# SQL language - data manipulation

(addendum to Chap.5 of lecture notes)

# Illustrative example

**Client**

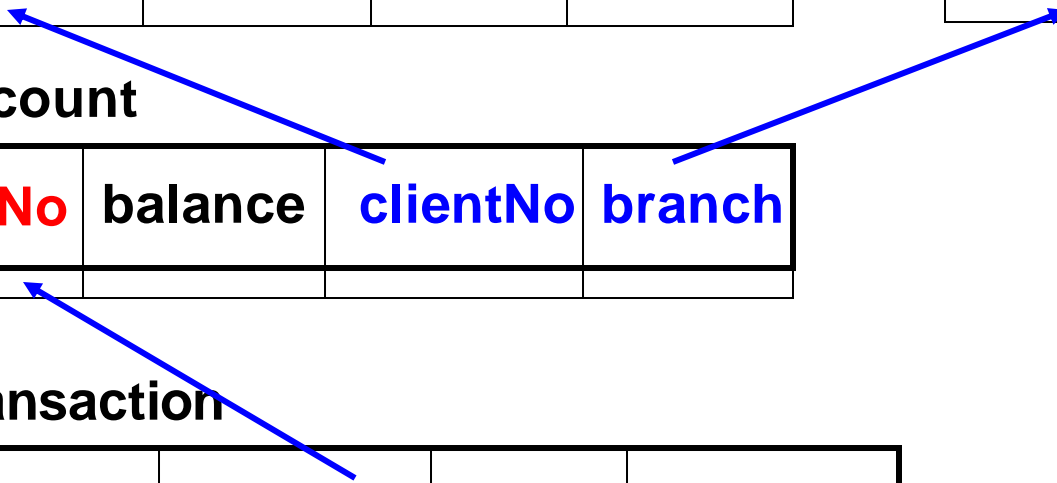| clientNo | name | street | town |
|----------|------|--------|------|
|          |      |        |      |

**Branch**

| name | assets |
|------|--------|
|      |        |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
|       |         |          |        |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
|         |       |      |        |

# "Who are the clients of the bank?"(1)

**Client**

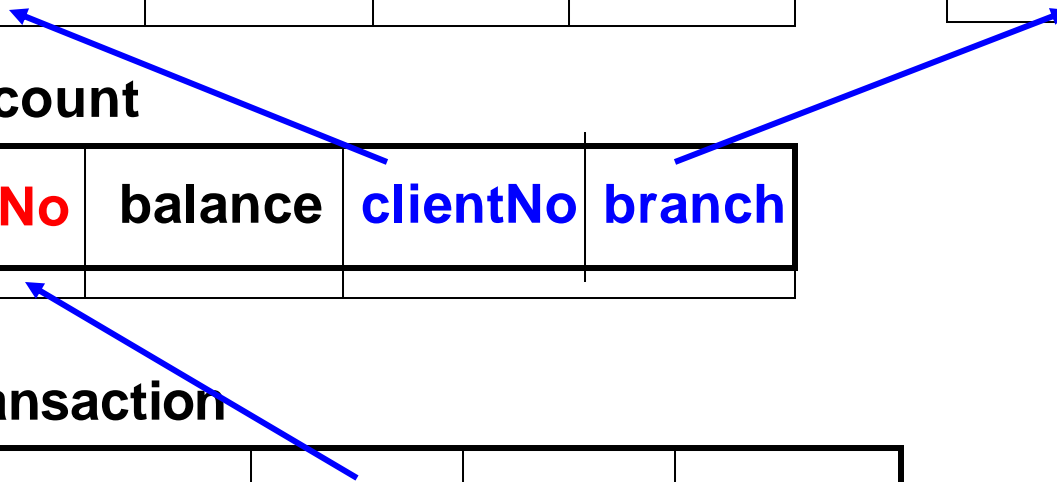| clientNo | name | street | town |
|----------|------|--------|------|
|          |      |        |      |

**Branch**

| name | assets |
|------|--------|
|      |        |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
|       |         |          |        |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
|         |       |      |        |

