be added to this database by stating its name and data type. State its purpose and give an example of the data it could contain.

Field name .....

Data Type .....

Purpose .....

.....

Example of data .....[2]

(b) Use the query-by-example grid below to provide a list of all four legged mammals that are herbivores, sorted alphabetically by species, with only the species displayed.

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

14.22 Winter 2017 P22

6 A database table, TRAIN, is to be set up for a railway company to keep a record of the engines available for use. Each engine has a unique number made up of 5 digits, nnnnn. The engines are classified as freight (F) or passenger (P) together with a power classification that is a whole number between 0 and 9, for example F8. The railway company keeps a record of the date of the last service for each engine.

(a) Identify the **three** fields required for the database. Give each field a suitable name and data type. Provide a sample of data that you could expect to see in the field.

Field 1 Name .....

Data type .....

Data sample .....

Field 2 Name .....

Data type .....

Data sample .....

Field 3 Name .....

Data type .....

Data sample .....[6]

(b) State the field that you should choose as the primary key.

.....[1]

(c) Using the query-by-example grid below, write a query to identify all passenger engines that have not been serviced in the past 12 months. Only display the engine numbers. [3]

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

14.23 March 2018 P22 (India)

6 A database table, JEWEL, is used to keep a record of jewellery for sale in a shop. Each item of jewellery can be made of silver, platinum or gold metal. The shop stocks rings, bracelets and necklaces. The number in stock and the price is also stored.

(a) Identify the **four** fields required for the database. Give each field a suitable name and data type. Explain why you chose the data type for each field.

Field 1 Name ..... Data type .....

Explanation ..... .

.....

Field 2 Name ..... Data type .....

Explanation ..... .

.....

Field 3 Name ..... Data type .....

Explanation ..... .

.....

Field 4 Name ..... Data type .....

Explanation ..... .

.....[8] **(**

b) Explain why none of these fields could be used as a primary key.

..... .

.....[1] **(**

c) Using the query-by-example grid below, write a query to identify the silver bracelets. Only display the number in stock and the price.

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

Comments on Question 6

(a) *Nearly all candidates identified some appropriate fields and could also provide a suitable data type and explanation. Many candidates provided excellent answers worth full marks.*

(b) *Nearly all candidates gave a correct explanation as to why none of the fields were suitable use as a primary key.*

(c) *Nearly all candidates correctly identified the fields required in the query-by-example grid. Most candidates correctly identified which fields to show. Many candidates provided suitable criteria to identify that only details of silver bracelets were required.*

14.24Summer 2018 P21

6 A database table, PERFORMANCE, is used to keep a record of the performances at a local theatre.

Show Number	Type	Title	Date	Sold Out
SN091	Comedy	An Evening at Home	01 Sept	Yes
SN102	Drama	Old Places	02 Oct	No
SN113	Jazz	Acoustic Evening	03 Nov	No
SN124	Classical	Mozart Evening	04 Dec	Yes
SN021	Classical	Bach Favourites	01 Feb	Yes
SN032	Jazz	30 Years of Jazz	02 Mar	Yes
SN043	Comedy	Street Night	03 Apr	No
SN054	Comedy	Hoot	04 May	No

(a) State the number of fields and records in the table.

Fields .....

Records .....[2]

(b) Give **two** validation checks that could be performed on the **Show Number** field.

Validation check 1 .....

.....

Validation check 2 .....

..... [2]

(c) Using the query-by-example grid, write a query to identify jazz performances that are not sold out. Only display the date and the title. [4]

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

14.25Summer 2018 P21

6 A database table, TREES, is used to keep a record of the trees in a park. Each tree is given a unique number and is examined to see if it is at risk of dying. There are over 900 trees; part of the database table is shown.

