

# Databázové systémy a SQL

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## Lekce 6 - Pokročilé konstrukce SQL

Daniel Klimeš

- Určování pořadí záznamů
- Hodnoty předchozích a následujících řádků
- Rozšířené agregace
  - Výpočet procent
  - Parciální agregace
  - Kumulativní součet
  - Klouzavý průměr

Rozšíření SQL o

**... OVER (PARTITION BY sloupec ORDER BY sloupec)**

## RANK, DENSE\_RANK, ROW\_NUMBER

Sloupec X	RANK	DENSE_RANK	ROW_NUMBER
100	1	1	1
200	2	2	2
200	2	2	3
300	4	3	4
400	5	4	5

- **RANK( ) OVER ([PARTITION BY sex] ORDER BY date\_of\_birth DESC)**
- **RANK( ) OVER (ORDER BY date\_of\_birth DESC NULLS LAST)**
- **Není možné používat za WHERE a HAVING - nutné zanoření**  
*Can not be used after WHERE and HAVING as condition*

## Příklad:

```
SELECT patient_id, sex, date_of_birth,
RANK( ) OVER (PARTITION BY sex ORDER BY date_of_birth DESC NULLS LAST),
DENSE_RANK( ) OVER (PARTITION BY sex ORDER BY date_of_birth DESC NULLS LAST),
ROW_NUMBER( ) OVER (PARTITION BY sex ORDER BY date_of_birth DESC NULLS LAST)
FROM patients LIMIT 100
```

## Využití v sekci WHERE – nutné zapouzdření

```
SELECT * FROM (
  SELECT patient_id, sex, date_of_birth,
  RANK( ) OVER (PARTITION BY sex ORDER BY date_of_birth DESC NULLS LAST) poradi
  FROM patients) x
WHERE poradi < 10
```

**... Další varianta hledání nejstaršího studenta**

- LAG (value\_expression [,offset] [,default]) OVER ([query\_partition\_clause] order\_by\_clause)
- LEAD (value\_expression [,offset] [,default]) OVER ([query\_partition\_clause] order\_by\_clause)

- LAG = hodnota z předchozího řádku / *previous row value*
- LEAD = hodnota z následujícího řádku / *next row value*

```
SELECT study_id, TO_CHAR (date_of_enrollment, 'yyyy'), COUNT(*) letos,
LAG(COUNT(*),1,'0') OVER(PARTITION BY study_id
ORDER BY TO_CHAR (date_of_enrollment, 'yyyy') ) loni
FROM patient_study
GROUP BY study_id, TO_CHAR (date_of_enrollment, 'yyyy')
ORDER BY study_id, TO_CHAR (date_of_enrollment, 'yyyy')
```

*Pozn. POSTGRESQL 9.1: LAG(COUNT(\*),1, '0')*

Agregační funkce s procentickým vyjádřením

```
SELECT COUNT(*) FROM student
```

```
SELECT studies, COUNT(*) FROM student
GROUP BY studies
```

**Procentické zastoupení – standardní SQL:**

```
SELECT studies, COUNT(*) pocet , COUNT(*) * 100.0/(SELECT
COUNT(*) FROM student) procento FROM student
GROUP BY studies
```

**Analytická funkce**

```
SELECT studies, COUNT(*) pocet, COUNT(*) *100.0 /
SUM(COUNT(*)) OVER () procento FROM student
GROUP BY studies
```

## Procentické zastoupení – standardní SQL:

```
SELECT study_id, COUNT(*),
COUNT(*) * 100.0 / (SELECT COUNT(*) FROM patient_study) procento
FROM patient_study
GROUP BY study_id
```

## Analytická funkce

```
SELECT study_id, COUNT(*),
COUNT(*) / SUM(COUNT(*) OVER ()) * 100 procento
FROM patient_study
GROUP BY study_id
```

```
UPDATE student SET completiontype= 'Z'
WHERE mod(uc0,2) = 1 – Rozdělení datového souboru
```

```
SELECT completiontype, studies, count(*) pocet, COUNT(*) *100.0 /
SUM(COUNT(*)) OVER () procento FROM student
GROUP BY completiontype, studies
ORDER BY completiontype
```

```
SELECT completiontype, studies, count(*) pocet, COUNT(*) *100.0 /
SUM(COUNT(*)) OVER () procento ,
COUNT(*) *100.0 / SUM(COUNT(*)) OVER (PARTITION BY
completiontype) proc_podskupiny
FROM student
GROUP BY completiontype, studies
ORDER BY completiontype
```



### Procentické zastoupení pracovišť (počtu jejich pacientů) v jednotlivých studiích

```
SELECT study_id, study_site, COUNT(*),
COUNT(*) / SUM(COUNT(*)) OVER (PARTITION BY study_id) * 100 procento
FROM patient_study
GROUP BY study_id, study_site
```

```
SELECT studies, COUNT(*) pocet FROM
student
GROUP BY studies
```

```
SELECT studies, COUNT(*) pocet,
SUM(COUNT(*)) OVER (ORDER BY studies)
FROM student
GROUP BY studies
```

```
SELECT sex, studies, COUNT(*) pocet,
SUM(COUNT(*)) OVER (PARTITION BY sex ORDER BY studies)
kumulace_skupina,
SUM(COUNT(*)) OVER (ORDER BY sex, studies) kumulace_celkem FROM
student
GROUP BY sex, studies
ORDER BY sex, studies
```

