

Unit 4: Exchanging Data
(4b. Databases, A Level Only Content)

Marks: /61

Answer all the questions.

1(a). The video table consists of the following fields: VideoID, VideoName, Presenter, Topic.

(i) Describe what is meant by the term *primary key*.

----- [2]

(ii) Write an SQL query that finds the name and presenter of all videos on the Topic of "The CPU".

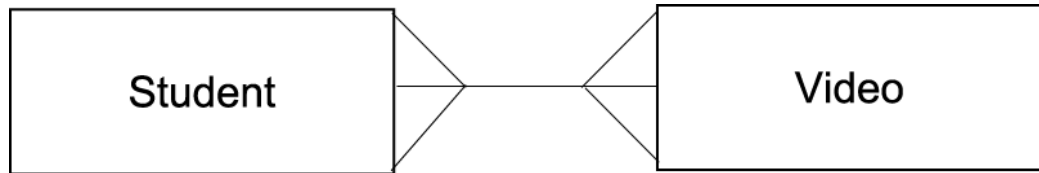
----- [4]

(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.

[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.

----- [2]

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

Advantage -----

Disadvantage -----

[2]

(c). A band called *RandomBits* removes their permission for their songs to be streamed.

The company removes all the songs belonging to *RandomBits* from their service.

(i) Identify the law with which the company are complying.

----- [1]

(ii) Write an SQL statement that will remove all songs by *RandomBits* from the table `Song`.

----- [2]

(iii) When the songs have been removed, explain what must happen to the table `PlayListEntry` if the database is to retain its referential integrity. (You are not expected to write the SQL to do this).

----- [1]

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.

----- [2]

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



Explain why this design would be inefficient for customers.

----- [2]

(c). Some of the Structured Query Language (SQL) for this database is

```
SELECT Surname, Title, PhoneNo  
FROM CUSTOMER  
WHERE Town = "Coventry"  
ORDER BY Surname
```

Describe the purpose of this code and give **one** situation in which it may be used.

[5]

- 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.

----- [1]

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

----- [3]

(c). An extract from the database is shown below:

userID	name	passwordHash
1	admin	0e5a511
2	DenverJ34	f60ccdc
3	TaylorJ22	3a050bc

(i) The username admin is entered into the form.

State what the value of statement would be after line 03 of the code in Fig. 8 .1 is run.

----- [1]

(ii) State what the value of hashInDB would be after line 04 of the code in Fig. 8.1 is run.

----- [1]

(d). In SQL the character ; denotes the next statement and the characters — denote a comment.

The username DenverJ34'; DROP TABLE users; — is entered into the form.

(i) State what the value of statement would be after line 03 is run.

----- [1]

(ii) Describe what happens when line 04 is run.

----- [2]

(iii) State the name of a law the user has broken by entering the username DenverJ34'; DROP TABLE users; --

----- [1]

6(a). A web forum stores all its content in a database.

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

<code>userID</code>	<code>username</code>	<code>passwordHash</code>	<code>locked</code>
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.

----- [2]

(b). The user's password is passed to a function that generates a hash and the result is stored in `passwordHash`.

(i) Describe what is meant by the term 'hash'.

----- [1]

(ii) Describe **one** advantage to storing the password as a hash.

----- [2]

(c).

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

[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`

[3]

(e). The function `checkAccess` takes in the password the user has entered (`givenPassword`) along with the password hash (`passwordHash`) and locked value (`locked`).

`passwordHash` and `locked` have already been extracted from the database before being passed to the function. It should return the value `true` if a user should be allowed access to a system and `false` if they aren't.

Your function should make use of the pre-written function `hash()` which takes in a string and returns the hash of that string.

e.g.

`hash("Hello")` returns `f7ff9e8b7bb2e09b70935a5d785e0cc5d9d0abf0`

Complete the function `checkAccess`.

```
function checkAccess (givenPassword, passwordHash, locked)
```


endfunction

[4]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a	i	<ul style="list-style-type: none"> A field that has a unique value / a unique identifier (1) for every record in that table (1) – in this case VideoID (1). 	2	Up to 2 marks for a valid description.
		ii	<ul style="list-style-type: none"> SELECT VideoName, Presenter (1) FROM Video (1) WHERE Topic (1) =“The CPU” (1). 	4	For 4 marks. Do not award first mark if any other field or SELECT * SELECT VideoName, Presenter FROM Video WHERE Topic=“The CPU”
	b	i	<ul style="list-style-type: none"> Many to Many relationships are not allowed / in 3NF (1). 	1	For 1 mark.
		ii	<ul style="list-style-type: none"> Table added between student and video (1). Student to middle table 1:M relationship (1). Middle table to video M:1 relationship (1). 	3	For 3 marks.
			Total	10	
2	a		<ul style="list-style-type: none"> – A primary key must have a unique value for every record – The values for all these fields could repeat. (1 per –)	2	
	b		<ul style="list-style-type: none"> – Advantage: Searches of Artist can be performed more quickly. – Disadvantage: The index takes up extra space in the database. (1 per –)	2	
	c	i	Copyright, Design and Patents Act	1	Accept Copyright Act / Law
		ii	<ul style="list-style-type: none"> - DELETE FROM Song - WHERE Artist='RandomBits' (1 mark per –, max 2)	2	
		iii	All entries in PlaylistEntry which contain songs by RandomBits must be removed.	1	
			Total	8	

