

* When insert/delete/update of table, the corresponding indexes must be updated

Useful indexes

- 1) Primary key (default index)
- 2) UNIQUE (candidate keys)
- 3) foreign keys (used in join queries)
- 4) an attribute that is almost a key.
(i.e., relatively few rows that have the same value for the attribute)
e.g. FName + LName on MyCourses
- 5) if tuples are clustered on that attribute.
e.g. - dno in Employee
- major in MyCourses

Indexes that are not useful

- 1) an attribute with very few values.
e.g. sex = 'M' or 'F'
- 2) salary where common salary values are stored in almost all blocks. → retrieve entire file

3) attribute on which equality or $<$, $>$ queries rarely asked.

e.g. address in Employee

Example: COMPANY database

Query: Given an emp name (Fname + Lname), find the department name

EMP ① Fname + Lname ✓
 ② dno X

Dept ③ Dnumber ✓
 ④ Dname X

Query: Given SSN, give the names of all projects the emp works on.

EMP: SSN X
works-on: ESSN ✓
Project: Pnumber ✓

Query: Given ~~SSN~~^{Fname + Lname}, give the names of all projects the emp works on.

EMP: SSN X
Emp: Fname + Lname ✓

works-on: SSN ✓

Project: Pnumber ✓

Query: Given a department name, list all emp SSNs who work in the department.

Dept: ① dnumber ✗

② dname ✓

Emp ③ SSN ✗

④ dno ✓

Transactions

New: Ch 20.1, 20.2, 20.3, 20.6

Old: Ch 21.1, 21.2, 21.3, 21.6

Example 1: Bank

Q1: update accounts

set bal = bal + 100

where accno = 450;

Q2: update accounts

set bal = bal - 100

where accno = 500;

Q1 ; Q2 must be done atomically ; as a single unit.

ALL or NONE

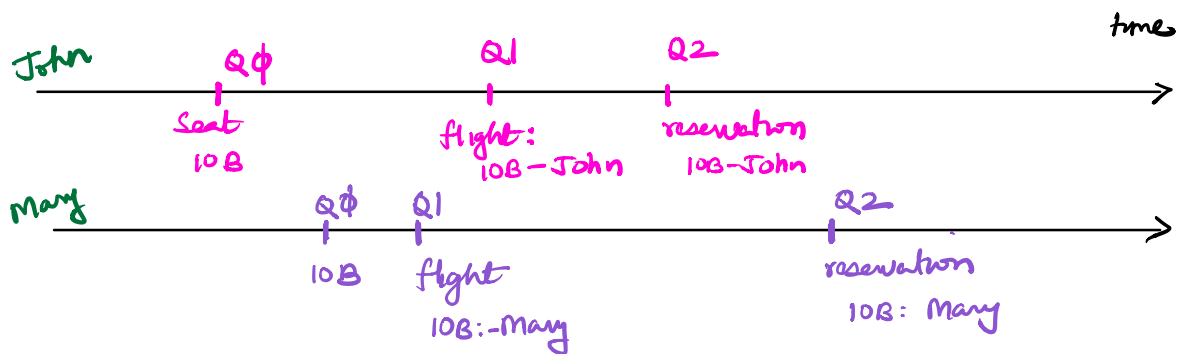
model so far: single user ; single storage ; no failures
Reality : multiple users ; distributed storage ; failures

Example 2: Airline ; 2 users ; 1 seat

Q0: check seat availability

Q1: reserve seat on flight to a passenger

Q2: assign seat to passenger on reservation.



Flight: 10B - John
Reservation 10B - Mary

} Q1 ; Q2 must be done atomically

I A Transaction (TX) is a group of queries that must be performed as a unit, in order
↓
atomically



Example 1 revisited bank

balance: $\text{bala} = 100$ $\text{balb} = 50$

User 1: transfers money from Acct A to Acct B

User 1

Q1: $\text{bala} = \text{bala} - 10$

Q2: $\text{balb} = \text{balb} + 10$

User 2

q1: Read $x = \text{bala}$

q2: Read $y = \text{balb}$

q3: Print x, y

TX T1: Q1 ; Q2

TX T2: q1 ; q2 ; q3

What are the legal results for q3:

$x = 100, y = 50$

or

$x = 90, y = 60$

The output must always be $T_1; T_2$ or $T_2; T_1$