# "Who are the clients of the bank?"(2)

SELECT

FROM


SELECT *

FROM Client

# "Which towns are the clients of the bank from?"(1)

**Client**

| clientNo | name | street | town |
|---|---|---|---|
| | | | |

**Branch**

| name | assets |
|---|---|
| | |

**Account**

| accNo | balance | clientNo | branch |
|---|---|---|---|
| | | | |

**Transaction**

| transNo | accNo | date | amount |
|---|---|---|---|
| | | | |

# "Which towns are the clients of the bank from?"(2)

```
SELECT

FROM
```

# "Which accounts are managed in branch Janska?"(1)



**Client**

| clientNo | name | street | town |
|---|---|---|---|
| | | | |

**Branch**

| name | assets |
|---|---|
| | |

**Account**

| accNo | balance | clientNo | branch |
|---|---|---|---|
| | | | |

**Transaction**

| transNo | accNo | date | amount |
|---|---|---|---|
| | | | |

# "Which accounts are managed in branch Janska?"(2)

SELECT

FROM

# "How much are assets of branches in USD at the rate of 25 CZK/$? Order in ascending way."(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
|          |      |        |      |

**Branch**
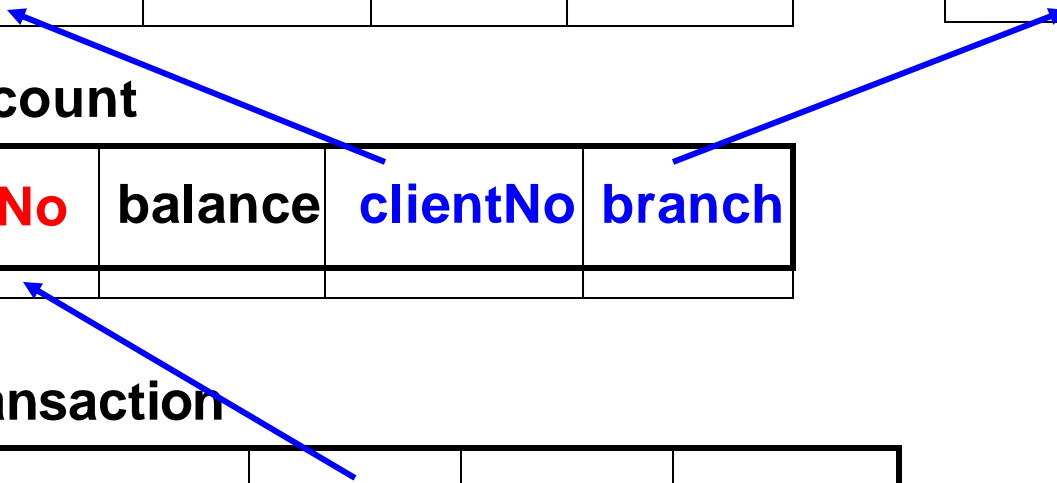
| name | assets |
|------|--------|
|      |        |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
|       |         |          |        |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
|         |       |      |        |

# "How much are assets of branches in USD at the rate of 25 CZK/$? Order in ascending way."(2)

```
SELECT

FROM



SELECT name, assets/25 assetsUSD

FROM Branch

ORDER BY 2
```

# "Which clients have their account in branch Janska?"(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
|  |  |  |  |

**Branch**

| name | assets |
|------|--------|
|  |  |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
|  |  |  |  |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
|  |  |  |  |

# „ Which clients have their account in branch Janska?"(2)

```
SELECT

FROM
```

# "Which clients performed their transactions on 12.10.1998?"(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
| | | | |

**Branch**

| name | assets |
|------|--------|
| | |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
| | | | |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
| | | | |

# "Which clients performed their transactions on 12.10.1998?"(2)

```
SELECT

FROM
```

# Join types - general join (θ join)

**T1**

| A | B | X |
|---|---|---|
| 0 | a | x |
| 1 | a | x |
| 3 | c | z |

**T2**

| X | C | D |
|---|---|---|
| x | 1 | 0 |
| x | 2 | 0 |
| y | 3 | 1 |

**T1 JOIN T2 ON A<C**

| A | B | $X_{T1}$ | $X_{T2}$ | C | D |
|---|---|---|---|---|---|
| 0 | a | x | x | 1 | 0 |
| 0 | a | x | x | 2 | 0 |
| 0 | a | x | y | 3 | 1 |
| 1 | a | x | x | 2 | 0 |
| 1 | a | x | y | 3 | 1 |

# Join types - join on equality (equijoin)

**T1**

| A | B | X |
|---|---|---|
| 0 | a | x |
| 1 | a | x |
| 3 | c | z |

**T2**

| X | C | D |
|---|---|---|
| x | 1 | 0 |
| x | 2 | 0 |
| y | 3 | 1 |

**T1 JOIN T2 ON A=D**

| A | B | $X_{T1}$ | $X_{T2}$ | C | D |
|---|---|---|---|---|---|
| 0 | a | x | x | 1 | 0 |
| 0 | a | x | x | 2 | 0 |
| 1 | a | x | y | 3 | 1 |

