

SQL Cheat-Sheet – Quick Reference

Erweiterte Referenz basierend auf Lectures 7-10, 13-15 Themen: SELECT, DDL/DML, Normalisierung, Joins, SET Operations, Views, Transaktionen, Functions, Trigger

📖 Wie nutze ich dieses Cheat-Sheet?

Dieses Dokument ist eine **erweiterte Referenz** für die wichtigsten SQL-Konzepte:

Grundlagen:

- L7: SELECT, WHERE, ORDER BY, GROUP BY, Aggregation
- L8: CREATE TABLE, ALTER, DROP, INSERT, UPDATE, DELETE, Constraints
- L9: Normalisierung (1NF, 2NF, 3NF), ER-Diagramme
- L10: Joins (INNER, LEFT, RIGHT, FULL, CROSS), Subqueries

Fortgeschritten:

- L13: SET Operations (UNION, INTERSECT, EXCEPT), Views
- L14: Transaktionen (BEGIN, COMMIT, ROLLBACK), ACID, Isolation Levels
- L15: Stored Functions (IF, CASE, RAISE), Trigger (BEFORE/AFTER)

Navigation:

- Nutze das **Inhaltsverzeichnis** (☰ links oben)
- Springe direkt zum gewünschten Thema
- Alle Code-Beispiele sind **interaktiv** – probiere sie aus!

1. DDL – Tabellen definieren (L8)

1.1 CREATE TABLE

```
1 -- Grundstruktur
2 CREATE TABLE customers (
3     customer_id INTEGER PRIMARY KEY,
4     first_name TEXT NOT NULL,
5     last_name TEXT NOT NULL,
6     email TEXT UNIQUE,
7     created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP
8 );
```

```
-- Grundstruktur
CREATE TABLE customers (
    customer_id INTEGER PRIMARY KEY,
    first_name TEXT NOT NULL,
    last_name TEXT NOT NULL,
    email TEXT UNIQUE,
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP
)
```

ok

1.2 Datentypen

Typ	Verwendung	Beispiel
INTEGER	Ganzzahlen	age INTEGER
BIGINT	Große Ganzzahlen	user_id BIGINT
DECIMAL(p,s)	Präzise Dezimalzahlen	price DECIMAL(10,2)
FLOAT/DOUBLE	Approximative Zahlen	latitude FLOAT
TEXT	Unbegrenzter Text	description TEXT
VARCHAR(n)	Text mit Längenlimit	email VARCHAR(255)
CHAR(n)	Festlängen-Text	country_code CHAR(2)
DATE	Datum	birth_date DATE
TIMESTAMP	Datum + Uhrzeit	created_at TIMESTAMP
BOOLEAN	Wahr/Falsch	is_active BOOLEAN
JSON	JSON-Objekte	metadata JSON

1.3 Constraints

```
1 CREATE TABLE orders (
2     order_id INTEGER PRIMARY KEY,
3     customer_id INTEGER NOT NULL,
```

-- Eindeutig + NOT
-- Pflichtfeld

```

4   total DECIMAL(10,2) CHECK (total >= 0),          -- Validierung
5   status TEXT CHECK (status IN ('pending', 'shipped', 'delivered')), 
6   created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP, -- Standardwert
7   FOREIGN KEY (customer_id) REFERENCES customers(customer_id)
8 );

```

```

CREATE TABLE orders (
    order_id INTEGER PRIMARY KEY,
    customer_id INTEGER NOT NULL,           -- Eindeutig + NOT NULL
    total DECIMAL(10,2) CHECK (total >= 0),      -- Validierung
    status TEXT CHECK (status IN ('pending', 'shipped', 'delivered')),
    created_at TIMESTAMP DEFAULT CURRENT_TIMESTAMP, -- Standardwert
    FOREIGN KEY (customer_id) REFERENCES customers(customer_id)
)

```

ok

Constraint-Übersicht:

Constraint	Zweck	Beispiel
PRIMARY KEY	Eindeutig + NOT NULL	user_id INTEGER PRIMARY KEY
FOREIGN KEY	Referenzielle Integrität	FOREIGN KEY (user_id) REFERENCES users(user_id)
UNIQUE	Eindeutig (NULL erlaubt)	email TEXT UNIQUE
NOT NULL	Pflichtfeld	name TEXT NOT NULL
CHECK	Benutzerdefiniert	age INTEGER CHECK (age >= 18)
DEFAULT	Standardwert	status TEXT DEFAULT 'active'

1.4 Foreign Keys

```

1 -- Mit ON DELETE / ON UPDATE
2 CREATE TABLE order_items (
3     item_id INTEGER PRIMARY KEY,
4     order_id INTEGER,
5     product_id INTEGER,
6     quantity INTEGER,

```

```

7   FOREIGN KEY (order_id) REFERENCES orders(order_id)
8   ON DELETE CASCADE,           -- Löscht Items, wenn Order gelöscht
9   FOREIGN KEY (product_id) REFERENCES products(product_id)
10  ON DELETE RESTRICT        -- Verhindert Löschen, wenn Items
11  existieren
11 );

```

-- Mit ON DELETE / ON UPDATE

```

CREATE TABLE order_items (
    item_id INTEGER PRIMARY KEY,
    order_id INTEGER,
    product_id INTEGER,
    quantity INTEGER,
    FOREIGN KEY (order_id) REFERENCES orders(order_id)
        ON DELETE CASCADE,           -- Löscht Items, wenn Order gelöscht wird
    FOREIGN KEY (product_id) REFERENCES products(product_id)
        ON DELETE RESTRICT        -- Verhindert Löschen, wenn Items existieren
)

```

relation "products" does not exist

ON DELETE Optionen:

Option	Verhalten
CASCADE	Abhängige Zeilen werden gelöscht
SET NULL	Foreign Key wird auf NULL gesetzt
RESTRICT	Löschen wird verhindert (Standard)
NO ACTION	Wie RESTRICT

1.5 ALTER TABLE

```

1  -- Spalte hinzufügen
2  ALTER TABLE customers
3  ADD COLUMN phone TEXT;
4
5  -- Spalte ändern (nicht alle DBs unterstützen alle Operationen)
6  ALTER TABLE customers
7  ALTER COLUMN email SET NOT NULL;
8
9  -- Spalte umbenennen (PostgreSQL)
10 ALTER TABLE customers

```

```
11 RENAME COLUMN phone TO mobile;
12
13 -- Tabelle umbenennen
14 ALTER TABLE customers RENAME TO clients;
15
16 -- Spalte löschen
17 ALTER TABLE clients
18 DROP COLUMN mobile;
```

-- Spalte hinzufügen
ALTER TABLE customers
ADD COLUMN phone TEXT

ok

-- Spalte ändern (nicht alle DBs unterstützen alle Operationen)
ALTER TABLE customers
ALTER COLUMN email SET NOT NULL

ok

-- Spalte umbenennen (PostgreSQL)
ALTER TABLE customers
RENAME COLUMN phone TO mobile

ok

-- Tabelle umbenennen
ALTER TABLE customers **RENAME TO** clients

ok

-- Spalte löschen
ALTER TABLE clients
DROP COLUMN mobile

ok

1.6 DROP TABLE

```
1 -- Einfach
2 DROP TABLE IF EXISTS temp_table;
3
4 -- Mit CASCADE (löscht auch abhängige Objekte)
5 DROP TABLE products CASCADE;
6
```



```
7 -- Mit RESTRICT (verhindert Löschen bei Abhängigkeiten)
8 DROP TABLE products RESTRICT;
```

```
-- Einfach
DROP TABLE IF EXISTS temp_table
```

ok

```
-- Mit CASCADE (löscht auch abhängige Objekte)
DROP TABLE products CASCADE
```

table "products" does not exist

2. DML – Daten manipulieren (L8)

2.1 INSERT

```
1 -- Einzelne Zeile
2 INSERT INTO customers (customer_id, first_name, last_name, email) VALUES (1, 'Alice', 'Anderson', 'alice@email.com');
3
4 -- Mehrere Zeilen (Bulk Insert)
5 INSERT INTO customers (customer_id, first_name, last_name, email) VALUES (2, 'Bob', 'Brown', 'bob@email.com'),
6 (3, 'Carol', 'Clark', 'carol@email.com'),
7 (4, 'David', 'Davis', 'david@email.com');
8
9
10 -- INSERT ... SELECT (Daten kopieren)
11 INSERT INTO customers_backup (customer_id, first_name, last_name, email) SELECT customer_id, first_name, last_name, email
12 FROM customers
13 WHERE email IS NOT NULL;
14
15 -- INSERT ... ON CONFLICT (Upsert)
16 INSERT INTO customers (customer_id, first_name, last_name, email) VALUES (1, 'Alice Updated', 'alice_new@email.com')
17 ON CONFLICT (customer_id) DO UPDATE
18 SET
19     first_name = EXCLUDED.first_name,
20     email = EXCLUDED.email;
```

```
-- Einzelne Zeile
INSERT INTO customers (customer_id, first_name, last_name, email)
VALUES (1, 'Alice', 'Anderson', 'alice@email.com')
```

relation "customers" does not exist

2.2 UPDATE

```
1 -- Einzelne Zeile
2 UPDATE customers
3 SET email = 'alice_new@email.com'
4 WHERE customer_id = 1;
5
6 -- Mehrere Spalten
7 UPDATE customers
8 SET
9   first_name = 'Alice',
10  last_name = 'Smith',
11  email = 'alice.smith@email.com'
12 WHERE customer_id = 1;
13
14 -- Berechnete Updates
15 UPDATE products
16 SET price = price * 1.10; -- 10% Preiserhöhung
17
18 -- UPDATE mit Subquery
19 UPDATE products
20 SET price = price * (1 - (
21   SELECT discount_percent / 100
22   FROM categories
23   WHERE categories.category_id = products.category_id
24 ));
```

```
-- Einzelne Zeile
UPDATE customers
SET email = 'alice_new@email.com'
WHERE customer_id = 1
```

relation "customers" does not exist

⚠️ Immer WHERE nutzen! Ohne WHERE werden ALLE Zeilen geändert!

2.3 DELETE

```
1 -- Einzelne Zeile
```

```
-- Einzelne Zeile
2 DELETE FROM customers
3 WHERE customer_id = 5;
4
5 -- Mehrere Zeilen
6 DELETE FROM customers
7 WHERE email IS NULL;
8
9 -- DELETE mit Subquery
10 DELETE FROM customers
11 WHERE customer_id NOT IN (
12     SELECT DISTINCT customer_id FROM orders
13 );
```

```
-- Einzelne Zeile
DELETE FROM customers
WHERE customer_id = 5
```

relation "customers" does not exist

⚠ Immer WHERE nutzen! Ohne WHERE werden ALLE Zeilen gelöscht!

2.4 TRUNCATE vs DELETE

```
1 -- DELETE: Selektiv, in Transaktion reversibel
2 DELETE FROM products WHERE price < 50;
3
4 -- TRUNCATE: Löscht alle Zeilen, schneller, meist nicht reversibel
5 TRUNCATE TABLE products;
```

```
-- DELETE: Selektiv, in Transaktion reversibel
DELETE FROM products WHERE price < 50
```

relation "products" does not exist

Feature	DELETE	TRUNCATE
WHERE-Klausel	✓ Ja	✗ Nein
Performance	Langsamer	Schneller
Rollback	✓ Möglich	⚠ DB-abhängig
Triggers	✓ Werden ausgelöst	✗ Meist nicht
Auto-Increment	Bleibt	Wird zurückgesetzt

3. SELECT – Daten abfragen (L7)

3.1 Grundstruktur

```
SELECT spalte1, spalte2, ...
FROM tabelle
WHERE bedingung
ORDER BY spalte [ASC|DESC]
LIMIT anzahl;
```

3.2 Beispieldatenbank laden

```
1  INSTALL httpfs;
2  LOAD httpfs;
3
4  CREATE TEMP TABLE products_raw AS
5  SELECT *
6  FROM read_json('https://raw.githubusercontent.com/andre-dietrich
    /Datenbanksysteme-Vorlesung/refs/heads/main/assets/dat/products.j
7
8 * CREATE TABLE products (
9     product_id INTEGER PRIMARY KEY,
10    name TEXT,
11    category TEXT,
12    brand TEXT,
13    price REAL,
14    stock INTEGER,
15    rating REAL,
16    created_at DATE
17 );
18
19  INSERT INTO products
```

```
20 SELECT
21   CAST(product_id AS INTEGER),
22   name::TEXT,
23   category::TEXT,
24   brand::TEXT,
25   CAST(price AS REAL),
26   CAST(stock AS INTEGER),
27   CAST(rating AS REAL),
28   CAST(created_at AS DATE)
29 FROM products_raw;
```

```
INSTALL httpfs
```

No data

```
LOAD httpfs
```

No data

```
CREATE TEMP TABLE products_raw AS
SELECT *
FROM read_json('https://raw.githubusercontent.com/andre-
dietrich/Datenbankensysteme-
Vorlesung/refs/heads/main/assets/dat/products.json')
```

	Count
1	932

```
CREATE TABLE products (
    product_id INTEGER PRIMARY KEY,
    name TEXT,
    category TEXT,
    brand TEXT,
    price REAL,
    stock INTEGER,
    rating REAL,
    created_at DATE
)
```

No data

```
INSERT INTO products
SELECT
    CAST(product_id AS INTEGER),
    name::TEXT,
    category::TEXT,
    brand::TEXT,
    CAST(price AS REAL),
    CAST(stock AS INTEGER),
    CAST(rating AS REAL),
    CAST(created_at AS DATE)
FROM products_raw
```