Tree Number	Type	Map Position	Age in Years	At Risk
TN091	Acacia	A7	250	Y
TN172	Olive	C5	110	N
TN913	Cedar	B9	8	N
TN824	Banyan	A3	50	Y
TN021	Pine	D5	560	Y
TN532	Teak	C8	76	Y
TN043	Yew	B1	340	N
TN354	Spruce	D4	65	N
TN731	Elm	B10	22	Y
TN869	Oak	C9	13	N
TN954	Pine		3	N

(a) State the number of fields in the table.

.....[1]

(b) The tree numbering system uses TN followed by three digits. The numbering system will not work if there are over 1000 trees.

Describe, with the aid of an example, how you could change the tree numbering system to allow for over 1000 trees. Existing tree numbers must not be changed.

.....

.....

.....

.....[2]

(c) Using the query-by-example grid, write a query to identify at risk trees over 100 years old. Display only the type and the position on the map. [4]

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

14.26 Winter 2018 P21

6 A database table, PORTRAIT, is used to keep a record of the portraits available from a photographic studio. Each portrait has a unique reference number PICnnn, where n is a single digit, for examplePIC123. The studio keeps a record of the size (for example 20 × 15), the type (black and white or colour), and the price in dollars.

(a) Complete the table to show the most appropriate data type for each of the fields.[4]

Field	**Data type**
Reference Number	
Size	
Type	
Price in $	

(b) The results from the query-by-example grid should show the reference number, price, type and size of all portraits under $50. Identify the **three** errors in the query-by-example grid.

Field:	Reference No	Price in $	Type	Size
Table:	PORTRAIT	PORTRAIT	PORTRAIT	PORTRAIT
Sort:				
Show:	☑	☑	☐	☑
Criteria:		>50.00		
or:				

Error 1 .....

.....

Error 2 .....

.....

Error 3 .....

.....[3]

14.27 Winter 2018 P23

6 An online fruit tree specialist sells fruit trees in various sizes. A database table, TREETAB, shows the tree type and, for each size, the price and whether they are in stock.

Tree Type	Size1	Size1 In	Size2	Size2 In	Size3	Size3 In
Apple	10.95	Yes	14.95	Yes	29.95	Yes
Apple	12.95	Yes	14.95	Yes	29.95	Yes
Cherry	24.95	No	34.95	No	59.95	Yes
Fig	19.95	Yes	29.95	No	49.95	Yes
Guava	19.95	No	29.95	No	59.95	No
Nectarine	8.50	Yes	11.95	Yes	19.95	Yes
Olive	19.95	No	39.95	Yes	59.95	Yes
Peach	9.25	No	11.95	Yes	19.95	Yes
Pear	10.95	Yes	14.95	Yes	29.95	Yes
Plum	8.95	Yes	11.95	Yes	19.95	Yes
Pomegranate	12.95	No	18.95	Yes	34.95	No
Quince	34.95	Yes	44.95	Yes	84.95	No

(a) State whether any of the fields shown would be suitable as a primary key.

.....

Explain your answer

.....

.....

.....[2]

(b) Complete the table to show the most appropriate data type for each of the fields based on the data shown in the table at the start of question 6. [3]

Field	Data type
Tree Type	
Size3	
Size2 In	

(a) Show the output that would be given by this query-by-example.

Field:	Tree Type	Size 1	Size 1 In	
Table:	TREETAB	TREETAB	TREETAB	
Sort:		Descending		
Show:	☑	☑	☑	☐
Criteria:		<10.00		
or:				

.....

.....

.....

.....[4]

(d) Using the following query-by-example grid, write a query to identify all types of the fruit trees that are out of stock for all three sizes. Make sure the type of the tree and the various 'in stock' fields are shown. The trees should be listed in alphabetical order by type.

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

14.28 March 2019 P22

6 A database table, BIKETYRES, is used to keep a record of tyres for sale in a cycle shop.

Tyres are categorised by width and diameter in milimetres, whether they have an inner tube and the type of terrain for which they are designed.

