

THEME A: CONCEPTS · A3.1

Database fundamentals — Mark scheme

33 marks · covers A3.1.1

How to mark. Each creditworthy point is on its own line and ends with a semicolon (;). A line beginning with ... is an *expansion* of the line above it, so the pair is worth the marks shown. A slash (/) separates acceptable alternative wordings. Words in (brackets) are not needed for the mark. Mark positively: credit what the student has got right rather than penalising what is missing, and accept any valid alternative not listed here. Do not award more than the maximum for a part. Where a later part uses a wrong answer from an earlier part correctly, award follow-through marks (FT). HL marks parts that assess higher level only content.

Q	ANSWER	MARKS
1(a) A3.1.1	Award [1] max An attribute (or set of attributes) whose value is unique for every record, so that each row in the table can be identified without ambiguity;	1
1(b) A3.1.1	Award [3] max Award [1] per point up to [3] max. It is a foreign key; It holds the primary key value of a record in the MEMBER table, so it links each booking to the member who made it; This creates the relationship between the two tables, here one member to many bookings; It enforces referential integrity: a booking cannot be entered for a MemberID that does not exist in MEMBER; ...(so) the member's details are stored once in MEMBER and referred to, rather than repeated in every booking;	3
1(c) A3.1.1	Award [2] max Award [1] for the correct pair of attributes and [1] for the justification. (CourtNo, SlotStart); Neither attribute is unique on its own, since a court appears in several bookings and a start time applies to several courts, but together they identify one booking uniquely because a court can be booked only once per start time; Do not accept MemberID as part of the key: a member may hold several bookings. Award [1] max for the correct attributes with no justification.	2
2(a) A3.1.1	Award [3] max Award [1] per point up to [3] max. The answer must refer to the club's data. Each member's surname, email and join date are stored once, in a single row of MEMBER; A booking stores only the member's ID, not a repeated copy of their details; ...(so) a member with fifty bookings still has their email stored once rather than fifty times; Less storage is used, and there is no risk of the same member's details being entered differently on different forms; When a member changes their email it is updated in one place and every booking reflects the change immediately;	3
2(b) A3.1.1	Award [2] max	2

Q	ANSWER	MARKS
	Award [1] per point up to [2] max. Data integrity means the data stored is accurate, complete and consistent, and stays that way over time; It is enforced by constraints such as data types, required fields, valid ranges and referential integrity between tables; ...(so) the database rejects entries that would leave it in an invalid state;	
2(c) A3.1.1	Award [1] max Any one, [1] max. Each fact is stored in only one place, so there are no conflicting copies to disagree with each other; Referential integrity prevents a booking referring to a member who does not exist; Constraints on each column reject values of the wrong type or format; A change made once is immediately visible to everyone reading the database;	1
3(a) A3.1.1	Award [3] max Award [1] per point up to [3] max. Concurrency control manages what happens when two transactions try to change the same data at the same time; The first transaction takes a lock on the record for court 3 at 11:00; The second transaction must wait until that lock is released rather than reading stale data; When it resumes, it sees the slot is already taken and its booking is rejected; ...(so) the database avoids the lost update that would occur if both were allowed to write, and only one member gets the court;	3
3(b) A3.1.1	Award [3] max Award [1] per point up to [3] max. Making the booking and charging the account are two changes that must both succeed or both fail; They are grouped into a single transaction, so the database treats them as one indivisible unit; If the system fails between the two steps, the transaction is rolled back; ...(so) the club cannot end up charging a member for a court they were not given, or giving a court away for free; Once the transaction is committed the change is durable and survives a later crash;	3
4(a) A3.1.1	Award [3] max Award [1] per point up to [3] max. Each member of staff has their own account and must authenticate before reaching the data; Permissions are granted per user or per role, so the coaches, the treasurer and the receptionist are given different rights; Rights can be set separately for reading, inserting, updating and deleting, and applied to particular tables; A view can expose only certain columns or rows, so the receptionist sees booking times without seeing financial data; Access can be logged, so it is possible to see who read or changed a record;	3
4(b) A3.1.1	Award [2] max Award [1] for the point and [1] for the expansion. Any one advantage. A query states which records are wanted and the database finds them;	2

Q	ANSWER	MARKS
	...(so) an answer that would take hours of manual searching is returned in moments, even across large tables; A query can combine data from several tables and calculate totals in one step; ...(so) the treasurer can produce a summary without copying figures between tables by hand; The same query can be saved and rerun; ...(so) the result is consistent and free from the transcription errors of manual reading;	
5(a) A3.1.1	Award [3] max Award [1] per point up to [3] max. A relational database requires the structure of every table to be defined in advance, with fixed columns and data types; Adding a coaching report and a video means altering the schema of an existing table, or creating new tables and relationships; The change has to be applied to a table that already holds live data, which needs care and may require the system to be taken offline; Every application and query written against the old structure may need updating; ...(so) the database cannot simply accept a new kind of field for one member the way a schema-less store could;	3
5(b) A3.1.1	Award [2] max Award [1] per point up to [2] max. A relational database is designed for data that fits neatly into rows and columns, and a video has no such structure; It can only really be stored as a large binary object or as a file path held outside the database; ...(so) the database cannot search, sort or query the contents of the video in any meaningful way; Storing large binary objects also inflates the database and slows backups;	2
6 A3.1.1	Award [5] max This is a discuss question (AO3), so both sides are required, applied to the scale described. Award [1] per point up to [5] max, but award a maximum of [3] if only one side is given, and a maximum of [4] without a supported conclusion. Arguments that it remains suitable Bookings and payments are highly structured and relational, which is exactly what the model handles well; Transactions must be reliable because money is involved, and relational databases guarantee this; Concurrency control is already proven for many simultaneous users; The technology is mature with wide community support, well-understood tooling and available expertise; Relational systems can be scaled vertically, and read replicas can spread the query load across countries; Arguments that it becomes unsuitable Relational databases scale out across many servers far less easily than distributed alternatives, so growth eventually hits a ceiling; Queries joining several very large tables slow down as volume rises; The rigid schema is hard to change once hundreds of millions of rows exist, yet a merged national business is likely to need new fields;	5

Q	ANSWER	MARKS
	Unstructured data such as coaching videos still sits awkwardly alongside the relational data; Users in many countries need data held near them, and keeping copies consistent across regions is difficult; Conclusion (credit any supported judgement, for example) A relational database should be kept for bookings and payments, where integrity and transactions matter most, with a separate store used for videos and other unstructured content;	

Total for this paper: 33 marks