A3 DATABASES · A3.3

Database programming with SQL

Talking to a database: the **SQL** language families, **queries** and **INNER JOIN**, changing data, **aggregate** functions, views, and **ACID** (worked queries on page 3).

01 SQL sublanguages

DDL	CREATE, ALTER, DROP — structure.
DML	SELECT, INSERT, UPDATE, DELETE — data.
DCL	GRANT, REVOKE — access.
TCL	COMMIT, ROLLBACK — transactions.

02 Query clauses

SELECT	Which columns to return.
FROM	The main table.
INNER JOIN ... ON	Combine tables on a shared key.
WHERE	Filter rows by a condition.
ORDER BY	Sort the results.
GROUP BY	Group rows for aggregates.

03 Changing data · always with a WHERE

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INSERT

Add a new record. INSERT INTO Student (StudentID, StudentName) VALUES ('S5','Eve');

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UPDATE

Change records. UPDATE Student SET MentorID='M3' WHERE StudentID='S4';

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DELETE

Remove records. DELETE FROM Student WHERE StudentID='S4';

04 Aggregate functions

COUNT	How many rows.
SUM	Total of a column.
AVG	Average of a column.
MIN / MAX	Smallest / largest value.
GROUP BY	One result per category.

05 Views

View	A virtual table: a saved query.
No data	Shows a live result, stores nothing.
Simplify	Wrap a complex JOIN in one name.
Security	Expose only certain columns/rows.

06 ACID · how transactions protect data

Atomicity	All the operations in the transaction succeed, or none do (no half-finished changes).	A
Consistency	The database moves from one valid state to another, never breaking its rules.	C
Isolation	Concurrent transactions do not interfere with each other.	I
Durability	Once committed, the changes survive even a power loss or crash.	D

07 SQL in action · queries and INNER JOIN

Sample data · two tables linked by MentorID

Student

StudentID	StudentName	MentorID
S1	Aisha	M2
S2	Ben	M1
S3	Chloe	M2
S4	Dan	M9

Mentor

MentorID	MentorName
M1	Mr Ng
M2	Ms Patel
M3	Dr Owusu

Basic query · students mentored by M2, sorted by name

```
SELECT StudentName
FROM Student
WHERE MentorID = 'M2'
ORDER BY StudentName;
```

Result

StudentName
Aisha
Chloe

INNER JOIN · pair each student with their mentor's name

```
SELECT Student.StudentName,
       Mentor.MentorName
FROM Student
INNER JOIN Mentor
  ON Student.MentorID = Mentor.MentorID;
```

Result (only matching rows)

StudentName	MentorName
Aisha	Ms Patel
Ben	Mr Ng
Chloe	Ms Patel

Why no Dan or Dr Owusu? INNER JOIN keeps a row only when the key matches in **both** tables. Dan's mentor M9 does not exist, and mentor M3 has no students, so both are dropped.

FINAL PASS BEFORE THE EXAM

Rapid exam tips

Eight things that lose marks in Paper 1 if you slip on them. Skim before you walk in.

01

DDL defines structure (CREATE/ALTER/DROP); **DML** changes data (SELECT/INSERT/UPDATE/DELETE).

02

DELETE removes rows; **DROP** removes the whole table.

03

Always add a **WHERE** to UPDATE or DELETE, or you change every row.

04

An **INNER JOIN** matches a foreign key to a primary key with **ON**, and keeps only rows that match in **both** tables.

05

Aggregates (**COUNT, SUM, AVG, MIN, MAX**) need **GROUP BY** for per-category results.

06

A **view** is a virtual table (a saved query), not stored data.

07

A **transaction** is all-or-nothing. Know **ACID**: atomicity, consistency, isolation, durability.

08

When asked to classify a command, name its family: **DDL, DML, DCL, or TCL**.