	Count
1	932

3.3 Spalten auswählen

```
1 -- Alle Spalten
2 SELECT * FROM products LIMIT 5;
3
4 -- Spezifische Spalten
5 SELECT name, price, category FROM products LIMIT 5;
6
7 -- Mit Alias
8 SELECT
9     name AS product_name,
10    price AS price_eur,
11    category
12   FROM products LIMIT 5;
```

```
-- Alle Spalten
SELECT * FROM products LIMIT 5
Catalog Error: Table with name products does not exist!
Did you mean "pg_proc"?
LINE 2: SELECT * FROM products LIMIT 5
          ^
-- Spezifische Spalten
SELECT name, price, category FROM products LIMIT 5
```

No data

```
-- Mit Alias
SELECT
    name AS product_name,
    price AS price_eur,
    category
FROM products LIMIT 5
```

	product_name	price_eur	category
1	Laptop 14" 2.0	1399.030029296875	Electronics
2	Portable SSD Max M	805.9299926757812	Electronics
3	4K Monitor - Green	522.47998046875	Electronics
4	Tablet 10	985.75	Electronics
5	Portable SSD Lite	508.2300109863281	Electronics

3.4 WHERE – Filtern

```
1 -- Vergleichsoperatoren: =, <>, <, >, <=, >=
2 SELECT name, price FROM products
3 WHERE price < 50;
4
5 -- Logische Operatoren: AND, OR, NOT
6 SELECT name, price, category FROM products
7 WHERE category = 'Electronics' AND price < 100;
8
9 -- BETWEEN
10 SELECT name, price FROM products
11 WHERE price BETWEEN 100 AND 500;
12
13 -- IN
14 SELECT name, category FROM products
15 WHERE category IN ('Electronics', 'Office', 'Groceries');
```

```
16
17 -- LIKE (Pattern Matching)
18 SELECT name FROM products
19 WHERE name LIKE '%Laptop%'; -- % = beliebig viele Zeichen
20
21 -- NULL-Werte
22 SELECT name, rating FROM products
23 WHERE rating IS NULL;
```

```
-- Vergleichsoperatoren: =, <>, <, >, <=, >=
SELECT name, price FROM products
WHERE price < 50
```

	name	price
1	4K Monitor	24.920000076293945
2	Basic T-Shirt Max	24.34000015258789
3	Jacket	44
4	Jacket L	29.280000686645508
5	Raincoat	43.810001373291016
6	Jeans - Silver	34.15999984741211
7	Leggings L	18.100000381469727
8	Jeans	35.779998779296875
9	Cap Lite	35.54999923706055
10	Dress Shirt - Blue	39.970001220703125
11	Chinos	8.640000343322754
12	Leggings L	11.569999694824219
13	Polo Shirt Pro XL	14.930000305175781
14	Sneakers	9.789999961853027
15	Leggings	31.280000686645508
16	Hoodie Lite L - White	30.030000686645508
17	Jeans Max	12.520000457763672
18	Dress Shirt 2.0 S	6.130000114440918
19	Hoodie	34.900001525878906
20	Leggings	40.04999923706055
21	Chinos Max M	38.029998779296875
22	Jacket Plus M	40.52000045776367
23	Granola 750g	31.600000381469727
24	Olive Oil 1L - Silver	26.729999542236328
25	Tomato Sauce 400g Max XL	34.119998931884766
26	Olive Oil 1L M	36.099998474121094
27	Green Tea 50 bags M	26.450000762939453
28	Green Tea 50 bags - Black	20.040000915527344
29	Arabica Coffee Beans 1kg	0.8999999761581421
30	Pasta Fusilli 500g Plus	38.16999816894531
31	Olive Oil 1L M - Green	18.639999389648438

32	Green Tea 50 bags Max	35.939998626708984
33	Arabica Coffee Beans 1kg Plus	19.8799991607666
34	Sea Salt 500g	19.399999618530273
35	Green Tea 50 bags	38.52000045776367
36	Arabica Coffee Beans 1kg	37.90999984741211
37	Pasta Fusilli 500g Max M	4.489999771118164
38	Basmati Rice 1kg L - White	18.389999389648438
39	Tomato Sauce 400g	10.350000381469727
40	Dark Chocolate 85% 100g XL - Green	30.329999923706055
41	Tomato Sauce 400g	29.100000381469727
42	Basmati Rice 1kg Plus - White	33.790000915527344
43	Basmati Rice 1kg Max L	4.760000228881836
44	Basmati Rice 1kg Lite S	38.29999923706055
45	Granola 750g Plus - Green	16.09000015258789
46	Organic Oat Milk 1L	19.229999542236328
47	Dark Chocolate 85% 100g	37.93000030517578
48	Sea Salt 500g Max - Blue	29.719999313354492
49	Tomato Sauce 400g - Black	5.71999979019165
50	Olive Oil 1L	29.25
51	Organic Oat Milk 1L	6.03000020980835
52	Green Tea 50 bags - Silver	23.989999771118164
53	Honey 500g 2.0 - White	34.7599983215332
54	Sea Salt 500g - White	34.369998931884766
55	Olive Oil 1L	34.540000915527344
56	Green Tea 50 bags S - Red	8.079999923706055
57	Organic Oat Milk 1L	26.049999237060547
58	Arabica Coffee Beans 1kg Pro XL - Blue	33.56999969482422
59	Honey 500g 2.0 M	13.140000343322754
60	Olive Oil 1L M	15.430000305175781
61	Arabica Coffee Beans 1kg Lite	21.65999984741211
62	Granola 750g Max	6.110000133514404
63	Basmati Rice 1kg Pro	4.389999866485596

64	Almonds 200g Lite XL	2.4800000190734863
65	Pasta Fusilli 500g Max XL	7.199999809265137
66	Basmati Rice 1kg	14.489999771118164
67	Organic Oat Milk 1L	13.609999656677246
68	Sea Salt 500g	38.40999984741211
69	Dark Chocolate 85% 100g Lite L - Green	23.610000610351562
70	Pasta Fusilli 500g Lite M	13.270000457763672
71	Sea Salt 500g Lite - Graphite	3.069999933242798
72	Organic Oat Milk 1L Lite S - Red	2.25
73	Honey 500g Lite S	8.130000114440918
74	Tomato Sauce 400g	23.399999618530273
75	Basmati Rice 1kg 2.0 - Red	5.320000171661377
76	Green Tea 50 bags Plus	39.84000015258789
77	Almonds 200g - Green	31.09000015258789
78	Granola 750g XL - Graphite	1.990000095367432
79	Green Tea 50 bags	29.260000228881836
80	Tomato Sauce 400g - White	27.360000610351562
81	Pasta Fusilli 500g - Black	32.2599983215332
82	Arabica Coffee Beans 1kg - Green	18.68000030517578
83	Sea Salt 500g - Green	13.100000381469727
84	Green Tea 50 bags XL	15.170000076293945
85	Honey 500g - Black	1.7300000190734863
86	Almonds 200g	3.5899999141693115
87	Granola 750g - White	30.3799991607666
88	Dark Chocolate 85% 100g - White	15.75
89	Dark Chocolate 85% 100g - White	22.690000534057617
90	Pasta Fusilli 500g - Silver	38.970001220703125
91	Tomato Sauce 400g L - Black	16.030000686645508
92	Sea Salt 500g	26.670000076293945
93	Almonds 200g Max	26.280000686645508
94	Olive Oil 1L - Silver	5.409999847412109
95	Tomato Sauce 400g Max	10.800000190734863

96	Almonds 200g - Graphite	28.170000076293945
97	Granola 750g Plus	32.529998779296875
98	Granola 750g	39.65999984741211
99	Almonds 200g Max - White	7.199999809265137
100	Sea Salt 500g - White	24.15999984741211
101	Honey 500g	13.029999732971191
102	Arabica Coffee Beans 1kg	3.0899999141693115
103	Honey 500g Max	34.66999816894531
104	Arabica Coffee Beans 1kg	36.58000183105469
105	Dark Chocolate 85% 100g L - Red	20.34000015258789
106	Organic Oat Milk 1L Max	5.329999923706055
107	Green Tea 50 bags	3.680000066757202
108	Green Tea 50 bags	32.880001068115234
109	Sea Salt 500g	16.290000915527344
110	Organic Oat Milk 1L 2.0	6.860000133514404
111	Green Tea 50 bags	38.06999969482422
112	Honey 500g Max S	36.369998931884766
113	Honey 500g - Black	28.209999084472656
114	Basmati Rice 1kg	2.3299999237060547
115	Granola 750g 2.0 - Blue	37.529998779296875
116	Dark Chocolate 85% 100g M - Black	28.280000686645508
117	Sea Salt 500g Max XL - Silver	37.43000030517578
118	Green Tea 50 bags - Black	17.030000686645508
119	Arabica Coffee Beans 1kg Plus - Blue	17.31999969482422
120	Organic Oat Milk 1L Plus M	15.989999771118164
121	Arabica Coffee Beans 1kg Max XL - Silver	22.3799991607666
122	Dark Chocolate 85% 100g Max S - Silver	10.670000076293945
123	Office Scissors	13.710000038146973
124	Sticky Notes (12 pads) Lite	11.960000038146973
125	Ergonomic Chair Plus	15.399999618530273
126	A4 Copy Paper 500 sheets	33.79999923706055
127	Ergonomic Chair	11.920000076293945

128	Whiteboard Markers (8-pack) Max - Blue	33.04999923706055
129	Whiteboard Markers (8-pack)	30.940000534057617
130	Gel Pens (10-pack) Lite	10.020000457763672
131	Binder 5cm	23.209999084472656
132	Laptop Stand Lite	7.53000020980835
133	Air Fryer 4L	27.290000915527344
134	Toaster 2-slice Lite	32.65999984741211
135	Cutlery Set (24 pcs) Lite - White	15.220000267028809
136	Remote Control Car Plus L	12.180000305175781
137	Science Kit - Volcano XL	7.480000019073486
138	Plush Bear 30cm - Silver	20.1299991607666
139	Remote Control Car XL - Green	30.920000076293945
140	Marble Run 2.0	6.849999904632568
141	RC Drone Mini S	43.599998474121094
142	Plush Bear 30cm	24.15999984741211
143	Building Blocks Set Max - Blue	27.860000610351562
144	Remote Control Car Plus XL	26.950000762939453
145	STEM Robot Kit	28.110000610351562
146	Building Blocks Set L	21.34000015258789
147	RC Drone Mini Plus	40.650001525878906
148	RC Drone Mini	41.189998626708984
149	Wooden Train Set S - Blue	29.25
150	Building Blocks Set Lite	44.119998931884766
151	Building Blocks Set Max	46.45000076293945
152	Puzzle 1000 pieces Pro - Blue	7.699999809265137
153	Puzzle 1000 pieces Pro L - White	36.349998474121094
154	Remote Control Car Pro	30.729999542236328
155	Wooden Train Set M	37.599998474121094
156	Bike Helmet L	32.13999938964844
157	Basketball Max M	40.439998626708984
158	Compression Shirt	43.619998931884766
159	Bike Helmet	24.809999465942383

160	Tennis Racket Pro	42.029998779296875
161	Dumbbells Pair 2x5kg	44.63999938964844
162	Running Shoes 2.0 S	37.63999938964844
163	Football Size 5 Plus S	31.270000457763672
164	Cycling Gloves Pro - Blue	30.440000534057617
165	Moisturizing Cream 50ml L - Black	41.900001525878906
166	Face Serum 30ml Max	31.690000534057617
167	Hair Oil 100ml - Green	12.15999984741211
168	Lip Balm Plus XL	5.570000171661377
169	Face Serum 30ml XL	39.400001525878906
170	Body Lotion 250ml Pro S - Graphite	4.489999771118164
171	Lip Balm Max - Black	38.77000045776367
172	Conditioner 300ml 2.0	47.0099983215332
173	Face Mask Sheet XL	9.920000076293945
174	Moisturizing Cream 50ml Max	31.440000534057617
175	Body Lotion 250ml	25.170000076293945
176	Hair Oil 100ml	30.290000915527344
177	Face Serum 30ml Plus M	29.360000610351562
178	Micellar Water 400ml Max XL	29.65999984741211
179	Moisturizing Cream 50ml Pro - Green	48.63999938964844
180	Conditioner 300ml XL	32.34000015258789
181	Facial Cleanser 200ml Max	49.540000915527344
182	Face Mask Sheet	22.299999237060547
183	Lip Balm Max	30.829999923706055
184	Facial Cleanser 200ml	31.850000381469727
185	Body Lotion 250ml	16.459999084472656
186	Facial Cleanser 200ml	19.850000381469727
187	Conditioner 300ml L	38.5099983215332
188	Lip Balm	24.459999084472656
189	Face Mask Sheet	16.059999465942383
190	Sunscreen SPF50 100ml	39.84000015258789
191	Facial Cleanser 200ml S	46.029998779296875