# Join types - natural join

**T1**

| A | B | X |
|---|---|---|
| 0 | a | x |
| 1 | a | x |
| 3 | c | z |

**T2**

| X | C | D |
|---|---|---|
| x | 1 | 0 |
| x | 2 | 0 |
| y | 3 | 1 |

**T1 NATURAL JOIN T2**

| A | B | X | C | D |
|---|---|---|---|---|
| 0 | a | x | 1 | 0 |
| 0 | a | x | 2 | 0 |
| 1 | a | x | 1 | 0 |
| 1 | a | x | 2 | 0 |

# Join types - natural left outer join

**T1**

| A | B | X |
|---|---|---|
| 0 | a | x |
| 1 | a | x |
| 3 | c | z |

**T2**

| X | C | D |
|---|---|---|
| x | 1 | 0 |
| x | 2 | 0 |
| y | 3 | 1 |

**T1 NATURAL LEFT JOIN T2**

| A | B | X | C | D |
|---|---|---|---|---|
| 0 | a | x | 1 | 0 |
| 0 | a | x | 2 | 0 |
| 1 | a | x | 1 | 0 |
| 1 | a | x | 2 | 0 |
| 3 | c | z |   |   |

# „ "Which clients performed their transactions on 12.10.1998?"(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
| | | | |

**Branch**

| name | assets |
|------|--------|
| | |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
| | | | |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
| | | | |

# „ "Which clients performed their transactions on 12.10.1998?"(2)

```
SELECT


FROM
```

# "Are there any clients living at the same address?"(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
|          |      |        |      |

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
|          |      |        |      |

**Branch**

| name | assets |
|------|--------|
|      |        |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
|       |         |          |        |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
|         |       |      |        |

# "Are there any clients living at the same address?"(2)

```
SELECT



FROM

WHERE
```

# "Are there any clients living at the same address?"(3)

```
SELECT


FROM
```

# "How many clients does the bank have?"(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
| | | | |

**Branch**

| name | assets |
|------|--------|
| | |

**Account**

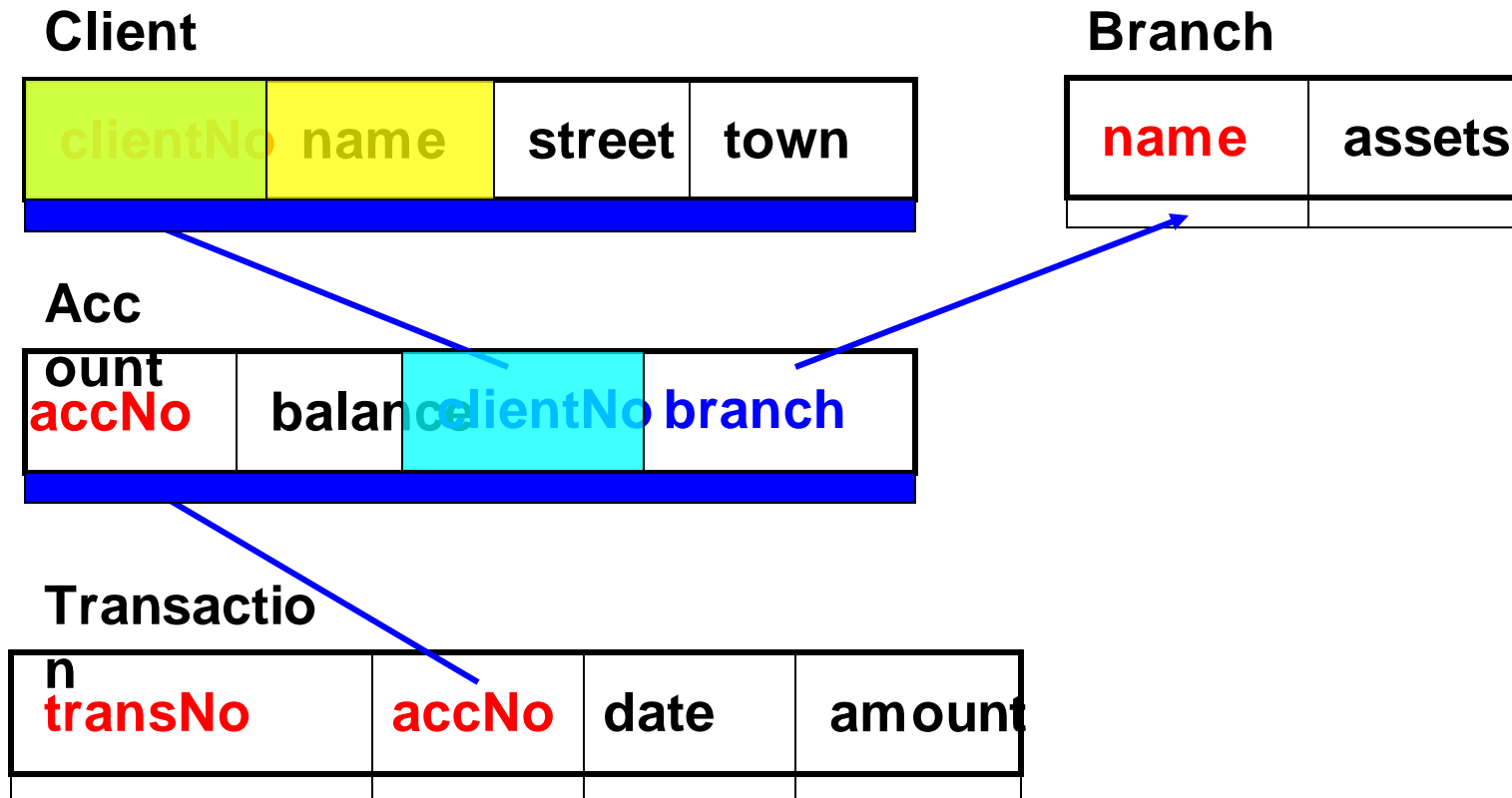| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
| | | | |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
| | | | |

