GCST

1.3.2
DATABASES
TOPIC WISE EXAM QUESTIONS

A-LEVEL OCR

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SPEC

1.3.2 Databases	a) Relational database, flat file, primary key, foreign key, secondary key, entity relationship modeling, normalisation and indexing. See appendix 5g. b) Methods of capturing, selecting, managing and exchanging data. c) Normalisation to 3NF. d) SQL - Interpret and modify. See appendix 5d. e) Referential Integrity. f) Transaction processing, ACID (Atomicity, Consistency, Isolation, Durability), record locking and redundancy.	Candidates need to understand what is meant by a database. Candidates should be familiar with basic database terminology such as fields, records and tables. Candidates should know the difference between a flat file and a relational database, and be able to explain the benefits and limitations of each approach. Candidates should be able to use Normalisation to produce a suitable database schema and explain the benefits of doing so. They should be able to normalise up to 3NF. Candidates should know and be able to apply the criteria for 1NF, 2NF and 3NF. Candidates should know what is meant by a primary key, foreign key and secondary key and how each are used in a database. Candidates should be able produce and follow Entity relationship diagrams which include 1:1, 1:M and M:M relationships. They should be able to identify how tables should be linked. Candidates need to have an awareness of a range of methods for capturing data (such as forms, OCR, OMR and sensors) selecting data (such as Query By Example and SQL), managing data (such as changing data by manipulating it – e.g. arithmetic functions, adding, editing, deleting the data) and exchanging data (with commons formats such as CSV and JSON). Candidates won't be specifically asked about any one of these methods but may be asked to discuss/justify suitable methods as part of a more open question. Candidates need to have an understanding of the need to interrogate data within a database. Candidates should understand the purpose of indexing in a database and the benefits of using indexing to optimise the searching for data. Candidates need to have experience of a range of methods for capturing data (such as forms – what do they collect, what do they look like - data mining, where does the data come from, how is it collected and analysed), selecting data (such as how to produce QBEs – adding fields, tables, criteria, sorting - selecting through Boolean expressions – AND, OR, NOT), managing data (such as changing data by manipulating it – e.g. arithmetic functions - , adding, editing, deleting the data) and exchanging data (such as methods of transferring data – electronic i.e. memory stick, e-mail, and non-electronic e.g. paper based - appropriate formats for the transfer of data and communication mediums to transfer data – such as the structure, is it in a table or a list). Candidates should have experience of using SQL to edit and modify data in a database. They should understand the need for SQL as a standard language. Candidates should be able write and follow scripts using the SQL commands listed in appendix 5d. Candidates need to understand what is meant by referential integrity, and why this is desirable in a database. Candidates should understand what is meant by transaction processing, and scenarios where transaction processing takes place. Candidates should understand the problems that arise from transaction processing, and how these can be overcome. Candidates should understand the ACID rules for transaction processing, and why databases should be built to these standards. Candidates should understand how record locking prevents the overriding of data, and understand how record locking takes place.

4 A team of programmers create a robot that will be used in a factory. The robot will be able to do the work of multiple humans.

(f) Details of all users that have accessed the robot are stored in a database table called `TblAccessLog`. This table stores the username and user type of each user. When a user accesses the robot, the current date is added to the `DateAccessed` field for that user.

A selection of the data from this table is shown here. Username is the key field.

Username	UserType	DateAccessed
Mrphy003	User	08/05/21, 07/06/21, 08/06/21
Lwis076	Admin	17/04/21, 19/07/21
Bbby412	NotNeeded	01/06/21, 02/07/21, 14/07/21

TblAccessLog

(i) Write an SQL statement to delete all records from the table `TblAccessLog` for users who have a UserType of `"NotNeeded"`.

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..... [2]

(ii) State **two** requirements for a database to be in First Normal Form (1NF).

1 .....

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2 .....

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[2]

(iii) Explain why the structure of `TblAccessLog` means that this database is **not** in First Normal Form (1NF).

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..... [2]

4 OCRConfectionery is a sweet manufacturing company.

They want to use a relational database to store details of the orders their customers make.