Tyre Code	Width	Diameter	Tube	Terrain	Stock Level
SLTT	23	700	YES	Asphalt	18
MLNT	24	700	NO	Asphalt	23
LLNT	28	700	NO	Asphalt	19
SLTM	23	700	YES	Mixed	22
MLTM	24	700	YES	Mixed	14
LLTM	28	700	YES	Mixed	12
SLTH	23	700	YES	Hard	10
MLTH	24	700	YES	Hard	5
LLNH	28	700	NO	Hard	7
SLNM	23	700	NO	Mixed	12
MLNM	24	700	NO	Mixed	22
LLNM	28	700	NO	Mixed	18
SSNT	23	650	NO	Asphalt	10
MSNT	24	650	NO	Asphalt	8
SSTM	23	650	YES	Mixed	5
MSNM	24	650	NO	Mixed	4

The query-by-example grid below displays the tyre code and the stock level of all 28mm width tyres suitable for mixed terrain.

Field:	Tyre Code	Stock Levl	Width	Terrain
Table:	BYKETYRES	BYKETYRES	BYKETYRES	BYKETYRES
Sort:				
Show:	☑	☑	☐	☐
Criteria:			=28	='Mixed'
or:				

Alter the query to show the tyre code and stock level in ascending order of stock level for all 24mm asphalt terrain tyres. Write the new query in the following query-by-example grid.

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

14.29 Summer 2019 P21

5 The table, BEVERAGES, shows the number of calories in 100ml of a range of popular beverages. It also shows the availability of these drinks in a can, a small bottle and a large bottle.

BevNo	BevName	Calories	Can	Small Bottle	Large Bottle
Bev01	Cola	40	Yes	Yes	Yes
Bev02	Lime	45	Yes	No	Yes
Bev03	Energy Drink 1	52	Yes	Yes	No
Bev04	Energy Drink 2	43	Yes	No	No
Bev05	Mango	47	Yes	No	Yes
Bev06	Lemon Iced Tea	38	Ye	No	Yes
Bev07	Lemonade	58	Yes	Yes	Yes
Bev08	Orange Juice	46	Yes	Yes	No
Bev12	Apple Juice	50	Yes	Yes	No
Bev15	Chocolate Milk	83	Yes	Yes	No

(a) Give a reason for choosing BevNo as the primary key for this table.

.....

..... [1]

(b) State the number of records shown in the table BEVERAGES.

..... [1]

(c) List the output that would be given by this query-by-example.

Field:	BevNo	BevName	Can	Small Bottle	Large Bottle
Table:	BEVERAGES	BEVERAGES	BEVERAGES	BEVERAGES	BEVERAGES
Sort:		Descending			
Show:	☑	☑	☐	☐	☐
Criteria:			= "Yes"	= "Yes"	= "Yes"
or:					

.....

.....

.....

..... [3]

(d) Complete the query-by-example grid to output a list showing just the names and primary keys of all the beverages with a calorie count greater than 45. The list should be in alphabetical order of names. [4]

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

14.30 Summer 2019 P22

6 A database table, FLIGHT, is used to keep a record of flights from a small airfield. Planes can carry passengers, freight or both. Some flights are marked as private and only carry passengers.

Flight number	Plane	Notes	Departure time	Passengers
FN101	Caravan 1	Private passenger flight	08:00	Y
CN101	Caravan 2	Freight only	08:30	N
CN102	Piper 1	Freight only	09:00	N
FN104	Piper 2	Passengers only	09:20	Y
FN105	Piper 1	Freight and passengers	10:00	Y
FN106	Caravan 1	Passengers only	10:30	Y
CN108	Caravan 2	Freight only	08:00	N
CN110	Lear	Private passenger flight	08:00	Y

(a) State the field that could have a Boolean data type.

Field ..... [1]

(b) A query-by-example has been written to display just the flight numbers of all planes leaving after 10:00 that only carry passengers.

Field:	Flight number	Passengers	Departure time		
Table:	FLIGHT	FLIGHT	FLIGHT		
Sort:					
Show:	☐	☑	☐		
Criteria:		=Y	= 10:00		
or:					

Explain why the query-by-example is incorrect, and write a correct query-by-example. [7]

Explanation .....

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