# "How many clients does the bank have?"(2)

```
SELECT

FROM
```

# "How many accounts and how much on them does every client have?"(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
| | | | |

**Branch**

| name | assets |
|------|--------|
| | |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
| | | | |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
| | | | |

# "How many accounts and how much on them does every client have?"(2)

```
SELECT


FROM
```

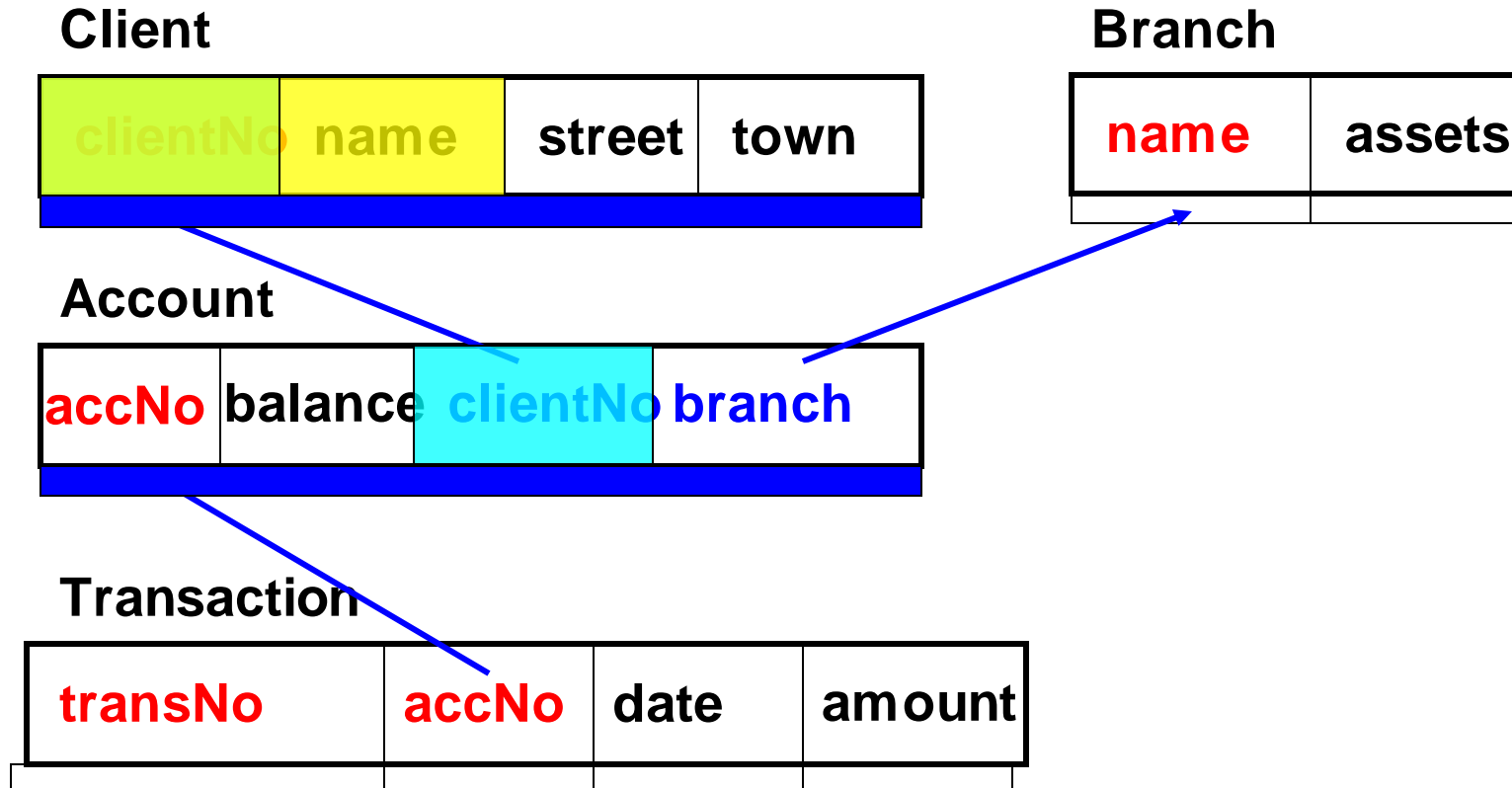# "How many accounts and how much on them does every client have?"(3)

```
SELECT


FROM
```