192	Paperback Novel Lite M	16.389999389648438
193	Poetry Collection Pro - White	27.969999313354492
194	Poetry Collection Pro	42.52000045776367
195	Poetry Collection - Green	29.3799991607666
196	Cookbook - Quick Meals Plus	15.60000381469727
197	Short Stories Plus	44.9300030517578
198	Short Stories Max S - Blue	9.47999542236328
199	Travel Guide: Japan Max	17.82999923706055
200	History of Art M - Green	37.95999084472656
201	Business Strategy 101 - Red	9.57999923706055
202	Beginners German Lite	48.8600061035156
203	History of Art Pro	13.64000343322754
204	Cookbook - Quick Meals XL	30.97999542236328
205	Short Stories L - Graphite	13.13000114440918
206	Paperback Novel Pro S	44.7299954223633
207	Poetry Collection M	19.620008392334
208	Short Stories - Graphite	17.45000762939453
209	Beginners German Lite	29.29000915527344
210	Travel Guide: Japan Pro - Graphite	6.19000057220459
211	Cookbook - Quick Meals Lite	36.8600061035156
212	Data Science Handbook	37.34998474121094
213	Travel Guide: Japan	16.19000534057617
214	Poetry Collection - Silver	7.05999942779541
215	Travel Guide: Japan Plus - Black	42.1599984741211
216	Short Stories Max M	33.4099984741211
217	Travel Guide: Japan 2.0	39.2000076293945
218	Business Strategy 101 Pro M	25.57999923706055
219	Data Science Handbook	22.20999084472656
220	Data Science Handbook	49.91999816894531
221	Business Strategy 101 XL - Blue	26.11000610351562
222	Travel Guide: Japan M - White	12.72999542236328
223	Business Strategy 101 - Green	27.6599984741211

224	Poetry Collection XL	30.1200008392334
225	Data Science Handbook	47.290000915527344
226	Business Strategy 101 - Silver	22.309999465942383
227	History of Art XL	22.030000686645508
228	Data Science Handbook Pro	7.800000190734863
229	Paperback Novel Pro S	48.380001068115234
230	Short Stories - Black	11.819999694824219
231	History of Art	31.450000762939453
232	Data Science Handbook L	29.709999084472656
233	Childrens Stories M	15.600000381469727
234	Poetry Collection - Green	26.690000534057617
235	Mystery Thriller - Silver	38.540000915527344
236	Paperback Novel	23.780000686645508
237	Beginners German	46.689998626708984
238	Mystery Thriller Lite	47.529998779296875
239	Short Stories	21.190000534057617
240	History of Art - Silver	28.010000228881836
241	Childrens Stories 2.0 S	11.010000228881836
242	Fantasy Epic Vol. 1	27.100000381469727
243	History of Art	36.849998474121094
244	Data Science Handbook S	28.540000915527344
245	Childrens Stories Plus	43.09000015258789
246	Travel Guide: Japan	19.700000762939453
247	Poetry Collection Max S	28.489999771118164
248	Data Science Handbook	28.219999313354492
249	Beginners German XL	22.43000030517578
250	Paperback Novel - Blue	6.539999961853027
251	Travel Guide: Japan XL	48.869998931884766
252	Pet Treats Mixed 500g Lite XL - Red	19.700000762939453
253	Bird Seed 1kg 2.0 - Blue	23.3799991607666
254	Pet Treats Mixed 500g Pro	13.420000076293945
255	Dog Leash Nylon Plus - Green	21.559999465942383

256	Aquarium Filter	48.619998931884766
257	Bird Seed 1kg	13.520000457763672
258	Aquarium Filter	29.239999771118164
259	Pet Treats Mixed 500g M	10.529999732971191
260	Pet Shampoo 250ml Pro - Red	26.75
261	Pet Shampoo 250ml XL - Black	38.939998626708984
262	Pet Bed Medium Max XL	42.11000061035156
263	Pet Bed Medium Plus	3.950000047683716
264	Bird Seed 1kg Pro S - Silver	4.980000019073486
265	Pet Bed Medium	18.260000228881836
266	Dog Leash Nylon - Silver	17.139999389648438
267	Aquarium Filter XL	47.83000183105469
268	Aquarium Filter - Blue	5.789999961853027
269	Pet Shampoo 250ml M	45.09000015258789
270	Fish Flakes 200g Max XL	31.030000686645508
271	Small Animal Hay 1kg L - Silver	32.189998626708984
272	Cat Scratching Post Plus	5.829999923706055
273	Bird Seed 1kg	4.300000190734863

-- Logische Operatoren: AND, OR, NOT

```
SELECT name, price, category FROM products
WHERE category = 'Electronics' AND price < 100
```

	name	price	category
1	4K Monitor	24.920000076293945	Electronics
2	Smartwatch - White	61.61000061035156	Electronics
3	4K Monitor	62.900001525878906	Electronics
4	Gaming Mouse	92.52999877929688	Electronics

-- BETWEEN

```
SELECT name, price FROM products
WHERE price BETWEEN 100 AND 500
```

	name	price
1	Laptop 14" Pro S	481.5299987792969
2	USB-C Hub - Red	317.3299865722656
3	Wireless Headphones	377.20001220703125
4	Tablet 10" - Black	128.33999633789062
5	Gaming Mouse Lite S	486.9700012207031
6	4K Monitor	226.25999450683594
7	Bluetooth Speaker XL	215.55999755859375
8	Gaming Mouse Pro S	270.9700012207031
9	Smartwatch Pro L - Graphite	394.2200012207031
10	Portable SSD Plus	271.3699951171875
11	Laptop 14" 2.0 - White	132.35000610351562
12	Portable SSD	289.75
13	USB-C Hub S	298.1099853515625
14	Soundbar Plus	146.52999877929688
15	Soundbar 2.0	231.8699951171875
16	Soundbar Max M	317.1400146484375
17	Tablet 10" S - Black	192.97999572753906
18	Gaming Mouse	317.3800048828125
19	Gaming Mouse Pro	415.4700012207031
20	Action Camera - White	129.1699981689453
21	USB-C Hub Plus	408.9200134277344
22	Leggings Max - Silver	245.35000610351562
23	Jacket Max XL	110.7699966430664
24	Hoodie - Black	106.25
25	Hoodie	184.1300048828125
26	Raincoat 2.0	131.5399932861328
27	Jeans XL	113.5199966430664
28	Jeans	104.87000274658203
29	Chinos Pro - Red	195.07000732421875
30	Polo Shirt	121.05999755859375
31	Jacket	140.52999877929688

32	Jacket	223.66000366210938
33	Sneakers Pro XL	185.7899932861328
34	Polo Shirt 2.0	235.5
35	Chinos L - Silver	205.42999267578125
36	Hoodie - Green	237.97999572753906
37	Chinos	138.47999572753906
38	Raincoat	143.42999267578125
39	Cap - Black	205.25999450683594
40	Dress Shirt Plus - Graphite	198.6699981689453
41	Socks (5-pack)	159.63999938964844
42	Polo Shirt - Red	243.7100067138672
43	Hoodie	108.48999786376953
44	Hoodie Plus L	129.17999267578125
45	Jacket 2.0	143.66000366210938
46	Socks (5-pack)	116.91000366210938
47	Socks (5-pack) Max S	127.87999725341797
48	Jeans	141.0399932861328
49	Cap - Green	193.14999389648438
50	Jacket - Green	122.69999694824219
51	Basic T-Shirt	102.4000015258789
52	Polo Shirt - Silver	227.75
53	Leggings Max S	233.5
54	Jeans Plus L	223.6199951171875
55	Basic T-Shirt Lite	146.1199951171875
56	Dress Shirt Max	151.33999633789062
57	Leggings 2.0 - Green	222.35000610351562
58	Raincoat Pro	103.93000030517578
59	Chinos	214.4199981689453
60	Hoodie 2.0 XL - Blue	152.3800048828125
61	Jacket	155.19000244140625
62	Chinos	135.27999877929688
63	Dress Shirt	103.5999984741211

64	Jeans 2.0 - Blue	164.42999267578125
65	Hoodie - Black	196.66000366210938
66	Chinos Lite	126.12999725341797
67	Hoodie	204.27000427246094
68	Polo Shirt	240.1699981689453
69	Jeans Pro - Graphite	171.82000732421875
70	Jacket Lite L - Red	222.7100067138672
71	Sneakers L	177.36000061035156
72	Dress Shirt Pro	198.33999633789062
73	Jeans	231.74000549316406
74	Wireless Mouse XL	375.2699890136719
75	Whiteboard Markers (8-pack) Plus XL	325.4800109863281
76	Wireless Mouse S	291.3800048828125
77	A4 Copy Paper 500 sheets - Silver	417.1000061035156
78	Ergonomic Chair Lite M	255.1999969482422
79	Gel Pens (10-pack)	345.1600036621094
80	Binder 5cm	107.18000030517578
81	Laptop Stand XL	374.7799987792969
82	Laptop Stand	113.69999694824219
83	Gel Pens (10-pack)	106.06999969482422
84	Ergonomic Chair XL	157.0399932861328
85	Ergonomic Chair - Red	383.0400085449219
86	Fountain Pen	470.7300109863281
87	Fountain Pen	283.19000244140625
88	Laptop Stand	402.7200012207031
89	Binder 5cm Pro	179.74000549316406
90	Desk Lamp LED - White	254.80999755859375
91	Fountain Pen 2.0 - Blue	299.239990234375
92	Wireless Mouse	377.42999267578125
93	Laptop Stand - Blue	474
94	Whiteboard Markers (8-pack) L	442.4100036621094
95	Laptop Stand	289.7699890136719

96	Fountain Pen	444
97	Laptop Stand Max L	223.74000549316406
98	Notebook A5 Dotted	293.5400085449219
99	Whiteboard Markers (8-pack) Lite	180.91000366210938
100	Binder 5cm L	322.8699951171875
101	Whiteboard Markers (8-pack) Max	140.72000122070312
102	Ergonomic Chair S	436.5899963378906
103	Ergonomic Chair	140.77000427246094
104	Laptop Stand	407.7699890136719
105	Binder 5cm Pro	483.7200012207031
106	Desk Lamp LED Pro - Blue	361.2300109863281
107	Laptop Stand	301.6300048828125
108	Laptop Stand	487.1000061035156
109	A4 Copy Paper 500 sheets	159.02000427246094
110	Notebook A5 Dotted - Green	215.47000122070312
111	A4 Copy Paper 500 sheets - Blue	407.6099853515625
112	Sticky Notes (12 pads) 2.0	432.6300048828125
113	Notebook A5 Dotted Lite - Black	303.510009765625
114	Office Scissors - Black	280.92999267578125
115	Sticky Notes (12 pads)	111.7699966430664
116	Fountain Pen S - Red	128.9499969482422
117	Fountain Pen - Red	320.5299987792969
118	Desk Lamp LED	353.4700012207031
119	Sticky Notes (12 pads) 2.0	478.1300048828125
120	Sticky Notes (12 pads) - White	363.32000732421875
121	Ergonomic Chair	281.69000244140625
122	Notebook A5 Dotted Plus	214.25999450683594
123	Laptop Stand - Blue	149.0399932861328
124	Laptop Stand Max	278.5899963378906
125	Whiteboard Markers (8-pack)	440.3900146484375
126	Desk Lamp LED Pro	479.6700134277344
127	A4 Copy Paper 500 sheets	461.9100036621094

128	Fountain Pen Lite	212.89999389648438
129	Binder 5cm	210.97000122070312
130	Desk Lamp LED L - Red	258.07000732421875
131	Notebook A5 Dotted 2.0	369.42999267578125
132	Fountain Pen	235.6300048828125
133	Sticky Notes (12 pads) Pro	172.52000427246094
134	Wireless Mouse	240.2100067138672
135	Ergonomic Chair - Graphite	290.3599853515625
136	Gel Pens (10-pack) 2.0	162.49000549316406
137	Laptop Stand Plus XL	425.239990234375
138	Binder 5cm - Graphite	424.25
139	Ergonomic Chair	159.5399932861328
140	Gel Pens (10-pack) Max - Blue	338.79998779296875
141	Wireless Mouse - Green	376.69000244140625
142	Sticky Notes (12 pads)	369.5
143	Office Scissors	186.82000732421875
144	Wireless Mouse Plus XL	189.27000427246094
145	Laptop Stand - White	476.8599853515625
146	Wireless Mouse Plus	364.4800109863281
147	Whiteboard Markers (8-pack)	415.8699951171875
148	Gel Pens (10-pack) XL	271.7900085449219
149	Notebook A5 Dotted	174.57000732421875
150	Gel Pens (10-pack) - Silver	262.6700134277344
151	Ergonomic Chair S	301.6600036621094
152	Notebook A5 Dotted 2.0	202.17999267578125
153	A4 Copy Paper 500 sheets M - Black	290.1099853515625
154	Ergonomic Chair	437.2900085449219
155	Toaster 2-slice	439.2900085449219
156	Water Filter Jug 2.5L - Blue	454.510009765625
157	Pressure Cooker 6L	356.45001220703125
158	Vacuum Cleaner Lite S	185.72999572753906
159	Glass Storage Set (10 pcs) Lite L - Blue	498.4800109863281

160	Vacuum Cleaner Lite	187.6300048828125
161	Cutlery Set (24 pcs)	402.0799865722656
162	Cutlery Set (24 pcs)	462.70001220703125
163	Water Filter Jug 2.5L Plus	173.86000061035156
164	Pressure Cooker 6L	180.17999267578125
165	Glass Storage Set (10 pcs)	275.4700012207031
166	Vacuum Cleaner Plus	199.47999572753906
167	Stainless Steel Pan 28cm	166.74000549316406
168	Stainless Steel Pan 28cm Pro	422.1300048828125
169	Ceramic Mug 350ml	279.6000061035156
170	Glass Storage Set (10 pcs)	174.7100067138672
171	Pressure Cooker 6L - Green	445.1499938964844
172	Toaster 2-slice	205.92999267578125
173	Glass Storage Set (10 pcs)	308.1600036621094
174	Blender 1.5L Plus	356.0799865722656
175	Blender 1.5L Lite	145.8300018310547
176	Stainless Steel Pan 28cm L	297.1000061035156
177	Toaster 2-slice Max L	148.36000061035156
178	Cutlery Set (24 pcs) 2.0	143.94000244140625
179	Blender 1.5L	453.8800048828125
180	Cutlery Set (24 pcs)	365.79998779296875
181	Toaster 2-slice M	170.10000610351562
182	Pressure Cooker 6L Pro S	318.1400146484375
183	Glass Storage Set (10 pcs) XL	100.37000274658203
184	Cutlery Set (24 pcs)	228.94000244140625
185	Cutlery Set (24 pcs) Lite - Silver	386.3699951171875
186	Vacuum Cleaner	432.95001220703125
187	Electric Kettle 1.7L	120.8499984741211
188	Vacuum Cleaner Pro	270.2900085449219
189	Toaster 2-slice - White	241.97000122070312
190	Toaster 2-slice L	475.19000244140625
191	Chef Knife 20cm	465.7799987792969