AVG(sloupec) OVER  
(ORDER BY sloupec ROWS BETWEEN x PRECEDING AND CURRENT ROW)

• **ROWS BETWEEN**



- **UNBOUNDED PRECEDING**
- **UNBOUNDED FOLLOWING**
- **CURRENT ROW**
- **počet řádků PRECEDING**
- **počet řádků FOLLOWING**

```
CREATE TABLE pocet_pacientu as
SELECT TO_CHAR(date_of_enrollment, 'yyyy-mm') mesic, COUNT(*)
pocet FROM patient_study
WHERE date_of_enrollment >= '2004-01-01'
GROUP BY TO_CHAR(date_of_enrollment, 'yyyy-mm')
ORDER BY TO_CHAR(date_of_enrollment, 'yyyy-mm')
```

```
SELECT * FROM pocet_pacientu
ORDER BY mesic
```

```
SELECT AVG(pocet) FROM
pocet_pacientu
```

```
SELECT mesic, pocet,
ROUND(AVG(pocet) OVER (ORDER BY mesic ROWS BETWEEN 3
PRECEDING AND CURRENT ROW),1) klouzavy_prumer
FROM pocet_pacientu
```

Spočítejte v tabulce pocet\_pacientu  
*Compute on table pocet\_pacientu*

- Kumulativní počet pacientů
- Procento měsíčního počtu
  - k celkovému počtu
  - k maximálnímu počtu
  - k průměrnému počtu
  - k ročnímu průměru
  - K předchozímu měsíci
- Klouzavý průměr za 2 uplynulé měsíce

```
SELECT mesic, pocet
FROM pocet_pacientu
ORDER BY mesic
```

```

SELECT mesic, pocet,
SUM(pocet) OVER (ORDER BY mesic) kumulativni_pocet,
SUM(pocet) OVER () suma,
MAX(pocet) OVER () maximum,
AVG(pocet) OVER () prumer,
AVG(pocet) OVER (PARTITION BY SUBSTR(mesic,1,4)) rocni_prumer,
LAG(pocet,1,'0') OVER (ORDER BY mesic) predchozi,
ROUND(AVG(pocet) OVER (ORDER BY mesic ROWS BETWEEN 2
PRECEDING AND 1 PRECEDING),1) klouzavy_prumer
FROM pocet_pacientu
ORDER BY mesic

```

- Zanoření a dopočet procent

```

SELECT mesic, pocet,
pocet * 100/ suma suma_proc,
pocet * 100/ maximum max_proc,
pocet * 100 / predchozi predchozi_proc
FROM (
SELECT mesic, pocet,
SUM(pocet) OVER (ORDER BY mesic) kumulativni_pocet,
SUM(pocet) OVER () suma,
MAX(pocet) OVER () maximum,
AVG(pocet) OVER () prumer,
AVG(pocet) OVER (PARTITION BY SUBSTR(mesic,1,4)) rocni_prumer,
LAG(pocet,1,'0') OVER (ORDER BY mesic) predchozi,
ROUND(AVG(pocet) OVER (ORDER BY mesic ROWS BETWEEN 2
PRECEDING AND 1 PRECEDING),1) klouzavy_prumer
FROM pocet_pacientu
) a
ORDER BY mesic

```



- Ošetření dělení nulou

```

SELECT mesic, pocet,
pocet * 100/ suma suma_proc,
pocet * 100/ maximum max_proc,
CASE WHEN predchozi > 0 THEN pocet * 100 / predchozi ELSE 0 END
predchozi_proc
FROM (
....
) a

```

- Zobrazte kumulativní procentické zastoupení pacientů podle věku
  - Věk, počet pacientů, kumulativní procento

- Zobrazte kumulativní procentické zastoupení pacientů podle věku
  - Věk, počet pacientů, kumulativní procento

```
SELECT EXTRACT (YEAR FROM AGE(date_of_birth))
FROM patients limit 100
```

```
SELECT vek, COUNT(*) FROM (
  SELECT EXTRACT (YEAR FROM AGE(date_of_birth)) vek
  FROM patients) a
WHERE vek > 0 and vek < 100
GROUP BY vek
ORDER BY vek
```

```

SELECT vek, pocet, kum_pocet * 100 / pocet_celkem kum_procento
FROM (
  SELECT vek, COUNT(*) pocet, SUM(COUNT(*)) OVER (ORDER BY VEK)
    kum_pocet, SUM(COUNT(*)) OVER () pocet_celkem
  FROM (
    SELECT EXTRACT (YEAR FROM AGE(date_of_birth)) vek
    FROM patients) a
  WHERE vek > 0 and vek < 100
  GROUP BY vek
  ORDER BY vek
) b

```

- FIRST\_VALUE (sloupec)
- LAST\_VALUE (sloupec)
- NTH\_VALUE (sloupec, poradi)

Srovnání s únorovou hodnotou daného roku

```
SELECT mesic, pocet,
NTH_VALUE(pocet,2) OVER (PARTITION BY SUBSTR(mesic,1,4))
unor_rok
FROM pocet_pacientu
```

<https://www.postgresql.org/docs/10/functions-aggregate.html>

## Medián

```
SELECT
percentile_cont(0.5) WITHIN GROUP (ORDER BY a),
percentile_disc(0.5) WITHIN GROUP (ORDER BY a)
FROM (
    SELECT a FROM generate_series(1,5) a
) x
```