Question		Answer/Indicative content	Marks	Guidance
3	a	<p><i>e.g.</i></p> <ul style="list-style-type: none"> • NoInStock... • ...to check stock levels / allow re-ordering • Location (in warehouse)... • ...to find item when needed 	2	<p>Marks for single example with reason only</p> <p>Accept other relevant examples</p> <p>Examiner's Comments</p> <p>A very open ended question that was designed to test candidates' ability to hypothesise about what should be in a database, most candidates achieved a creditable answer.</p>
	b	<ul style="list-style-type: none"> • Only one product can be on an order • Customer would have to make a separate order for each product required 	2	<p>Examiner's Comments</p> <p>A few candidates showed a lack of understanding of the E-R Diagram and said that customers would not be able to see the products, but most were able to correctly analyse what was asked for.</p>
	c	<ul style="list-style-type: none"> • Lists attributes Surname, Title, PhoneNo • from the table CUSTOMER • for all customers in Coventry • in ascending order of Surname • e.g. for local promotions / new store opening 	5	<p>Accept other relevant purposes</p> <p>Allow A - Z / alphabetical</p> <p>Examiner's Comments</p> <p>Another question that was targeted at precise technical language, it was clear from the candidates responses that some only had very superficial knowledge of this topic.</p>
		Total	9	

Question		Answer/Indicative content	Marks	Guidance
4	a	Branch name depends on Sort Code (i.e. there is a transitive relationship).	1	
	b	<p>Create another table for Branches which should include sort-code and branch name. (1) Make sort code the primary key of the BRANCH table/ Add a primary key to BRANCH. (1) Remove Branch name from Customers, leave sortcode as primary key/ Remove sort-code and branch name from customers and add the primary key values from BRANCS as the foreign key (1)</p> <p>ALTERNATIVE ANSWER (ER-DIAGRAM) Two tables CUSTOMER and BRANCH (or similar names) (1) Link from CUSTOMER to BRANCHES is Many (1) to One (1)</p>	3	
		Total	4	

Question		Answer/Indicative content	Marks	Guidance	
5	a	<p>Any five from:</p> <p>Takes the username and password from the form (1)</p> <p>Uses the username to create an SQL statement (1) to get the passwordHash belonging to the given username (1) Runs the SQL Statement (1) hashes the given password and compares it to the retrieved hash (1)</p> <p>If they match it generates a success webpage, otherwise it records the user's IP address. (1)</p>	5		
	b	i	<p>Any two from:</p> <p>A numerical address made of 4 numbers each between 0 and 255 / 32 hexadecimal digits (1)</p> <p>That uniquely identifies a device on a network. (1)</p> <p>It is a logical identifier (i.e. can change on a physical device) (1)</p>	2	
		ii	<p>IP address can help identify a user... (1)</p> <p>...so company can potentially track users attempting to gain unauthorised access (1)</p>	2	
	c	i	<p>SELECT passwordHash FROM users WHERE name = 'admin'</p>	1	
		ii	<p>0e5a511</p>	1	
	d	i	<p>SELECT passwordHash FROM users WHERE name = 'DenverJ34'; DROP TABLE users; --</p>	1	
		ii	<p>Gets passwordHash for username DenverJ34 (1)</p> <p>then deletes the table called users. (1)</p>	2	
		iii	<p>Computer Misuse Act</p>	1	
Total			15		

Question		Answer/Indicative content	Marks	Guidance
6	a	A field which has a unique value for every record / A unique identifier. (1) E.g. userID (1)	2 (AO1.1 – 1, AO2.1 -1)	Examiner's Comments Well received and answered by most candidates.
	b	i	A result generated by applying an algorithm / numeric process to a value. (1)	1 (AO1.1)
		ii	Hash functions are one way / can't be reverse (1) If someone gains access to the database they cannot access user's password. (1)	2 (AO1.2 1 mark, AO2.1 1 mark) Examiner's Comments Many candidates achieved the mark in part i) few achieved both marks in part ii) mostly stating as opposed to describing the advantage e.g. 'those who gain unauthorised access cannot access passwords' without going on to say 'hash functions are one way'.
	c		SELECT passwordHash, locked (1) FROM Users (1) WHERE username='Apollo' (1)	3 (AO 3.2) Examiner's Comments In most cases, candidates who achieved marks in c) went on to achieve marks in d) with few candidates achieving all marks in either. Many candidates did not use correct SQL statement structure or syntax e.g. confusing attribute names with string literals.

Question		Answer/Indicative content	Marks	Guidance
	d	<p>UPDATE Users (1) SET locked=1 (1)</p> <p>WHERE username='Hades' (1)</p>	<p>3</p> <p>(AO 3.2)</p>	<p>Allow other updating method e.g. a DELETE statement followed by an INSERT statement, for full marks e.g.</p> <pre>DELETE FROM Users WHERE username = 'Hades' (1 mark) INSERT INTO Users (1 mark) VALUES (<userID value>,'Hades',<passwordHash value>,1) (1 mark)</pre> <p>Examiner's Comments In most cases, candidates who achieved marks in c) went on to achieve marks in d) with few candidates achieving all marks in either. Many candidates did not use correct SQL statement structure or syntax e.g. confusing attribute names with string literals.</p>
	e	<p>Takes a hash of givenPassword (NB this may be done inline e.g. if hash (givenPassword)==passwordHash and locked==0 then (1)</p> <p>Returns true if password is correct and account is unlocked. (1)</p> <p>Returns false if account is locked (1)</p> <p>Returns false if password is incorrect (1)</p>	<p>4</p> <p>(AO 3.2)</p>	<p>Example code:</p> <pre>temp = hash(givenPassword) if temp==passwordHash and locked==0 then return true else return false endif</pre> <p>Candidates may have taken a different approach - any solution that fulfils the criteria on the left should get them marks.</p> <p>Examiner's Comments Candidates were asked to complete a function in this question. Although many students demonstrated reasonable logic in solving this problem, some used output statements rather than returned values from the function, therefore, not gaining full marks.</p>
		Total	15	