192	Chef Knife 20cm Plus	245.5
193	Air Fryer 4L Pro M	268.5199890136719
194	Chef Knife 20cm - Silver	499.6099853515625
195	Water Filter Jug 2.5L Plus L	387.17999267578125
196	Stainless Steel Pan 28cm Lite	279.80999755859375
197	Ceramic Mug 350ml	300.95001220703125
198	Air Fryer 4L - Black	327.1199951171875
199	Blender 1.5L - Green	356.5199890136719
200	Cutlery Set (24 pcs)	320.3599853515625
201	Electric Kettle 1.7L S	432.7699890136719
202	Toaster 2-slice Plus	308.19000244140625
203	Air Fryer 4L Lite - White	388.20001220703125
204	Ceramic Mug 350ml Pro - Red	398.8699951171875
205	Toaster 2-slice Plus	182.22000122070312
206	Electric Kettle 1.7L - Graphite	242.41000366210938
207	Vacuum Cleaner	463.2099914550781
208	Cutlery Set (24 pcs)	415.4599914550781
209	Water Filter Jug 2.5L M	347.7200012207031
210	Air Fryer 4L - Red	169.55999755859375
211	Art Set 150 pcs	112.2300033569336
212	Wooden Train Set	139.1699981689453
213	STEM Robot Kit L - Green	197.49000549316406
214	Puzzle 1000 pieces Max M	146.49000549316406
215	STEM Robot Kit Lite XL	148.57000732421875
216	RC Drone Mini Max	122.91999816894531
217	Wooden Train Set 2.0 XL	126.62999725341797
218	Marble Run Plus	121.41999816894531
219	Building Blocks Set	194.47999572753906
220	Puzzle 1000 pieces Lite	107.08999633789062
221	Wooden Train Set Plus	158.75
222	Board Game Classic	122.75
223	RC Drone Mini	171.97999572753906

224	Puzzle 1000 pieces XL	128.1199951171875
225	RC Drone Mini - Green	144.57000732421875
226	Remote Control Car 2.0 M	130.7899932861328
227	RC Drone Mini M - Blue	130.5
228	Art Set 150 pcs 2.0 - Graphite	190.97999572753906
229	STEM Robot Kit	133.63999938964844
230	Remote Control Car 2.0 - Black	138.25
231	Wooden Train Set 2.0 - Silver	154.50999450683594
232	STEM Robot Kit XL - Green	191.16000366210938
233	RC Drone Mini - Graphite	111.83999633789062
234	Puzzle 1000 pieces Max S	171.7100067138672
235	Marble Run - Silver	107.87000274658203
236	Building Blocks Set	188.4499969482422
237	STEM Robot Kit	144.77000427246094
238	Building Blocks Set - White	183.8699951171875
239	Marble Run Plus - Blue	129.41000366210938
240	Remote Control Car S	167.5
241	Board Game Classic 2.0 - Red	147.94000244140625
242	Remote Control Car L - Blue	149.72000122070312
243	Marble Run Pro L	120.20999908447266
244	Science Kit - Volcano - Green	199.2899932861328
245	Building Blocks Set	193.1699981689453
246	Plush Bear 30cm Plus	113.45999908447266
247	STEM Robot Kit	189.36000061035156
248	Building Blocks Set	158.77999877929688
249	Science Kit - Volcano S	181.1999969482422
250	Building Blocks Set XL	107.63999938964844
251	RC Drone Mini Lite - Silver	156.22999572753906
252	Marble Run	157.80999755859375
253	Art Set 150 pcs Max M	133.27000427246094
254	Remote Control Car Pro	193.25
255	Puzzle 1000 pieces Max	119.26000213623047

256	Wooden Train Set Max L - Graphite	127.01000213623047
257	Board Game Classic Plus - Blue	180.36000061035156
258	RC Drone Mini	103.86000061035156
259	Science Kit - Volcano	126
260	Puzzle 1000 pieces - Graphite	131.27000427246094
261	Building Blocks Set Lite	140.49000549316406
262	STEM Robot Kit	136.91000366210938
263	Building Blocks Set	127.01000213623047
264	Bike Helmet Pro S	165.61000061035156
265	Compression Shirt	262.3699951171875
266	Basketball	250.92999267578125
267	Compression Shirt M - Graphite	313.5799865722656
268	Basketball	265.510009765625
269	Fitness Tracker Pro	142.49000549316406
270	Cycling Gloves Pro	113.62000274658203
271	Fitness Tracker XL	228.42999267578125
272	Fitness Tracker	172.1199951171875
273	Compression Shirt - Silver	128.94000244140625
274	Water Bottle 1L Pro M	323.9599914550781
275	Water Bottle 1L - White	207.02999877929688
276	Running Shoes	157.35000610351562
277	Compression Shirt	157.58999633789062
278	Bike Helmet	217.6199951171875
279	Basketball Lite L	317.1700134277344
280	Compression Shirt	220.2899932861328
281	Running Shoes - Green	196.77000427246094
282	Running Shoes	322.1600036621094
283	Water Bottle 1L Pro	291.04998779296875
284	Football Size 5 Lite L	310.3699951171875
285	Jump Rope XL	158.82000732421875
286	Cycling Gloves	199.8000030517578
287	Cycling Gloves - Red	249.38999938964844

288	Fitness Tracker Max	285.70001220703125
289	Dumbbells Pair 2x5kg 2.0	186.9499969482422
290	Fitness Tracker	249.69000244140625
291	Water Bottle 1L Pro	273.5400085449219
292	Compression Shirt 2.0 - Black	118.0199966430664
293	Cycling Gloves S	110.51000213623047
294	Tennis Racket S	309.010009765625
295	Running Shoes	123.13999938964844
296	Water Bottle 1L	286.07000732421875
297	Tennis Racket Lite - Graphite	157.58999633789062
298	Cycling Gloves L - Blue	104.26000213623047
299	Running Shoes Pro - Green	287.260009765625
300	Football Size 5 Plus M	132.22000122070312
301	Cycling Gloves S	224.5800018310547
302	Yoga Mat 6mm Lite - Blue	165.61000061035156
303	Cycling Gloves	109.41999816894531
304	Basketball	253.86000061035156
305	Basketball Pro	229.67999267578125
306	Yoga Mat 6mm Max	111.70999908447266
307	Water Bottle 1L	207.52999877929688
308	Jump Rope	204.47999572753906
309	Compression Shirt Plus	218.3300018310547
310	Dumbbells Pair 2x5kg	294.42999267578125
311	Running Shoes Plus	299.6000061035156
312	Compression Shirt Pro	103.9800033569336
313	Dumbbells Pair 2x5kg	261.3800048828125
314	Running Shoes Max M	101.02999877929688
315	Dumbbells Pair 2x5kg Pro - Blue	108.66999816894531
316	Fitness Tracker Pro	162.89999389648438
317	Tennis Racket Pro	164.08999633789062
318	Football Size 5 Pro	135.6699981689453
319	Basketball Lite	322.0799865722656

320	Fitness Tracker Lite - Graphite	162.27999877929688
321	Basketball - Blue	193.2899932861328
322	Water Bottle 1L Lite	166.00999450683594
323	Dumbbells Pair 2x5kg L	291.5799865722656
324	Cycling Gloves - Green	236.3000030517578
325	Dumbbells Pair 2x5kg Max M	339.05999755859375
326	Tennis Racket Lite	267.80999755859375
327	Cycling Gloves 2.0	322.3299865722656
328	Tennis Racket 2.0 - Black	320.3399963378906
329	Football Size 5 Pro - Graphite	318.4700012207031
330	Shampoo 300ml Plus L	107.01000213623047
331	Hand Cream 75ml Plus XL - Red	136.27000427246094
332	Body Lotion 250ml Pro - Black	126.13999938964844
333	Face Mask Sheet Max	138.5
334	Conditioner 300ml	130.1699981689453
335	Micellar Water 400ml Pro	129.8000030517578
336	Micellar Water 400ml Pro	100.05999755859375
337	Moisturizing Cream 50ml Lite	134.05999755859375
338	Hair Oil 100ml Lite S	120.61000061035156
339	Face Mask Sheet L	131.33999633789062
340	Body Lotion 250ml Pro	111.37000274658203
341	Hair Oil 100ml 2.0 - White	127.30999755859375
342	Conditioner 300ml Pro L	105.44000244140625
343	Sunscreen SPF50 100ml 2.0 - Green	135.2100067138672
344	Moisturizing Cream 50ml	120.47000122070312
345	Moisturizing Cream 50ml	124.66000366210938
346	Facial Cleanser 200ml Plus	134.25
347	Sunscreen SPF50 100ml	114.51000213623047
348	Hand Cream 75ml Plus	139.5800018310547
349	Face Mask Sheet	135.27999877929688
350	Aquarium Filter S - White	104.36000061035156
351	Pet Bed Medium L	120.69999694824219

352	Pet Shampoo 250ml	180.44000244140625
353	Pet Shampoo 250ml M	141.08999633789062
354	Dog Leash Nylon	172.75999450683594
355	Pet Treats Mixed 500g M - White	147.8300018310547
356	Pet Shampoo 250ml Plus - Blue	102.16999816894531
357	Pet Shampoo 250ml 2.0 - Silver	141.82000732421875
358	Cat Litter 10L - Graphite	116.62000274658203
359	Cat Scratching Post Pro	100.86000061035156
360	Cat Litter 10L 2.0 S	160.8300018310547
361	Cat Litter 10L	113.45999908447266
362	Aquarium Filter Pro	172.0500030517578
363	Cat Litter 10L M - Green	194.52999877929688
364	Pet Bed Medium	136.77000427246094
365	Dog Leash Nylon	140.6199951171875
366	Bird Seed 1kg Plus	132.10000610351562
367	Pet Shampoo 250ml	178.36000061035156
368	Fish Flakes 200g S - Blue	184.89999389648438
369	Bird Seed 1kg	199.0800018310547
370	Cat Scratching Post Plus	147.8800048828125
371	Cat Litter 10L M	121.4800033569336
372	Pet Shampoo 250ml - Red	173.8000030517578
373	Dry Dog Food 5kg	111.94000244140625
374	Pet Treats Mixed 500g	183.4199981689453
375	Pet Bed Medium L	108.12000274658203
376	Cat Toys (6-pack)	189.38999938964844
377	Bird Seed 1kg S - Silver	142.55999755859375
378	Pet Shampoo 250ml Max - Green	177.80999755859375
379	Aquarium Filter	193.86000061035156
380	Pet Bed Medium	104.2699966430664
381	Cat Litter 10L 2.0 XL	185.24000549316406
382	Cat Scratching Post - Red	162.25999450683594
383	Pet Bed Medium Pro - Red	144.36000061035156

384	Fish Flakes 200g M	120.55999755859375
385	Dog Leash Nylon Lite	104.69000244140625
386	Pet Bed Medium - Silver	193.47999572753906
387	Small Animal Hay 1kg	111.22000122070312
388	Bird Seed 1kg 2.0 - Blue	124.9800033569336
389	Bird Seed 1kg - White	113.43000030517578
390	Small Animal Hay 1kg Plus	136.5399932861328
391	Pet Treats Mixed 500g Pro S - Black	181.9600067138672
392	Pet Treats Mixed 500g	143.77999877929688
393	Cat Litter 10L	196
394	Aquarium Filter L	189.22999572753906
395	Pet Shampoo 250ml Plus - White	111.93000030517578
396	Dog Leash Nylon XL	148.2899932861328

-- IN

```
SELECT name, category FROM products
WHERE category IN ('Electronics', 'Office', 'Groceries')
```

	name	category
1	Laptop 14" 2.0	Electronics
2	Portable SSD Max M	Electronics
3	4K Monitor - Green	Electronics
4	Tablet 10	Electronics
5	Portable SSD Lite	Electronics
6	Soundbar - Red	Electronics
7	Mechanical Keyboard - Black	Electronics
8	Laptop 14" Plus	Electronics
9	Action Camera - Green	Electronics
10	Soundbar	Electronics
11	4K Monitor	Electronics
12	Action Camera XL	Electronics
13	Gaming Mouse Plus M	Electronics
14	Bluetooth Speaker Plus	Electronics
15	Noise-Canceling Earbuds Lite	Electronics
16	Action Camera - Blue	Electronics
17	Laptop 14" Pro S	Electronics
18	Gaming Mouse	Electronics
19	USB-C Hub - White	Electronics
20	USB-C Hub - Red	Electronics
21	Wireless Headphones	Electronics
22	Laptop 14" 2.0 - Black	Electronics
23	Wireless Headphones M	Electronics
24	Tablet 10" - Green	Electronics
25	Soundbar Plus	Electronics
26	USB-C Hub Plus	Electronics
27	Noise-Canceling Earbuds Max	Electronics
28	Tablet 10" - Black	Electronics
29	Mechanical Keyboard - Blue	Electronics
30	Action Camera	Electronics
31	Tablet 10" Plus	Electronics