(a) State **two** benefits of using a relational database instead of a flat file database.

1 .....

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2 .....

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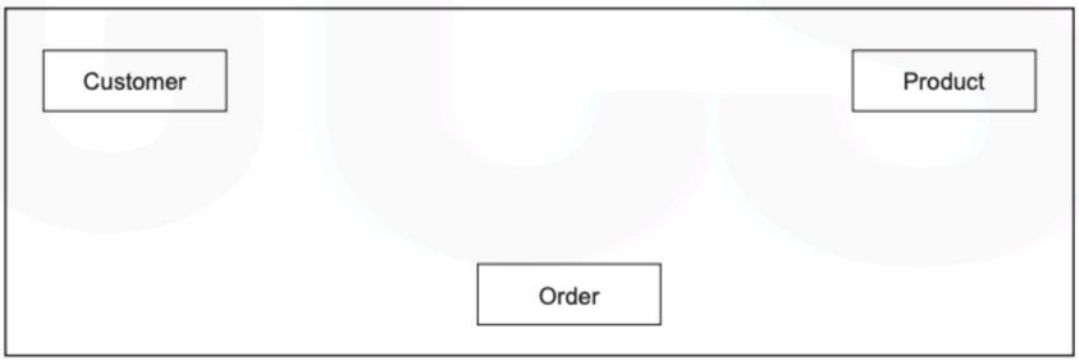
[2]

(b) One customer can order as many different products as they like in the same order. A customer can also place as many orders as they like.

One product can be ordered multiple times in the same order or ordered by multiple different customers.

Complete the entity relationship diagram to show the relationships between the Product, Customer and Order entities.



'2]

(c) The order table has these fields.

OrderID OrderDate OrderAmount CustomerID ProductID

(i) State the difference between a primary key and a foreign key.

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..... [2]

(ii) State **one** foreign key in the order table.

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..... [1]

(iii) State why CustomerID would not make a suitable primary key in the order table.

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..... [1]

2 A video streaming service uses a relational database. An extract of the data from two tables from this database is shown in **Fig. 2**.

`Membership` contains data about current memberships that customers hold and `package` contains data about different streaming packages available.

Username	FirstName	StartDate	PackageType
User001	Amaya	08/05/2016	Premium
User002	Amit	06/06/2019	Basic
User003	Tom	17/08/2019	Free
User004	Kareem	08/08/2017	Basic
User005	Sarah	25/03/2020	Premium

Membership

PackageType	CostPerMonth(£)	Adverts
Premium	12.99	false
Basic	7.99	true
Free	0.00	true

Package

Fig. 2

(a) (i) State what is meant by the term 'primary key'.

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

(ii) Identify the foreign key used in the database and the table name where this is a foreign key.

Foreign Key .....

.....

Table Name .....

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[2]

(b) The `Adverts` field indicates if customers will be shown adverts. `true` indicates that customers will be shown adverts, and `false` indicates that adverts are not shown.

Write Structured Query Language (SQL) to return the `Username` and `FirstName` fields for all customers who see adverts.

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..... **[5]**

(c) When new customers join the streaming service, their name, email address and contact details are captured so that they can be entered into the database.

(i) Identify **one** method of capturing a new customer's personal data, describing why this method is suitable.

Method .....

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Suitability .....

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[3]

(ii) Sometimes the company may need to move or backup its data they hold about customers.

Identify **two** methods of exchanging data with other computer systems.

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2 .....

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[2]

(d) The database supports ACID transactions. ACID stands for Atomicity, Consistency, Isolation and Durability.

(i) Describe what is meant by a transaction being durable.

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..... **[2]**

(ii) Give **one** way that durability can be achieved for a completed transaction.

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

(iii) Explain how record locking can be used to ensure that the ACID principle of isolation is achieved when carrying out multiple transactions.

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..... **[3]**

(iv) Give **one** disadvantage of using record locking.

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

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2021

1 OCR Insurance uses a computer system to calculate the price that customers pay for car insurance.

(d) Customers' details are stored in the flat file database table `Customer`. An extract of the table is shown below.