## "How many accounts and how much on them does every client have?"(4)

```
SELECT name, clientNo,
  COUNT(c_uctu)count,SUM(balance)
  total
FROM Client NATURAL LEFT JOIN
  Account
GROUP BY clientNo, name
ORDER BY 4 DESC;
```

# "Which clients have on their accounts more than 100000 CZ?"(1)

# "Which clients have on their accounts more than  100000 CZ?"(2)

```
SELECT


FROM
```

# "Which clients have on their accounts more than 100000 CZ?"(3)

SELECT

FROM

# ANY/SOME, ALL

| a | b | c |
|---|---|---|

=

<>

>=

…

ANY/SOME

FARLLSE

| A | B | C |
|---|---|---|
|   |   |   |
|   |   |   |
|   |   |   |
|   |   |   |

# "Which clients living out of Brno have more money in the bank than clients living in Brno?"(1)

```
SELECT C.name, C.clientNo, SUM(balance)total
FROM Client C, Account A
WHERE C.clientNo=A.clientNo AND
  C.town<>'Brno'
GROUP BY C.name,C.clientNo
HAVING SUM(balance)>.
```

# "Which clients living out of Brno have more money in the bank than clients living in Brno?"(2)

```
SELECT name, clientNo, SUM(balance) total
FROM Client NATURAL JOIN Account
WHERE town<>'Brno'
GROUP BY clientNo, name
HAVING SUM(balance)>.
```

# EXISTS

EXISTS

FROM ... SE

| A | B | C |
|---|---|---|
|   |   |   |
|   |   |   |
|   |   |   |
|   |   |   |

# "Which clients have their account only in branch Janska?"(1)

**Client**

| clientNo | name | street | town |
|---|---|---|---|
| | | | |

**Branch**

| name | assets |
|---|---|
| | |

**Account**

| accNo | balance | clientNo | branch |
|---|---|---|---|
| | | | |

**Transaction**

| transNo | accNo | date | amount |
|---|---|---|---|
| | | | |

# "Which clients have their account only in branch Janska?"(2)

```
SELECT DISTINCT C.*

FROM Client C, Account A

WHERE C.clientNo=A.clientNo AND
  A.branch='Janska'
  AND NOT EXISTS
```

# "Which clients have in branch Janska only one account?"(1)

**Client**

| clientNo | name | street | town |
|----------|------|--------|------|
|          |      |        |      |

**Branch**

| name | assets |
|------|--------|
|      |        |

**Account**

| accNo | balance | clientNo | branch |
|-------|---------|----------|--------|
|       |         |          |        |

**Transaction**

| transNo | accNo | date | amount |
|---------|-------|------|--------|
|         |       |      |        |

# "Which clients have in branch Janska only one account?"(2)

```
SELECT C.*
FROM Client C
WHERE (SELECT COUNT(*)
        FROM Account A
        WHERE C.clientNo=A.clientNo
            AND
            A.pobocka='Janska') = 1
```

# IN

| a | b | c |
|---|---|---|

| A | B | C |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

<span style="color:red">IN</span>

≡

= ANY

<span style="color:red">FALSE</span>

# "Which clients did there transactions in October 1998?"(2)

```
SELECT *
FROM Client
```