32	Noise-Canceling Earbuds	Electronics
33	Smartwatch - White	Electronics
34	Bluetooth Speaker M	Electronics
35	4K Monitor	Electronics
36	Tablet 10	Electronics
37	Action Camera Plus	Electronics
38	Bluetooth Speaker Pro	Electronics
39	Portable SSD Lite S	Electronics
40	Gaming Mouse - Graphite	Electronics
41	Portable SSD Lite - Graphite	Electronics
42	Wireless Headphones Pro S - Silver	Electronics
43	Gaming Mouse M	Electronics
44	Bluetooth Speaker Lite M	Electronics
45	Gaming Mouse Lite S	Electronics
46	4K Monitor - White	Electronics
47	4K Monitor	Electronics
48	4K Monitor	Electronics
49	Bluetooth Speaker XL	Electronics
50	Gaming Mouse Pro S	Electronics
51	Smartwatch Pro L - Graphite	Electronics
52	Portable SSD Plus	Electronics
53	Tablet 10	Electronics
54	4K Monitor	Electronics
55	USB-C Hub	Electronics
56	Wireless Headphones Max	Electronics
57	USB-C Hub Pro	Electronics
58	4K Monitor	Electronics
59	Action Camera 2.0	Electronics
60	Mechanical Keyboard	Electronics
61	Action Camera	Electronics
62	Laptop 14" 2.0 - White	Electronics
63	Portable SSD	Electronics

64	USB-C Hub S	Electronics
65	Gaming Mouse Plus S	Electronics
66	Soundbar Plus	Electronics
67	Smartwatch Pro - Blue	Electronics
68	4K Monitor L	Electronics
69	Gaming Mouse M	Electronics
70	Smartwatch S	Electronics
71	Soundbar Pro S	Electronics
72	Soundbar 2.0	Electronics
73	Soundbar Max M	Electronics
74	USB-C Hub - Black	Electronics
75	4K Monitor	Electronics
76	USB-C Hub XL	Electronics
77	Tablet 10" S - Black	Electronics
78	Mechanical Keyboard 2.0 XL	Electronics
79	Smartwatch	Electronics
80	Bluetooth Speaker	Electronics
81	Wireless Headphones	Electronics
82	Gaming Mouse	Electronics
83	Portable SSD 2.0	Electronics
84	4K Monitor XL	Electronics
85	Portable SSD	Electronics
86	Tablet 10" Pro - Black	Electronics
87	Laptop 14	Electronics
88	Laptop 14" Lite	Electronics
89	Tablet 10" - Graphite	Electronics
90	Tablet 10" Max	Electronics
91	Gaming Mouse Pro	Electronics
92	Smartwatch	Electronics
93	Bluetooth Speaker - Blue	Electronics
94	Wireless Headphones	Electronics
95	Gaming Mouse	Electronics

96	Bluetooth Speaker	Electronics
97	Action Camera - White	Electronics
98	Soundbar Max	Electronics
99	USB-C Hub Plus	Electronics
100	USB-C Hub S	Electronics
101	Wireless Mouse XL	Office
102	Whiteboard Markers (8-pack) Plus XL	Office
103	Whiteboard Markers (8-pack) Plus	Office
104	Wireless Mouse S	Office
105	Office Scissors	Office
106	A4 Copy Paper 500 sheets - Silver	Office
107	Ergonomic Chair Lite M	Office
108	Gel Pens (10-pack)	Office
109	Binder 5cm	Office
110	Laptop Stand XL	Office
111	Laptop Stand	Office
112	Gel Pens (10-pack)	Office
113	Ergonomic Chair XL	Office
114	Ergonomic Chair - Red	Office
115	Fountain Pen	Office
116	Fountain Pen	Office
117	Laptop Stand	Office
118	Binder 5cm Pro	Office
119	Sticky Notes (12 pads) Lite	Office
120	Desk Lamp LED - White	Office
121	Fountain Pen 2.0 - Blue	Office
122	Wireless Mouse	Office
123	Laptop Stand - Blue	Office
124	Whiteboard Markers (8-pack) L	Office
125	Laptop Stand	Office
126	Ergonomic Chair Plus	Office
127	Fountain Pen	Office

128	Laptop Stand Max L	Office
129	Wireless Mouse M	Office
130	Notebook A5 Dotted	Office
131	Whiteboard Markers (8-pack) Lite	Office
132	A4 Copy Paper 500 sheets	Office
133	Binder 5cm L	Office
134	Whiteboard Markers (8-pack) Max	Office
135	Ergonomic Chair S	Office
136	Ergonomic Chair	Office
137	Ergonomic Chair	Office
138	Laptop Stand	Office
139	Binder 5cm Pro	Office
140	Desk Lamp LED Pro - Blue	Office
141	Laptop Stand	Office
142	Laptop Stand	Office
143	A4 Copy Paper 500 sheets	Office
144	Office Scissors Pro	Office
145	Notebook A5 Dotted - Green	Office
146	A4 Copy Paper 500 sheets - Blue	Office
147	Sticky Notes (12 pads) 2.0	Office
148	Notebook A5 Dotted Lite - Black	Office
149	Office Scissors - Black	Office
150	Sticky Notes (12 pads)	Office
151	Fountain Pen S - Red	Office
152	Fountain Pen - Red	Office
153	Desk Lamp LED	Office
154	Sticky Notes (12 pads) 2.0	Office
155	Sticky Notes (12 pads) - White	Office
156	Ergonomic Chair	Office
157	Notebook A5 Dotted Plus	Office
158	Whiteboard Markers (8-pack) Max - Blue	Office
159	Laptop Stand - Blue	Office

160	Whiteboard Markers (8-pack)	Office
161	Laptop Stand Max	Office
162	Whiteboard Markers (8-pack)	Office
163	Desk Lamp LED Pro	Office
164	A4 Copy Paper 500 sheets	Office
165	Fountain Pen Lite	Office
166	Binder 5cm	Office
167	Gel Pens (10-pack) Lite	Office
168	Desk Lamp LED L - Red	Office
169	Notebook A5 Dotted 2.0	Office
170	Fountain Pen	Office
171	Sticky Notes (12 pads) Pro	Office
172	Wireless Mouse	Office
173	Ergonomic Chair - Graphite	Office
174	Gel Pens (10-pack) 2.0	Office
175	Binder 5cm	Office
176	Laptop Stand Lite	Office
177	Laptop Stand Plus XL	Office
178	Binder 5cm - Graphite	Office
179	Ergonomic Chair	Office
180	Gel Pens (10-pack) Max - Blue	Office
181	Wireless Mouse - Green	Office
182	Sticky Notes (12 pads)	Office
183	Office Scissors	Office
184	Wireless Mouse Plus XL	Office
185	Laptop Stand - White	Office
186	Wireless Mouse Plus	Office
187	Whiteboard Markers (8-pack)	Office
188	Gel Pens (10-pack) XL	Office
189	Notebook A5 Dotted	Office
190	Gel Pens (10-pack) - Silver	Office
191	Ergonomic Chair S	Office

192	Notebook A5 Dotted 2.0	Office
193	A4 Copy Paper 500 sheets M - Black	Office
194	Ergonomic Chair	Office
195	Granola 750g	Groceries
196	Olive Oil 1L - Silver	Groceries
197	Tomato Sauce 400g Max XL	Groceries
198	Olive Oil 1L M	Groceries
199	Green Tea 50 bags M	Groceries
200	Green Tea 50 bags - Black	Groceries
201	Arabica Coffee Beans 1kg	Groceries
202	Pasta Fusilli 500g Plus	Groceries
203	Olive Oil 1L M - Green	Groceries
204	Green Tea 50 bags Max	Groceries
205	Arabica Coffee Beans 1kg Plus	Groceries
206	Sea Salt 500g	Groceries
207	Green Tea 50 bags	Groceries
208	Arabica Coffee Beans 1kg	Groceries
209	Pasta Fusilli 500g Max M	Groceries
210	Basmati Rice 1kg L - White	Groceries
211	Tomato Sauce 400g	Groceries
212	Dark Chocolate 85% 100g XL - Green	Groceries
213	Tomato Sauce 400g	Groceries
214	Basmati Rice 1kg Plus - White	Groceries
215	Basmati Rice 1kg Max L	Groceries
216	Basmati Rice 1kg Lite S	Groceries
217	Granola 750g Plus - Green	Groceries
218	Organic Oat Milk 1L	Groceries
219	Dark Chocolate 85% 100g	Groceries
220	Sea Salt 500g Max - Blue	Groceries
221	Tomato Sauce 400g - Black	Groceries
222	Olive Oil 1L	Groceries
223	Organic Oat Milk 1L	Groceries

224	Green Tea 50 bags - Silver	Groceries
225	Honey 500g 2.0 - White	Groceries
226	Sea Salt 500g - White	Groceries
227	Olive Oil 1L	Groceries
228	Green Tea 50 bags S - Red	Groceries
229	Organic Oat Milk 1L	Groceries
230	Arabica Coffee Beans 1kg Pro XL - Blue	Groceries
231	Honey 500g 2.0 M	Groceries
232	Olive Oil 1L M	Groceries
233	Arabica Coffee Beans 1kg Lite	Groceries
234	Granola 750g Max	Groceries
235	Basmati Rice 1kg Pro	Groceries
236	Almonds 200g Lite XL	Groceries
237	Pasta Fusilli 500g Max XL	Groceries
238	Basmati Rice 1kg	Groceries
239	Organic Oat Milk 1L	Groceries
240	Sea Salt 500g	Groceries
241	Dark Chocolate 85% 100g Lite L - Green	Groceries
242	Pasta Fusilli 500g Lite M	Groceries
243	Sea Salt 500g Lite - Graphite	Groceries
244	Organic Oat Milk 1L Lite S - Red	Groceries
245	Honey 500g Lite S	Groceries
246	Tomato Sauce 400g	Groceries
247	Basmati Rice 1kg 2.0 - Red	Groceries
248	Green Tea 50 bags Plus	Groceries
249	Almonds 200g - Green	Groceries
250	Granola 750g XL - Graphite	Groceries
251	Green Tea 50 bags	Groceries
252	Tomato Sauce 400g - White	Groceries
253	Pasta Fusilli 500g - Black	Groceries
254	Arabica Coffee Beans 1kg - Green	Groceries
255	Sea Salt 500g - Green	Groceries

256	Green Tea 50 bags XL	Groceries
257	Honey 500g - Black	Groceries
258	Almonds 200g	Groceries
259	Granola 750g - White	Groceries
260	Dark Chocolate 85% 100g - White	Groceries
261	Dark Chocolate 85% 100g - White	Groceries
262	Pasta Fusilli 500g - Silver	Groceries
263	Tomato Sauce 400g L - Black	Groceries
264	Sea Salt 500g	Groceries
265	Almonds 200g Max	Groceries
266	Olive Oil 1L - Silver	Groceries
267	Tomato Sauce 400g Max	Groceries
268	Almonds 200g - Graphite	Groceries
269	Granola 750g Plus	Groceries
270	Granola 750g	Groceries
271	Almonds 200g Max - White	Groceries
272	Sea Salt 500g - White	Groceries
273	Honey 500g	Groceries
274	Arabica Coffee Beans 1kg	Groceries
275	Honey 500g Max	Groceries
276	Arabica Coffee Beans 1kg	Groceries
277	Dark Chocolate 85% 100g L - Red	Groceries
278	Organic Oat Milk 1L Max	Groceries
279	Green Tea 50 bags	Groceries
280	Green Tea 50 bags	Groceries
281	Sea Salt 500g	Groceries
282	Organic Oat Milk 1L 2.0	Groceries
283	Green Tea 50 bags	Groceries
284	Honey 500g Max S	Groceries
285	Honey 500g - Black	Groceries
286	Basmati Rice 1kg	Groceries
287	Granola 750g 2.0 - Blue	Groceries

288	Dark Chocolate 85% 100g M - Black	Groceries
289	Sea Salt 500g Max XL - Silver	Groceries
290	Green Tea 50 bags - Black	Groceries
291	Arabica Coffee Beans 1kg Plus - Blue	Groceries
292	Organic Oat Milk 1L Plus M	Groceries
293	Arabica Coffee Beans 1kg Max XL - Silver	Groceries
294	Dark Chocolate 85% 100g Max S - Silver	Groceries

-- LIKE (Pattern Matching)

```
SELECT name FROM products
WHERE name LIKE '%Laptop%'
```

	name
1	Laptop 14" 2.0
2	Laptop 14" Plus
3	Laptop 14" Pro S
4	Laptop 14" 2.0 - Black
5	Laptop 14" 2.0 - White
6	Laptop 14
7	Laptop 14" Lite
8	Laptop Stand XL
9	Laptop Stand
10	Laptop Stand
11	Laptop Stand - Blue
12	Laptop Stand
13	Laptop Stand Max L
14	Laptop Stand
15	Laptop Stand
16	Laptop Stand
17	Laptop Stand - Blue
18	Laptop Stand Max
19	Laptop Stand Lite
20	Laptop Stand Plus XL
21	Laptop Stand - White

```
-- % = beliebig viele Zeichen
-- NULL-Werte
SELECT name, rating FROM products
WHERE rating IS NULL
```

	name	rating
1	Action Camera	null
2	Hoodie M	null
3	Childrens Stories Pro	null
4	Dog Leash Nylon L	null
5	Cat Litter 10L	null

