

## Relational Algebra

| r1 |   |   |
|----|---|---|
| a  | b | c |
| 1  | 1 | 1 |
| 1  | 2 | 4 |
| 2  | 0 | 3 |

| r2 |   |
|----|---|
| a  | d |
| 1  | 1 |
| 0  | 1 |
| 2  | 1 |

| r3 |   |   |
|----|---|---|
| c  | d | e |
| 1  | 1 | 0 |
| 4  | 1 | 1 |
| 2  | 1 | 0 |
| 2  | 3 | 3 |

| r4 |   |   |
|----|---|---|
| a  | b | c |
| 1  | 1 | 0 |
| 1  | 2 | 2 |

1.  $\pi_{[a,b]}(\sigma_{[b>1 \vee c=3]}r1) \cup \pi_{[a,b]}r4$
2.  $\sigma_{[d=1]}r3 \times \pi_{[a]}r4$
3.  $\pi_{[b,c]}(\sigma_{[c=3]}r1) \times \pi_{[a,b]}r4$
4.  $\pi_{[a,c]}(r1 \cup r4)$
5.  $\pi_{[d]}r3 * \sigma_{[(a=0 \vee a=2) \wedge d=1]}r2$
6. Compute the following join variants for  $r1 \bowtie r2$ 
  - (a)  $r1 \bowtie r2$
  - (b)  $r1 \bowtie r2$
  - (c)  $r1 \bowtie r2$
  - (d) union join
  - (e)  $r1 \bowtie r2$
  - (f)  $r1 *_{[r1.a=r2.a \wedge b>1]} r2$
7. Compute the following join variants for  $r2 * r3$ 
  - (a)  $r2 \bowtie r3$
  - (b)  $r2 \bowtie r3$
  - (c)  $r2 \bowtie r3$
  - (d) union join
  - (e)  $r2 \bowtie r3$
8.  $(\pi_{[d]}r3) \setminus (\pi_{[d]}r2)$
9.  $\pi_{[a]}r2 * \sigma_{[c=2]}r3$

## Relational Algebra and SQL

- Please translate the tables from above (schema and values) into a Postgresql database.
- Verify the results of the relational algebra exercise by executing the corresponding SQL queries on the Postgresql database..