NUCS 339 - Lab 1
Northwestern University
Winter 2022
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Lab 1 - CPDB - Relational Algebra and SQL

1. $\pi_{trr\_id}(\sigma_{total\_number\_of\_shots \geq 10}(trr\_weapon\_discharge))$

2.

$\pi_{id, first\_name, last\_name, complaint\_percentile, honorable\_mention\_percentile}($
$\sigma_{first\_name = 'Jason' \wedge last\_name \text{ LIKE } 'v\%'}(data\_officer))$

3. $\rho(data\_officerbadgenumber, ob1)$
$\rho(data\_officerbadgenumber, ob2)$.

$\pi_{star}(\sigma_{Distinct}(ob1 \bowtie_{ob1.officer\_id = ob2.officer\_id \text{ AND } ob1.star \neq ob2.star} ob2))$

4. $\pi_{first\_name, last\_name}(\sigma_{birth\_year > 1992}(data\_officer))$.

Figure 1: Q1-5

Question 5

$\Pi_{first\_name, last\_name}(\sigma_{\text{birth\_year IS NOT NULL}}(\text{LIMIT 1 (data\_officer)}))$

6. $\rho(o1, data\_officer)$
$\rho(o2, data\_officer)$.

$\pi_{first\_name, last\_name}(\sigma_{Distinct}(o1 \bowtie_{o1.first\_name = o2.first\_name \text{ AND } o1.last\_name = o2.last\_name \text{ AND } o1.suffix\_name \neq o2.suffix\_name} o2))$

Figure 2: Q6

Question 7

$\rho(ag, data\_allegation)$
$\rho(aa, data\_allegation_areas)$
$\rho(area, data\_area)$
$\rho(race, data_race\_population)$

ρ(c, $\Pi_{area.id,\rho(complaint_count,COUNT(c))}$(GROUP BY$_{area.id}$ (ag $\bowtie_{ag.id=aa.allegation_id}$ aa $\bowtie_{aa.area_id=area.id}$)))

$\Pi_{area.name}$(LIMIT 5(GROUP BY$_{area.name}$(GROUP BY$_{c.complaint_count}$ (race $\bowtie_{race.area\_id=c.id}$
c $\bowtie_{race.area\_id=area.id}$ area))))

Question 8

Π_{rank}(LIMIT 1 (GROUP BY$_{rank}$((data_salary))))

Question 9

ρ(o, data_officer)
ρ(a, data_officerallegation)
ρ(award, data_award)
ρ(count, COUNT(GROUP BY$_{o.id}$(data_officer $\bowtie_{o.id=a.officer\_id}$ data_officerallegation)))
ρ (p, (HAVING count >= 100))
ρ(id_count, (COUNT (GROUP BY$_{p.id}$ (award $\bowtie_{award.officer\_id=o.id}$ p))))
$\sigma(AVG(id\_count))$

Question 10

ρ(o, data_officer)
ρ(a, data_officerallegation)
ρ(award, data_award)
ρ(count, COUNT(GROUP BY$_{o.id}$ π(data_officer $\bowtie_{o.id=a.officer\_id}$ data_officerallegation)))
ρ(p, HAVING(count < 10))
ρ(id_count, COUNT=(GROUP BY$_{p.id}$(award $\bowtie_{p.id=award.officer_id}$ p)))
$\sigma(AVG(id\_count))$

Question 11

ρ(o1, data_officerallegation)
ρ(o2, data_officerallegation)
$\pi_{\rho(num\_accusals,COUNT(o1.allegation\_id)),\rho(id1,o1.officer\_id),\rho(id2,o2.officer\_id)}\rho$(p, $\sigma_{o1.officer\_id \neq o2.officer\_id}$
(GROUP BY$_{o1.officer_id,o2.officer_id}$(o1 $\bowtie_{o1.allegation\_id=o2.allegation\_id}$ o2)))
$\pi_{p.id1,p.id2}(\sigma$(LIMIT 1 (p)))

Question 12

$\Pi_{name}(\sigma_{\text{median\_income IS NOT NULL}}(\text{LIMIT 3 (data\_area)}))$

Question 13

$\rho(\text{civil}, \Pi_{id}(\sigma_{is\_officer\_complaint=FALSE}(\text{data\_allegation})))$
$\rho(\text{v}, \text{data\_victim})$
$\rho(\text{c}, \text{civil})$
$\Pi_{race,COUNT_{DISTINCT}(allegation\_id)}(\text{ GROUP BY}_{v.race}(\text{v} \bowtie_{v.allegation\_id=c.id} \text{c}))$

Question 14

$\rho(cat, data\_allegationcategory)$
$\rho(a, data\_officerallegation)$
$\rho(ag, data\_allegation)$
$\rho(\text{d}, \Pi_{DISTINCTa.allegation\_id,cat.allegation\_name}(\text{cat} \bowtie_{cat.id=a.allegation\_category\_id} \text{a}))$
$\Pi_{allegation\_name}(\sigma_{\neg ag.is\_officer\_complaint}(\text{LIMIT 5 (GROUP BY}_{allegation\_name}(\text{ d} \bowtie_{ag.id=d.allegation\_id}$ ag))))

Question 15

$\rho(\text{oa}, \text{data\_officerallegation})$
$\rho(\text{s}, \text{data\_salary})$
$\rho(\text{o}, \sigma_{oa.officer\_id=s.officer\_id}(\pi_{oa.officer\_id,\rho(count,COUNT(oa.allegation\_id)),\rho(y,MAX(s.year))}(\text{oa}, \text{s})))$
$\text{AVG}(\pi_{s.salary}(\sigma_{o.count>=100}(\text{s} \bowtie_{s.officer\_id=o.officer\_id} \text{o})))$