3.5 ORDER BY – Sortieren

```
1 -- Aufsteigend (Standard)
2 SELECT name, price FROM products
3 ORDER BY price ASC
4 LIMIT 10;
5
6 -- Absteigend
7 SELECT name, price FROM products
8 ORDER BY price DESC
9 LIMIT 10;
10
11 -- Nach mehreren Spalten
12 SELECT category, name, price FROM products
13 ORDER BY category ASC, price DESC
14 LIMIT 10;
15
16 -- NULL-Behandlung
17 SELECT name, rating FROM products
18 ORDER BY rating DESC NULLS LAST
19 LIMIT 10;
```

```
-- Aufsteigend (Standard)
SELECT name, price FROM products
ORDER BY price ASC
LIMIT 10
```

	name	price
1	Arabica Coffee Beans 1kg	0.8999999761581421
2	Honey 500g - Black	1.7300000190734863
3	Granola 750g XL - Graphite	1.9900000095367432
4	Organic Oat Milk 1L Lite S - Red	2.25
5	Basmati Rice 1kg	2.3299999237060547
6	Almonds 200g Lite XL	2.4800000190734863
7	Sea Salt 500g Lite - Graphite	3.069999933242798
8	Arabica Coffee Beans 1kg	3.0899999141693115
9	Almonds 200g	3.5899999141693115
10	Green Tea 50 bags	3.680000066757202

```
-- Absteigend
SELECT name, price FROM products
ORDER BY price DESC
LIMIT 10
```

	name	price
1	Bluetooth Speaker	1493.8199462890625
2	Mechanical Keyboard	1462.4000244140625
3	4K Monitor	1445.8599853515625
4	Tablet 10	1433.699951171875
5	Soundbar Pro S	1425.739990234375
6	Bluetooth Speaker Lite M	1425.0899658203125
7	Gaming Mouse	1402.1300048828125
8	Laptop 14" 2.0	1399.030029296875
9	4K Monitor - White	1390.68994140625
10	4K Monitor XL	1389.72998046875

```
-- Nach mehreren Spalten
SELECT category, name, price FROM products
ORDER BY category ASC, price DESC
LIMIT 10
```

	category	name	price
1	Beauty	Hand Cream 75ml Plus	139.5800018310547
2	Beauty	Face Mask Sheet Max	138.5
3	Beauty	Hand Cream 75ml Plus XL - Red	136.27000427246094
4	Beauty	Face Mask Sheet	135.27999877929688
5	Beauty	Sunscreen SPF50 100ml 2.0 - Green	135.2100067138672
6	Beauty	Facial Cleanser 200ml Plus	134.25
7	Beauty	Moisturizing Cream 50ml Lite	134.05999755859375
8	Beauty	Face Mask Sheet L	131.33999633789062
9	Beauty	Conditioner 300ml	130.1699981689453
10	Beauty	Micellar Water 400ml Pro	129.8000030517578

```
-- NULL-Behandlung
SELECT name, rating FROM products
ORDER BY rating DESC NULLS LAST
LIMIT 10
```

	name	rating
1	4K Monitor - Green	5
2	Soundbar - Red	5
3	Action Camera - Green	5
4	Wireless Headphones M	5
5	Noise-Canceling Earbuds	5
6	Bluetooth Speaker M	5
7	USB-C Hub Pro	5
8	Gaming Mouse	5
9	Action Camera - White	5
10	Socks (5-pack) 2.0 M	5

3.6 DISTINCT – Duplikate entfernen

```
1 -- Eindeutige Kategorien
2 SELECT DISTINCT category
3 FROM products
4 ORDER BY category;
5
6 -- Eindeutige Kombinationen
7 SELECT DISTINCT category, brand
8 FROM products
9 ORDER BY category, brand;
```



```
-- Eindeutige Kategorien  
SELECT DISTINCT category  
FROM products  
ORDER BY category
```

	category
1	Beauty
2	Books
3	Clothing
4	Electronics
5	Groceries
6	Home & Kitchen
7	Office
8	Pets
9	Sports
10	Toys

```
-- Eindeutige Kombinationen  
SELECT DISTINCT category, brand  
FROM products  
ORDER BY category, brand
```

	category	brand
1	Beauty	AurumCare
2	Beauty	LunaLeaf
3	Beauty	OceanMist
4	Beauty	PureGlow
5	Beauty	SilkAura
6	Beauty	VelvetSkin
7	Books	Atlas Editions
8	Books	Northwind Press
9	Books	OpenPage
10	Books	Orion Leaf
11	Books	Silver Quill
12	Books	Sunset House
13	Clothing	AeroLoom
14	Clothing	Cotton&Co
15	Clothing	Meridian Wear
16	Clothing	Nordline
17	Clothing	PureThread
18	Clothing	Seaside
19	Clothing	UrbanTrail
20	Electronics	Auralite
21	Electronics	BlueWave
22	Electronics	Neutrino
23	Electronics	OrbiTech
24	Electronics	PixelPeak
25	Electronics	Voltix
26	Electronics	ZenCore
27	Groceries	DailyChoice
28	Groceries	Everfarm
29	Groceries	FreshField
30	Groceries	GreenVale
31	Groceries	Pure&Simple

32	Groceries	SunHarvest
33	Home & Kitchen	AquaPure
34	Home & Kitchen	BrightGlow
35	Home & Kitchen	CasaNova
36	Home & Kitchen	CozyNest
37	Home & Kitchen	Hearthstone
38	Home & Kitchen	KitchenCrafter
39	Office	DeskPro
40	Office	ErgoCraft
41	Office	InkFlow
42	Office	PaperMint
43	Office	StapleStar
44	Office	WriteRight
45	Pets	AquaPets
46	Pets	FurryFriends
47	Pets	HappyTail
48	Pets	Paw&Co
49	Pets	PetNest
50	Pets	WildFeast
51	Sports	AeroFlex
52	Sports	CoreAthlete
53	Sports	FitFoundry
54	Sports	PeakMotion
55	Sports	TrailRunner
56	Sports	WaveRider
57	Toys	HappyBlocks
58	Toys	KiddyLab
59	Toys	PlayVerse
60	Toys	RoboPal
61	Toys	SunnyPlay
62	Toys	WonderWorks

3.7 GROUP BY & Aggregation

```
1 -- Anzahl pro Kategorie
2 SELECT
3   category,
4   COUNT(*) AS product_count
5 FROM products
6 GROUP BY category
7 ORDER BY product_count DESC;
8
9 -- Mehrere Aggregate
10 SELECT
11   category,
12   COUNT(*) AS products,
13   ROUND(AVG(price), 2) AS avg_price,
14   MIN(price) AS cheapest,
15   MAX(price) AS most_expensive,
16   SUM(stock) AS total_stock
17 FROM products
18 GROUP BY category;
19
20 -- HAVING - Gruppen filtern
21 SELECT
22   category,
23   COUNT(*) AS count,
24   ROUND(AVG(price), 2) AS avg_price
25 FROM products
26 GROUP BY category
27 HAVING COUNT(*) > 50
28 ORDER BY count DESC;
29
30 -- WHERE + GROUP BY + HAVING
31 SELECT
32   brand,
33   COUNT(*) AS products,
34   ROUND(AVG(price), 2) AS avg_price
35 FROM products
36 WHERE category = 'Electronics'
37 GROUP BY brand
38 HAVING COUNT(*) > 5
39 ORDER BY products DESC;
```

```
-- Anzahl pro Kategorie
SELECT
    category,
    COUNT(*) AS product_count
FROM products
GROUP BY category
ORDER BY product_count DESC
```

	category	product_count
1	Electronics	100
2	Groceries	100
3	Pets	98
4	Books	95
5	Office	94
6	Toys	93
7	Clothing	92
8	Sports	91
9	Home & Kitchen	90
10	Beauty	79

```
-- Mehrere Aggregate
SELECT
    category,
    COUNT(*) AS products,
    ROUND(AVG(price), 2) AS avg_price,
    MIN(price) AS cheapest,
    MAX(price) AS most_expensive,
    SUM(stock) AS total_stock
FROM products
GROUP BY category
```

	category	products	avg_price	cheapest	most_expensive	total_
1	Electronics	100	814.81	24.920000076293945	1493.8199462890625	15703
2	Clothing	92	116.83	6.130000114440918	245.35000610351562	38229
3	Groceries	100	21.12	0.8999999761581421	39.84000015258789	10498
4	Office	94	266.53	7.53000020980835	487.1000061035156	41501
5	Home & Kitchen	90	370.11	15.220000267028809	691.3400268554688	27883
6	Toys	93	106.07	6.849999904632568	199.2899932861328	39661
7	Sports	91	172.76	24.809999465942383	339.05999755859375	45667
8	Beauty	79	73.31	4.489999771118164	139.5800018310547	44206
9	Books	95	41.27	6.190000057220459	78.86000061035156	23920
10	Pets	98	97.91	3.950000047683716	199.0800018310547	31533

```
-- HAVING - Gruppen filtern
SELECT
    category,
    COUNT(*) AS count,
    ROUND(AVG(price), 2) AS avg_price
FROM products
GROUP BY category
HAVING COUNT(*) > 50
ORDER BY count DESC
```

	category	count	avg_price
1	Electronics	100	814.81
2	Groceries	100	21.12
3	Pets	98	97.91
4	Books	95	41.27
5	Office	94	266.53
6	Toys	93	106.07
7	Clothing	92	116.83
8	Sports	91	172.76
9	Home & Kitchen	90	370.11
10	Beauty	79	73.31

```
-- WHERE + GROUP BY + HAVING
SELECT
    brand,
    COUNT(*) AS products,
    ROUND(AVG(price), 2) AS avg_price
FROM products
WHERE category = 'Electronics'
GROUP BY brand
HAVING COUNT(*) > 5
ORDER BY products DESC
```

	brand	products	avg_price
1	Voltix	20	875.83
2	Auralite	17	923.31
3	ZenCore	16	698.99
4	OrbiTech	15	773.56
5	Neutrino	14	736.94
6	PixelPeak	9	954.7
7	BlueWave	9	730.2

3.8 LIMIT & OFFSET – Paginierung

```

1 -- Top 10
2 SELECT name, price FROM products
3 ORDER BY price DESC
4 LIMIT 10;
5
6 -- Seite 2 (Zeilen 11-20)
7 SELECT name, price FROM products
8 ORDER BY name
9 LIMIT 10 OFFSET 10;
10
11 -- Cursor-basierte Paginierung (besser bei großen Offsets)
12 SELECT product_id, name, price FROM products
13 WHERE product_id > 'P00010'
14 ORDER BY product_id
15 LIMIT 10;
```

```
-- Top 10
SELECT name, price FROM products
ORDER BY price DESC
LIMIT 10
```

	name	price
1	Bluetooth Speaker	1493.8199462890625
2	Mechanical Keyboard	1462.4000244140625
3	4K Monitor	1445.8599853515625
4	Tablet 10	1433.699951171875
5	Soundbar Pro S	1425.739990234375
6	Bluetooth Speaker Lite M	1425.0899658203125
7	Gaming Mouse	1402.1300048828125
8	Laptop 14" 2.0	1399.030029296875
9	4K Monitor - White	1390.68994140625
10	4K Monitor XL	1389.72998046875

```
-- Seite 2 (Zeilen 11-20)
SELECT name, price FROM products
ORDER BY name
LIMIT 10 OFFSET 10
```

	name	price
1	4K Monitor XL	1389.72998046875
2	A4 Copy Paper 500 sheets	461.9100036621094
3	A4 Copy Paper 500 sheets	159.02000427246094
4	A4 Copy Paper 500 sheets	33.79999923706055
5	A4 Copy Paper 500 sheets - Blue	407.6099853515625
6	A4 Copy Paper 500 sheets - Silver	417.1000061035156
7	A4 Copy Paper 500 sheets M - Black	290.1099853515625
8	Action Camera	1259.300048828125
9	Action Camera	1027.699951171875
10	Action Camera - Blue	1322.9000244140625

```
-- Cursor-basierte Paginierung (besser bei großen Offsets)
SELECT product_id, name, price FROM products
WHERE product_id > 'P00010'
ORDER BY product_id
LIMIT 10
Conversion Error: Could not convert string 'P00010' to INT32
LINE 3: WHERE product_id > 'P00010'
          ^

```

4. Normalisierung (L9)

4.1 Normalformen-Übersicht

Normalform	Regel	Beispiel-Problem
1NF	Alle Werte sind atomar (keine Listen)	Adresse = „Straße, PLZ, Stadt“
2NF	1NF + keine partiellen Abhängigkeiten	Produktnamen hängt nur von product_id ab
3NF	2NF + keine transitiven Abhängigkeiten	Stadt hängt von PLZ ab

