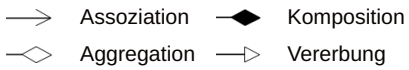
– uml diagramm (konzeptionell)
  – assoziationen, bedingungen
– transaktionen
  – isolation levels erklären, welche fehler sie beheben
  – fuzzy read, deadlock, dirty read, write skew, phantom read, serializable snapshot isolation, cascading rollbacks
  – schedule analysieren + Serialisierbarkeitsgraph
– begriffe (physisches schema, DBMS)
– b-baum indexe einfügen

DataBase System
Besteht aus Datenbankmanagementsystem und Datenbasen

DataBase Management System
– Redundanzfreiheit
– Datenintegrität
– Kapselung

ANSI Modell
Logische Ebene:
Interne Ebene:
Externe Ebene:
Mapping:

Unified Modeling Language


Complete:
Incomplete:
Disjoint:
Overlapping:

Normalisierung
1NF: Atomare Attributwerte
2NF: Nichtschlüsselattr. voll vom Schlüssel abhängig
3NF: Keine transitiven Abhängigkeiten
BCNF: Nur abhängigkeiten vom Schlüssel
(Voll-)funktionale Abhängigkeit:
Transitive Abhängigkeit:
Einfügeanomalie, Löschanomalie, Änderungsanomalie

Vererbung
Einzige Tabelle für Superklasse:
Tabelle pro Subklasse:
Tabelle pro Sub- und Superklasse:

Data Definition Language
```
CREATE SCHEMA s;
CREATE TABLE t (
  id SERIAL PRIMARY KEY,
  name TEXT UNIQUE,
  grade DECIMAL(2,1) NOT NULL,
  added TIMESTAMP DEFAULT CURRENT_TIMESTAMP,
  u VARCHAR(9) DEFAULT CURRENT_USER,
  fk INT FOREIGN KEY REFERENCES t2.id ON DELETE
CASCADE,
  CHECK (grade between 1 and 6)
);
ALTER TABLE t2 ADD CONSTRAINT c PRIMARY KEY (a, b);
TRUNCATE/DROP TABLE t;
```

Data Manipulation Language
```
INSERT INTO t (id, grade) VALUES (1, 1) RETURNING id;
```

Views
```
CREATE VIEW v (id, grade, u) AS SELECT id, grade, u
FROM t;
```

Data Control Language
```
CREATE ROLE r WITH LOGIN PASSWORD ''
GRANT INSERT ON TABLE t TO r;
REVOKE CREATE ON SCHEMA s FROM r;
ALTER ROLE r CREATEROLE, CREATEDB, INHERIT;
GRANT r TO user_name;
-- read all future created tables
ALTER DEFAULT PRIVILEGES IN SCHEMA s GRANT SELECT ON
TABLES TO readonlyuser;
CREATE POLICY p ON t FOR ALL TO PUBLIC USING (u =
current_user);
ALTER TABLE t ENABLE ROW LEVEL SECURITY;
```

Common Table Expressions
```
WITH RECURSIVE q AS (SELECT * FROM t WHERE grade>1
UNION ALL SELECT * FROM t INNER JOIN q ON q.u =
t.name) SELECT id as "ID" FROM q;
```

Window Functions
```
SELECT id, RANK() OVER (ORDER BY grade DESC) as r FROM
t;
```

Subqueries
```
SELECT * FROM t WHERE grade > ANY/IN/EXISTS (SELECT g
FROM t2);
```

JOIN
```
SELECT y.*, x.* FROM t AS y, JOIN LATERAL (SELECT *
FROM t2 WHERE t2.id = y.id) AS x;
```

GROUP BY
```
SELECT id, COUNT(*) FROM t GROUP BY grade, id HAVING
COUNT(*) > 2;
```

WHERE
```
BETWEEN 1 AND 5; LIKE '___%'
IN (1, 5)      ; LIKE '%asd'
```

INDEX
```
CREATE INDEX i ON t /*USING BTREE*/ (grade, UPPER(u))
INCLUDE added;
DROP INDEX i;
```

Transaktionen
```
BEGIN;  SAVEPOINT s;
COMMIT; ROLLBACK /*TO SAVEPOINT s*/;
```

Isolation
```
SET TRANSACTION ISOLATION LEVEL ...;
SET SESSION CHARACTERISTICS AS TRANSACTION ISOLATION
LEVEL ...;
```

	Read Uncommitted	Read Committed	Repeatable Read	Serializable
Dirty Write	*	*	*	✗
Dirty Read	✓	✗	✗	✗
Lost Update	✓	✓	✗	✗
Fuzzy Read	✓	✓	✗	✗
Phantom Read	✓	✓	✓	✗
Read Skew	✓	✓	✗	✗
Write Skew	✓	✓	✓	*
Deadlock				✗
Cascading Rollback				✗

Dirty Read: Lese Daten von nicht committed T's
Fuzzy Read: Versch. Werte beim mehrmaligen Lesen gleicher Daten (da durch andere T geändert)
Phantom Read: Neue/Gelöschte Rows einer anderen T

Relationale Algebra
$\pi_{R1,R4}(R)$ `SELECT R1,R4 FROM R;`
$\sigma_{R1>30}(R)$ `SELECT * FROM R WHERE R1 > 30;`
$\rho_{a \leftarrow R}$ `SELECT * FROM R AS a;`
$R \times S$ `SELECT * FROM R,S;`
$R \underset{A=B}{\bowtie} S$ `SELECT * FROM R JOIN S ON R.A=S.B;`

Serialisierbarkeit

Backup