CustomerID	Surname	Title	Phone	CarReg
JJ178	James	Mr	(0121) 343223	DY51 KKY
HG876	Habbick	Miss	(01782) 659234	PG62 CRG
EV343	Elise	Mrs	(07834) 123998	HN59 GFR
PG127	Pleston	Mr	(07432) 234543	JB67 DSF

(i) State what is meant by the term 'primary key', identifying the primary key in the table above.

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..... **[2]**

(ii) Write the SQL statement that would show only the `CustomerID` and `Surname` fields for customers with the `Title` "Miss" or "Mrs".

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..... **[4]**

(iii) Describe **one** problem that would arise with the flat file database structure if a customer wanted to insure more than one car at the same time.

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..... **[2]**

(iv) Describe how the flat file database structure could be altered to efficiently allow each customer to insure multiple cars at the same time. (You may assume each car is insured to only one customer.)

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..... **[5]**

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2020

1 A hotel uses a computer system to keep track of room bookings. The hotel staff are able to query a database to discover which rooms are booked or which rooms are free.

(d) The hotel stores data about rooms, customers and bookings in a database. Each customer can book multiple rooms and each room can be booked multiple times.

(i) Draw an Entity Relationship Diagram for this database.

[4]

(ii) Define what is meant by the term 'foreign key', giving **one** example of where a foreign key would be used in the hotel booking database.

Definition .....

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Example .....

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[3]

The hotel booking database enforces referential integrity.

(e) Explain what is meant by the term 'referential integrity' and how this could potentially be broken.

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..... **[2]**

7 RestaurantReview is a website that allows users to leave reviews and ratings for different restaurants.

The website uses a database with the following structure.

The database management system ensures referential integrity is maintained.

(a) Explain what is meant by referential integrity, giving an example which refers to the database described above.

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..... **[3]**

Whenever a review is added to the system, the restaurant's average rating is updated. This transaction is ACID.

The A in ACID refers to Atomic.

(c) Describe what is meant by the term 'Atomic' in the context of ACID transactions. You should refer to the example of a review being added.

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..... **[2]**

(d) State what the letters CID refer to in ACID.

C .....

I .....

D .....

[3]

3 An airport holds details of flights in a database using the table `Flight`. An extract of the table is shown below.

FlightID	FlightNumber	DestinationCode	DestinationName	DepartureDate	DepartureTime
1355	OC0089	JFK	John F. Kennedy	03/07/18	09:50
1453	CS1573	LHR	Heathrow	03/07/18	10:30
1921	OC7750	JFK	John F. Kennedy	04/07/18	08:30
1331	AM0045	YHZ	Halifax	04/07/18	14:25
1592	HB0326	RTM	Rotterdam	04/07/18	19:10
1659	CS0123	LHR	Heathrow	04/07/18	07:20

(a) Describe what the SQL statement below does.

```
SELECT FlightNumber FROM Flight WHERE DestinationCode='JFK'
```

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..... **[2]**

The airport cancels all its flights to Heathrow on 4th July 2018.

(b) The SQL statement below shows all the data for flights going to Halifax. Rewrite it so it instead removes all flights to Heathrow on 4th July 2018.

```
SELECT * FROM Flight WHERE DestinationName='Halifax'
```

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..... **[3]**

(c) Tables often have primary and secondary keys.

(i) State why `DestinationCode` would **not** be a suitable primary key for the `Flight` table.

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

(ii) State why `DestinationCode` would be a suitable secondary key for the `Flight` table.

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

(d) The airline wishes to ensure the database is normalised.

(i) Describe why the database can be considered to be in First Normal Form.

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..... **[2]**

(ii) Describe why the database can be considered to be in Second Normal Form.

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..... **[2]**

(iii) Describe why the database can **not** be considered to be in Third Normal form.

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..... **[2]**

(e) The airport wishes to allow airlines to be able to access the data it has on flights via the internet.

Describe **one** format or method the airport could use to provide the data to the airlines so they can use it in their own applications.