4.2 1NF – Erste Normalform

Regel: Alle Attribute sind atomar (kein einziges Attribut enthält mehrere Werte).

```
1 -- ❌ Nicht 1NF (Adresse nicht atomar)
2 CREATE TABLE users_bad (
3   user_id INTEGER,
4   name TEXT,
5   address TEXT -- "Hauptstraße 12, 04109 Leipzig"
6 );
7
8 -- ✅ 1NF (Adresse aufgeteilt)
9 CREATE TABLE users_good (
10   user_id INTEGER,
11   name TEXT,
12   street TEXT,      -- "Hauptstraße 12"
13   zip TEXT,         -- "04109"
14   city TEXT         -- "Leipzig"
15 );
```

```
-- ❌ Nicht 1NF (Adresse nicht atomar)
CREATE TABLE users_bad (
    user_id INTEGER,
    name TEXT,
    address TEXT -- "Hauptstraße 12, 04109 Leipzig"
)
```

ok

```
-- ✅ 1NF (Adresse aufgeteilt)
CREATE TABLE users_good (
    user_id INTEGER,
    name TEXT,
    street TEXT,    -- "Hauptstraße 12"
    zip TEXT,       -- "04109"
    city TEXT       -- "Leipzig"
)
```

ok

4.3 2NF – Zweite Normalform

Regel: 1NF + jedes Nicht-Schlüssel-Attribut hängt vom gesamten Primärschlüssel ab (keine partiellen Abhängigkeiten).

```

1  -- ❌ Nicht 2NF (product_name hängt nur von product_id ab, nicht von
   order_id)
2  CREATE TABLE order_items_bad (
3      order_id INTEGER,
4      product_id INTEGER,
5      product_name TEXT,      -- Redundant! Hängt nur von product_id ab
6      quantity INTEGER,
7      PRIMARY KEY (order_id, product_id)
8  );
9
10 -- ✅ 2NF (Produktdaten ausgelagert)
11 CREATE TABLE products (
12     product_id INTEGER PRIMARY KEY,
13     product_name TEXT
14 );
15
16 CREATE TABLE order_items_good (
17     order_id INTEGER,
18     product_id INTEGER,
19     quantity INTEGER,
20     PRIMARY KEY (order_id, product_id),
21     FOREIGN KEY (product_id) REFERENCES products(product_id)
```

```
22 );
```

```
-- ❌ Nicht 2NF (product_name hängt nur von product_id ab, nicht von order_id)
CREATE TABLE order_items_bad (
    order_id INTEGER,
    product_id INTEGER,
    product_name TEXT, -- Redundant! Hängt nur von product_id ab
    quantity INTEGER,
    PRIMARY KEY (order_id, product_id)
)
```

ok

```
-- ✅ 2NF (Produktdaten ausgelagert)
CREATE TABLE products (
    product_id INTEGER PRIMARY KEY,
    product_name TEXT
)
```

ok

```
CREATE TABLE order_items_good (
    order_id INTEGER,
    product_id INTEGER,
    quantity INTEGER,
    PRIMARY KEY (order_id, product_id),
    FOREIGN KEY (product_id) REFERENCES products(product_id)
)
```

ok

4.4 3NF – Dritte Normalform

Regel: 2NF + keine transitiven Abhängigkeiten (kein Nicht-Schlüssel-Attribut hängt von einem anderen Nicht-Schlüssel-Attribut ab).

```
1  -- ❌ Nicht 3NF (city hängt von zip ab → transitive Abhängigkeit)
2  CREATE TABLE customers_bad (
3      customer_id INTEGER PRIMARY KEY,
4      name TEXT,
5      zip TEXT,
6      city TEXT -- Hängt von zip ab!
7  );
8
9  -- ✅ 3NF (PLZ/Stadt ausgelagert)
10 CREATE TABLE locations (
11     location_id INTEGER PRIMARY KEY,
12     zip TEXT UNIQUE
```

```
12     zip TEXT UNIQUE,  
13     city TEXT  
14 );  
15  
16 CREATE TABLE customers_good (  
17     customer_id INTEGER PRIMARY KEY,  
18     name TEXT,  
19     location_id INTEGER,  
20     FOREIGN KEY (location_id) REFERENCES locations(location_id)  
21 );
```

-- **X** Nicht 3NF (city hängt von zip ab → transitive Abhängigkeit)

```
CREATE TABLE customers_bad (  
    customer_id INTEGER PRIMARY KEY,  
    name TEXT,  
    zip TEXT,  
    city TEXT -- Hängt von zip ab!  
)
```

ok

-- **✓** 3NF (PLZ/Stadt ausgelagert)

```
CREATE TABLE locations (  
    location_id INTEGER PRIMARY KEY,  
    zip TEXT UNIQUE,  
    city TEXT  
)
```

ok

```
CREATE TABLE customers_good (  
    customer_id INTEGER PRIMARY KEY,  
    name TEXT,  
    location_id INTEGER,  
    FOREIGN KEY (location_id) REFERENCES locations(location_id)  
)
```

ok

4.5 ER-Diagramm-Notation

Kardinalitäten:

- 1:1 (Eins-zu-Eins): `User ||--|| Profile` – Ein User hat genau ein Profil
- 1:N (Eins-zu-Viele): `User ||--o{ Order` – Ein User kann viele Orders haben
- N:M (Viele-zu-Viele): `Product }o--o{ Order` – Viele Products in vielen Orders (via Junction Table)

Schlüssel:

- PK = Primary Key (unterstrichen)
- FK = Foreign Key (gestrichelt)

5. Joins (L10)

5.1 Testdaten erstellen

```

1 -- Locations
2 CREATE TABLE locations (
3   location_id INTEGER PRIMARY KEY,
4   city TEXT NOT NULL,
5   postal_code TEXT NOT NULL
6 );
7
8 INSERT INTO locations VALUES
9   (1, 'Berlin', '10115'),
10  (2, 'Hamburg', '20095'),
11  (3, 'Munich', '80331');
12
13 -- Customers
14 CREATE TABLE customers (
15   customer_id INTEGER PRIMARY KEY,
16   first_name TEXT NOT NULL,
17   last_name TEXT NOT NULL,
18   location_id INTEGER,
19   FOREIGN KEY (location_id) REFERENCES locations(location_id)
20 );
21
22 INSERT INTO customers VALUES
23   (1, 'Alice', 'Anderson', 1),
24   (2, 'Bob', 'Brown', 2),
25   (3, 'Carol', 'Clark', 3),
26   (4, 'David', 'Davis', NULL); -- Kein Standort
27
28 -- Orders
29 CREATE TABLE orders (
30   order_id INTEGER PRIMARY KEY,
31   customer_id INTEGER,
32   order_date DATE,
33   FOREIGN KEY (customer_id) REFERENCES customers(customer_id)

```

```
34 );
35
36 INSERT INTO orders VALUES
37     (101, 1, '2024-01-15'),
38     (102, 1, '2024-02-20'),
39     (103, 2, '2024-01-22'),
40     (104, 3, '2024-03-10');
41 -- Kunde 4 hat keine Bestellung!
```

```
-- Locations
CREATE TABLE locations (
    location_id INTEGER PRIMARY KEY,
    city TEXT NOT NULL,
    postal_code TEXT NOT NULL
)
```

ok

```
INSERT INTO locations VALUES
(1, 'Berlin', '10115'),
(2, 'Hamburg', '20095'),
(3, 'Munich', '80331')
```

ok

```
-- Customers
CREATE TABLE customers (
    customer_id INTEGER PRIMARY KEY,
    first_name TEXT NOT NULL,
    last_name TEXT NOT NULL,
    location_id INTEGER,
    FOREIGN KEY (location_id) REFERENCES locations(location_id)
)
```

ok

```
INSERT INTO customers VALUES
(1, 'Alice', 'Anderson', 1),
(2, 'Bob', 'Brown', 2),
(3, 'Carol', 'Clark', 3),
(4, 'David', 'Davis', NULL)
```

ok

```
-- Kein Standort
-- Orders
CREATE TABLE orders (
    order_id INTEGER PRIMARY KEY,
    customer_id INTEGER,
    order_date DATE,
    FOREIGN KEY (customer_id) REFERENCES customers(customer_id)
)
```

ok

```
INSERT INTO orders VALUES  
    (101, 1, '2024-01-15'),  
    (102, 1, '2024-02-20'),  
    (103, 2, '2024-01-22'),  
    (104, 3, '2024-03-10')
```

ok

```
-- Kunde 4 hat keine Bestellung!
```

ok

5.2 INNER JOIN

Regel: Nur Zeilen, die in BEIDEN Tabellen übereinstimmen.

```
1 SELECT  
2     c.first_name,  
3     c.last_name,  
4     o.order_id,  
5     o.order_date  
6 FROM customers c  
7 INNER JOIN orders o ON c.customer_id = o.customer_id;
```

```
SELECT  
    c.first_name,  
    c.last_name,  
    o.order_id,  
    o.order_date  
FROM customers c  
INNER JOIN orders o ON c.customer_id = o.customer_id
```

#	first_name	last_name	order_id	order_date
1	Alice	Anderson	101	2024-01-15
2	Alice	Anderson	102	2024-02-20
3	Bob	Brown	103	2024-01-22
4	Carol	Clark	104	2024-03-10

4 rows

Ergebnis: Nur Kunden MIT Bestellungen (Alice, Bob, Carol). David fehlt!

5.3 LEFT JOIN (LEFT OUTER JOIN)

Regel: Alle Zeilen aus der linken Tabelle + passende aus der rechten. Wenn keine Übereinstimmung → NULL.

```
1 SELECT
2   c.first_name,
3   c.last_name,
4   o.order_id,
5   o.order_date
6 FROM customers c
7 LEFT JOIN orders o ON c.customer_id = o.customer_id;
```

```
SELECT
c.first_name,
c.last_name,
o.order_id,
o.order_date
FROM customers c
LEFT JOIN orders o ON c.customer_id = o.customer_id
```

#	first_name	last_name	order_id	order_date
1	Alice	Anderson	101	2024-01-15
2	Alice	Anderson	102	2024-02-20
3	Bob	Brown	103	2024-01-22
4	Carol	Clark	104	2024-03-10
5	David	Davis	null	null

5 rows

Ergebnis: Alle Kunden (auch David), aber bei David ist order_id = NULL.

Use Case: „Zeige alle Kunden, auch die ohne Bestellung.“

5.4 RIGHT JOIN (RIGHT OUTER JOIN)

Regel: Alle Zeilen aus der rechten Tabelle + passende aus der linken.

```
1 SELECT
2   c.first_name,
3   o.order_id
4 FROM customers c
5 RIGHT JOIN orders o ON c.customer_id = o.customer_id;
```

```

SELECT
  c.first_name,
  o.order_id
FROM customers c
RIGHT JOIN orders o ON c.customer_id = o.customer_id

```

#	first_name	order_id
1	Alice	101
2	Alice	102
3	Bob	103
4	Carol	104

4 rows

In der Praxis: Selten genutzt (kann durch LEFT JOIN ersetzt werden).

5.5 FULL OUTER JOIN

Regel: Alle Zeilen aus BEIDEN Tabellen. Wenn keine Übereinstimmung → NULL.

```

1 SELECT
2   c.first_name,
3   o.order_id
4 FROM customers c
5 FULL OUTER JOIN orders o ON c.customer_id = o.customer_id;

```

```

SELECT
  c.first_name,
  o.order_id
FROM customers c
FULL OUTER JOIN orders o ON c.customer_id = o.customer_id

```

#	first_name	order_id
1	Alice	101
2	Alice	102
3	Bob	103
4	Carol	104
5	David	null

5 rows

Ergebnis: Alle Kunden UND alle Bestellungen. Lücken werden mit NULL gefüllt.

Use Case: „Zeige alle Kunden UND alle Bestellungen, unabhängig von Beziehungen.“

5.6 CROSS JOIN (Kartesisches Produkt)

Regel: Jede Zeile der ersten Tabelle wird mit jeder Zeile der zweiten kombiniert.

```
1 SELECT
2   c.first_name,
3   l.city
4 FROM customers c
5 CROSS JOIN locations l;
```

```
SELECT
  c.first_name,
  l.city
FROM customers c
CROSS JOIN locations l
```

#	first_name	city
1	Alice	Berlin
2	Alice	Hamburg
3	Alice	Munich
4	Bob	Berlin
5	Bob	Hamburg
6	Bob	Munich
7	Carol	Berlin
8	Carol	Hamburg
9	Carol	Munich
10	David	Berlin
11	David	Hamburg
12	David	Munich

12 rows

Ergebnis: 4 Kunden × 3 Städte = 12 Zeilen.

Use Case: Selten! Z.B. für Preis-Matrices oder kombinatorische Abfragen.

5.7 Self Join

Regel: Tabelle mit sich selbst joinen (z.B. Hierarchien).

```
1 -- Mitarbeiter-Hierarchie
2 CREATE TABLE employees (
3     emp_id INTEGER PRIMARY KEY,
4     name TEXT,
5     manager_id INTEGER,
6     FOREIGN KEY (manager_id) REFERENCES employees(emp_id)
7 );
8
9 INSERT INTO employees VALUES
10    (1, 'CEO', NULL),
11    (2, 'CTO', 1),
12    (3, 'Dev Lead', 2),
13    (4, 'Developer', 3);
14
15 -- Wer ist wessen Manager?
16 SELECT
17     e.name AS employee,
18     m.name AS manager
19 FROM employees e
20 LEFT JOIN employees m ON e.manager_id = m.emp_id;
```

```
-- Mitarbeiter-Hierarchie
CREATE TABLE employees (
    emp_id INTEGER PRIMARY KEY,
    name TEXT,
    manager_id INTEGER,
    FOREIGN KEY (manager_id) REFERENCES employees(emp_id)
)
```

ok

```
INSERT INTO employees VALUES
(1, 'CEO', NULL),
(2, 'CTO', 1),
(3, 'Dev Lead', 2),
(4, 'Developer', 3)
```

ok

```
-- Wer ist wessen Manager?
SELECT
    e.name AS employee,
    m.name AS manager
FROM employees e
LEFT JOIN employees m ON e.manager_id = m.emp_id
```

#	employee	manager
1	CEO	null
2	CTO	CEO
3	Dev Lead	CTO
4	Developer	Dev Lead

4 rows

5.8 Mehrere Joins kombinieren

```
-- Kunde → Bestellung → Positionen → Produkte
SELECT
    c.first_name,
    o.order_id,
    oi.quantity,
    p.product_name,
    p.price
FROM customers c
INNER JOIN orders o ON c.customer_id = o.customer_id
INNER JOIN order_items oi ON o.order_id = oi.order_id
```

```
INNER JOIN products p ON oi.product_id = p.product_id;
```

Faustregel: Jeder JOIN braucht eine ON-Bedingung!

