1) $\pi_{\text{first\_name, middle\_initial, last\_name}} (\sigma_{\text{appointed\_date} > \text{date('2020-03-15')}} (\text{data\_officer}))$
2) Cannot calculate sum in the given set of relational algebra operators.
3) $\pi_{\text{data\_officer.first\_name, data\_officer.middle\_initial, data\_officer.last\_name}} (\sigma_{\text{max\_date.appointed\_date} = \text{data\_officer.appointed\_date}} (\text{data\_officer} \times \rho(\text{max\_date}, (\pi_{\text{appointed\_date}} (\text{data\_officer}) - \pi_{\text{C1.appointed\_date}} (\sigma_{\text{C1.appointed\_date} < \text{C2.appointed\_date}} (\rho(\text{C1}, (\text{data\_officer})) \times \rho(\text{C2}, (\text{data\_officer}))))))))$
4) $\pi_{\text{data\_officer.id, data\_officer.first\_name, data\_officer.last\_name}} (\text{data\_officer} \bowtie_{\text{ids.officer\_id} = \text{data\_officer.id}} \rho(\text{ids}, (\pi_{\text{al3.officer\_id}} (\sigma_{\text{al3.allegation\_id != attempt.act1 and al3.allegation\_id != attempt.act2}} (\rho(\text{al3}, \text{data\_officerallegation} \bowtie_{\text{attempt.officer\_id} = \text{al3.officer\_id}} \rho(\text{attempt}, (\rho(\text{al1.allegation\_id} \rightarrow \text{act1}, \text{al2.allegation\_id} \rightarrow \text{act2}, \pi_{\text{al1.allegation\_id, al2.allegation\_id, al2.officer\_id}} (\sigma_{\text{al2.allegation\_id} \neq \text{al1.allegation\_id}} (\rho(\text{al2}, \text{data\_officerallegation} \bowtie_{\text{al2.officer\_id} = \text{al1.officer\_id}} \rho(\text{al1}, \text{data\_officerallegation}))))))))))))$
5) Not possible: in part of this query we would need to use SUM to count up the population counts. As we cannot calculate sum in our relational algebra operators, we cannot do this.
6) $\pi_{\text{L.id, R.id, L.last\_unit\_id, R.last\_unit\_id}} (\rho(\text{L}, (\pi_{\text{last\_unit\_id, id, allegation\_id}} (\text{data\_officer} \bowtie_{\text{data\_officer.id} = \text{data\_officerallegation.officer\_id}} \text{data\_officerallegation}))) \bowtie_{\text{L.allegation\_id} = \text{R.allegation\_id and L.id} < \text{R.id and L.last\_unit\_id} \neq \text{R.last\_unit\_id}} \rho(\text{R}, (\pi_{\text{last\_unit\_id, id, allegation\_id}} (\text{data\_officer} \bowtie_{\text{data\_officer.id} = \text{data\_officerallegation.officer\_id}} \text{data\_officerallegation}))))$
7) Cannot be cone as this requires calculating averages, which cannot be done in relational algebra
8) $\pi_{\text{rank, sustained\_count}} (\text{data\_officer} - \pi_{\text{s1.rank, s1.allegations}} (\rho(\text{s1}, \text{data\_officer}) \bowtie_{\text{s1.rank} = \text{s2.rank and s1.sustained\_count} < \text{sustained\_count}} \rho(\text{s2}, \text{data\_officer})))$
9) Not possible to do. Firstly, the manipulation of extracting year from end_date cannot be done in relational algebra. Additionally, this requires the count of rows, which is not possible in our set of operators.
10) Not possible. In order to get the number of each type of complaints, counting rows is required. This is not possible in our set of relational algebra operators.