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..... **[2]**

7 A web forum stores all its content in a database.

(a) The forum stores details of its users in the table called `Users`. An extract of `Users` is shown below.

userID	username	passwordHash	locked
1	Zeus	8dfa46a79248037752bba6166fcb34f8	1
2	Hera	74d39d60507eb55e000c6ec5c1265891	0
3	Poseidon	b015d770d0208ddcce2c2c719fe29371	0

Describe what is meant by the term 'primary key', giving an example from the table above.

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..... [2]

(c) Write an SQL statement to get just the `passwordHash` and `locked` values of the user `Apollo`.

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..... [3]

(d) Sometimes users can have their accounts locked if they behave inappropriately. When this is the case the `locked` field is set to 1 rather than 0.

Write an SQL statement that locks the account of the user `Hades`

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..... [3]

6 An insurance company's offices have a large number of black and white printers.

The company's technicians keep accurate records of the printers in the building, and the quantity of toner cartridges in stock, in a flat file database. An extract of the database is shown in Fig. 1.

Printer Model	Location	Notes	Cartridge Code	Quantity in stock	Re-order URL
LasPrint LP753	office 3		LP-7XB	12	www.megacheapprint.com/toner/LP-7XB
LasPrint LP710	office 6	drum replaced	LP-7XB	12	www.megacheapprint.com/toner/LP-7XB
Zodiac ZN217	reception		Zod17	4	www.zodiaclaserprinting.com/shop/Z17
Zodiac ZN217	conference Room 2	had to add RAM	Zod17	4	www.megacheapprint.com/toner/LP-7XB
LasPrint LP753	office 8		LP-7XB	12	www.megacheapprint.com/toner/LP-7XB

Fig. 1

(a) Describe **two** issues, referring to Fig. 1, that might arise from using a flat file database structure.

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2 .....

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..... **[4]**

A relational database is created with three tables:

- PrinterModel: this stores all the data about each model of printer
- PrinterInstance: this stores the data about each individual printer in the building
- Cartridge: this stores information about the toner cartridges.

(b) Draw an entity-relationship diagram to show the relationships between the three tables.

[4]

(b). The Big Brains exam board has produced a website that allows students to access revision videos.

All pages in the site contain the following tag in the head section.

```
<link href="themes/standard.css" rel="stylesheet" type="text/css" />
```

The exam board wants to use a database to keep track of which videos each student has viewed. The structure it plans to use is shown below:

(i) Identify **one** reason why this structure would not be suitable.

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[1]

(ii) Draw a new version of the structure to solve this problem.

[3]

2(a). A database stores information about songs on a music streaming service.

One of the tables called `Song` has the fields.

```
Title, Artist, Genre, Length
```

Explain why none of these fields would be suitable as a primary key.

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[2]

(b). Give **one** advantage and **one** disadvantage of indexing the field Artist.

Advantage .....

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Disadvantage .....

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[2]

3(a). A company sells garden furniture. It has decided to create a relational database. A first, incomplete database design includes two tables PRODUCT and ORDER.

PRODUCT (ProductId, ProductType, Size, Price,...)
ORDER (OrderId, OrderDate, ProductId,...)

For example, the product which has ProductId 12345 is a large bench which has a price of £150.

State **one** additional piece of data which should be included in PRODUCT and give **one** reason why it is needed.

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.....[2]

(b). A CUSTOMER table is added. An entity-relationship (E-R) diagram is shown.

Explain why this design would be inefficient for customers.

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.....[2]

4(a). Every bank account has an account number and sort code. The sort code identifies the bank branch (location of the bank) with which the account is held and the account number uniquely identifies the bank account. An extract from a bank's database table is shown in Fig. 5.1.

CustomerID	Forename	Surname	Acc No	Sort Code	Branch Name
145204	Elaine	Murray	14725200	67-34-56	Hull
657875	Jordan	Rogers	62703441	67-45-67	Truro
735951	Monim	Khan	96385547	67-00-11	Cambridge
744078	Tom	Banner	45623929	67-00-11	Cambridge

Fig. 5.1

State why the table in Fig. 5.1 is not in Third Normal Form.

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[1]

(b). Explain how the database could be put into Third Normal Form.

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[3]

If you found this useful, drop a follow to help me out!

THANK YOU!

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