5.9 Join-Cheat-Sheet

Join-Typ	Ergebnis	Use Case
INNER JOIN	Nur übereinstimmende Zeilen	Kunden MIT Bestellungen
LEFT JOIN	Alle aus links + passende aus rechts	Alle Kunden (auch ohne Orders)
RIGHT JOIN	Alle aus rechts + passende aus links	Selten (wie LEFT, nur umgekehrt)
FULL OUTER JOIN	Alle aus beiden (Lücken = NULL)	Alle Kunden UND alle Orders
CROSS JOIN	Kartesisches Produkt (alle Kombinationen)	Kombinatorik, Matrizen
SELF JOIN	Tabelle mit sich selbst	Hierarchien, Vergleiche

6. SET Operations (L13)

SET Operations kombinieren Ergebnismengen zweier Queries – ähnlich wie Mengenoperationen in der Mathematik.

Wichtige Regeln:

- Beide SELECT-Statements müssen **gleich viele Spalten** haben
- Spaltentypen müssen **kompatibel** sein
- Spaltennamen werden aus der ersten Query übernommen

6.1 UNION – Vereinigung

Regel: Kombiniert beide Ergebnismengen und **entfernt Duplikate**.

```
1 -- Newsletter-Liste: Alle Personen (Kunden + Mitarbeiter)
2 SELECT first_name, last_name, 'Customer' AS type
3 FROM customers
4 UNION
5 SELECT first_name, last_name, 'Employee' AS type
```

```

5   SELECT first_name, last_name, 'Employee' AS type
6   FROM employees
7   ORDER BY last_name;

```

```
-- Newsletter-Liste: Alle Personen (Kunden + Mitarbeiter)
SELECT first_name, last_name, 'Customer' AS type
FROM customers
UNION
SELECT first_name, last_name, 'Employee' AS type
FROM employees
ORDER BY last_name
```

column "first_name" does not exist

UNION vs UNION ALL:

Operation	Duplikate	Performance
UNION	Werden entfernt	Langsamer
UNION ALL	Bleiben erhalten	Schneller

```

1 -- UNION ALL: Behält alle Einträge (auch Duplikate) 🔗
2 SELECT first_name, last_name FROM customers
3 UNION ALL
4 SELECT first_name, last_name FROM employees;
```

```
-- UNION ALL: Behält alle Einträge (auch Duplikate)
SELECT first_name, last_name FROM customers
UNION ALL
SELECT first_name, last_name FROM employees
```

column "first_name" does not exist

Tipp: Nutze **UNION ALL**, wenn keine Duplikate existieren oder gewünscht sind!

6.2 INTERSECT – Schnittmenge

Regel: Nur Zeilen, die in **BEIDEN** Ergebnismengen vorkommen.

```

1 -- Mitarbeiter, die auch Kunden sind (basierend auf Name) 🔗
2 SELECT first_name, last_name
3 FROM customers
4 INTERSECT
```

```
5 INTERSECT  
6 SELECT first_name, last_name  
7 FROM employees  
8 ORDER BY last_name;
```

```
-- Mitarbeiter, die auch Kunden sind (basierend auf Name)  
SELECT first_name, last_name  
FROM customers  
INTERSECT  
SELECT first_name, last_name  
FROM employees  
ORDER BY last_name
```

column "first_name" does not exist

Alternative mit JOIN:

```
-- Gleichwertig mit INNER JOIN  
SELECT DISTINCT c.first_name, c.last_name  
FROM customers c  
INNER JOIN employees e  
ON c.first_name = e.first_name  
AND c.last_name = e.last_name;
```

Wann INTERSECT? Klarer Intent: „Zeig mir die Überschneidung!“

6.3 EXCEPT – Differenz

Regel: Zeilen aus der ersten Query, die NICHT in der zweiten vorkommen.

```
1 -- Kunden, die KEINE Mitarbeiter sind  
2 SELECT first_name, last_name  
3 FROM customers  
4 EXCEPT  
5 SELECT first_name, last_name  
6 FROM employees  
7 ORDER BY last_name;
```

```
-- Kunden, die KEINE Mitarbeiter sind  
SELECT first_name, last_name  
FROM customers  
EXCEPT  
SELECT first_name, last_name  
FROM employees  
ORDER BY last_name
```

column "first_name" does not exist

⚠ Reihenfolge zählt! A EXCEPT B ≠ B EXCEPT A

```
-- Umgekehrt: Mitarbeiter, die KEINE Kunden sind  
SELECT first_name, last_name FROM employees  
EXCEPT  
SELECT first_name, last_name FROM customers;
```

Alternative mit LEFT JOIN:

```
-- Gleichwertig mit Anti-Join  
SELECT c.first_name, c.last_name  
FROM customers c  
LEFT JOIN employees e  
ON c.first_name = e.first_name  
AND c.last_name = e.last_name  
WHERE e.employee_id IS NULL;
```

6.4 SET Operations kombinieren

```
-- Komplexe Abfragen mit mehreren SET Operations  
(SELECT first_name, last_name FROM customers WHERE location_id = 1  
UNION  
SELECT first_name, last_name FROM customers WHERE location_id = 2)  
EXCEPT  
SELECT first_name, last_name FROM employees;
```

Tipp: Nutze Klammern () für klare Gruppierung!

7. Views (L13)

7.1 Was sind Views?

Views sind gespeicherte Queries, die wie virtuelle Tabellen funktionieren. Sie speichern keine Daten, sondern nur die Query-Definition.

Vorteile:

- **✓ Wiederverwendbarkeit:** Komplexe Queries einmal definieren
- **✓ Abstraktion:** Versteckt Komplexität vor Nutzern
- **✓ Sicherheit:** Kontrollierter Zugriff auf Daten
- **✓ Konsistenz:** Eine Definition, überall nutzbar

7.2 CREATE VIEW

```
1 -- Einfache View: Aktive Kunden mit Standort
2 CREATE VIEW active_customers AS
3 SELECT
4   c.customer_id,
5   c.first_name,
6   c.last_name,
7   c.email,
8   l.city,
9   l.postal_code
10 FROM customers c
11 INNER JOIN locations l ON c.location_id = l.location_id
12 WHERE c.is_active = true;
13
14 -- View nutzen wie eine Tabelle
15 SELECT * FROM active_customers WHERE city = 'Berlin';
```



```
-- Einfache View: Aktive Kunden mit Standort
CREATE VIEW active_customers AS
SELECT
  c.customer_id,
  c.first_name,
  c.last_name,
  c.email,
  l.city,
  l.postal_code
FROM customers c
INNER JOIN locations l ON c.location_id = l.location_id
WHERE c.is_active = true
```

column c.email does not exist

7.3 Views mit Aggregation

```
1 -- Customer-Summary: Bestellungen pro Kunde
2 CREATE VIEW customer_summary AS
3 SELECT
4   c.customer_id
```



```

5   c.customer_id,
6   c.first_name || ' ' || c.last_name AS full_name,
7   COUNT(o.order_id) AS order_count,
8   COALESCE(SUM(o.total_amount), 0) AS total_spent,
9   MAX(o.order_date) AS last_order_date
10  FROM customers c
11  LEFT JOIN orders o ON c.customer_id = o.customer_id
12  GROUP BY c.customer_id, c.first_name, c.last_name;
13  -- VIP-Kunden finden
14  SELECT * FROM customer_summary
15  WHERE total_spent > 1000
16  ORDER BY total_spent DESC;

```

```

-- Customer-Summary: Bestellungen pro Kunde
CREATE VIEW customer_summary AS
SELECT
  c.customer_id,
  c.first_name || ' ' || c.last_name AS full_name,
  COUNT(o.order_id) AS order_count,
  COALESCE(SUM(o.total_amount), 0) AS total_spent,
  MAX(o.order_date) AS last_order_date
FROM customers c
LEFT JOIN orders o ON c.customer_id = o.customer_id
GROUP BY c.customer_id, c.first_name, c.last_name

```

column o.total_amount does not exist

7.4 Views aktualisieren

```

1  -- View ersetzen
2  CREATE OR REPLACE VIEW active_customers AS
3  SELECT
4    c.customer_id,
5    c.first_name,
6    c.last_name,
7    c.email,
8    l.city
9  FROM customers c
10 LEFT JOIN locations l ON c.location_id = l.location_id
11 WHERE c.is_active = true;

```

```
-- View ersetzen
CREATE OR REPLACE VIEW active_customers AS
SELECT
  c.customer_id,
  c.first_name,
  c.last_name,
  c.email,
  l.city
FROM customers c
LEFT JOIN locations l ON c.location_id = l.location_id
WHERE c.is_active = true
```

column c.email does not exist

7.5 Views löschen

```
1 -- View entfernen
2 DROP VIEW IF EXISTS customer_summary;
3
4 -- Mit CASCADE (löscht auch abhängige Views)
5 DROP VIEW customer_summary CASCADE;
```

```
-- View entfernen
DROP VIEW IF EXISTS customer_summary
```

ok

```
-- Mit CASCADE (löscht auch abhängige Views)
DROP VIEW customer_summary CASCADE
```

view "customer_summary" does not exist

7.6 Materialized Views (PostgreSQL)

Materialized Views speichern das Ergebnis physisch → schneller, aber nicht automatisch aktualisiert.

```
-- Materialized View erstellen
CREATE MATERIALIZED VIEW sales_stats AS
SELECT
  DATE_TRUNC('month', order_date) AS month,
  COUNT(*) AS orders,
  SUM(total_amount) AS revenue
FROM orders
GROUP BY month;
```

```
-- Daten aktualisieren (manuell)
REFRESH MATERIALIZED VIEW sales_stats;

-- Löschen
DROP MATERIALIZED VIEW sales_stats;
```

View vs Materialized View:

Feature	VIEW	MATERIALIZED VIEW
Speicherung	Nur Query-Definition	Physische Daten
Aktualität	Immer aktuell	Manuell refreshen
Performance	Query bei jedem Zugriff	Schnell (vorberechnet)
Speicherplatz	Minimal	Benötigt Platz

Use Cases:

- **VIEW:** Einfache Abstraktion, Sicherheit, oft geänderte Daten
- **MATERIALIZED VIEW:** Komplexe Aggregationen, Reports, seltene Änderungen

8. Transaktionen & ACID (L14)

8.1 Was sind Transaktionen?

Transaktion = Logische Arbeitseinheit, die garantiert, dass entweder **alle** Operationen erfolgreich sind – oder **keine**.

Metapher: Ein Paket mit Garantiesiegel – entweder kommt alles an oder gar nichts.

8.2 Transaktionssteuerung

```

1  -- Transaktion starten
2  BEGIN TRANSACTION;  -- oder: START TRANSACTION;
3
4  -- Operationen ausführen
5  UPDATE accounts SET balance = balance - 100 WHERE id = 'A';
6  UPDATE accounts SET balance = balance + 100 WHERE id = 'B';
7
8  -- Bestätigen (Änderungen dauerhaft speichern)
9  COMMIT;
10
11 -- Undo: Rücksicht nehmen
```

```
-- ROLLBACK;
```

```
-- Transaktion starten  
BEGIN TRANSACTION
```

ok

```
-- oder: START TRANSACTION;  
  
-- Operationen ausführen  
UPDATE accounts SET balance = balance - 100 WHERE id = 'A'
```

relation "accounts" does not exist

Wichtig: Ohne **COMMIT** werden Änderungen **nicht** dauerhaft gespeichert!

8.3 SAVEPOINT – Partielle Rollbacks

```
1 BEGIN;  
2  
3 UPDATE accounts SET balance = balance - 100 WHERE id = 'A';  
4  
5 SAVEPOINT transfer_step1;  
6  
7 UPDATE accounts SET balance = balance + 100 WHERE id = 'B';  
8 -- Fehler! Konto B existiert nicht  
9  
10 ROLLBACK TO transfer_step1; -- Nur Schritt 2 rückgängig  
11 COMMIT; -- Schritt 1 bleibt bestehen
```

```
BEGIN
```

current transaction is aborted, commands ignored until end of transaction block

8.4 ACID-Eigenschaften

ACID = Vier Garantien, die jede Transaktion erfüllen sollte:

A – Atomicity (Atomarität)

C – Consistency (Konsistenz)

I – Isolation

D – Durability (Dauerhaftigkeit)

8.5 Isolation Levels

8.6 Transaktions-Probleme

Problem 1: Dirty Read

Problem 2: Lost Update

Problem 3: Deadlock

8.7 Best Practices

9. Functions & Trigger (L15)

9.1 Stored Functions

Grundsyntax (PostgreSQL)

Beispiel: Preisberechnung

9.2 Kontrollstrukturen

IF / THEN / ELSE

CASE

9.3 Fehlerbehandlung: RAISE

9.4 Trigger

Trigger-Function erstellen

BEFORE vs AFTER

Beispiel: Audit-Logging

Trigger löschen

9.5 Use Cases

10. Best Practices

7.1 Query-Optimierung

7.2 Schema-Design

7.3 Datenmanipulation

10. Best Practices

10.1 Query-Optimierung

10.2 Schema-Design

10.3 Datenmanipulation

10.4 Transaktionen & Concurrency

10.5 Functions & Trigger

11. Häufige Fehler & Lösungen

✗ Fehler: UPDATE ohne WHERE

✗ Fehler: Kartesisches Produkt

✗ Fehler: NULL-Vergleich mit =

✗ Fehler: Alias in WHERE

✗ Fehler: Transaktion nicht geschlossen

✗ Fehler: UNION ohne gleiche Spaltenanzahl

12. Weiterführende Themen

13. Quick-Links zur Vorlesung

 **Zusätzliche Ressourcen**