CPSC 304: Introduction to Relational Databases
Tutorial #4 Solution: Relational Algebra

(Note that other solutions are possible.)

Part A

1. $\pi_{sname,color}$ [($\sigma_{sname='Albert' \text{ v } sname='Andrea'}$ (Sailors)) ⋈ Reserves ⋈ Boats]

   You can use the union operator in your answer. For example:

   $\pi_{sname,color}$ [($\sigma_{sname='Albert'}$ (Sailors)) ⋈ Reserves ⋈ Boats] ∪
   $\pi_{sname,color}$ [($\sigma_{sname='Andrea'}$ (Sailors)) ⋈ Reserves ⋈ Boats]

2. π_{sid} ($\sigma_{rating=7}$ (Sailors)) ∪ π_{sid} [$\sigma_{bid=103}$ (Reserves)]

3. π_{sname} ([π_{sid} (Sailors) – π_{sid} ($\sigma_{color='red'}$ (Boats) ⋈ Reserves)] ⋈ Sailors)

4. πsname ([π_{sid} (Sailors) – πsid ($\sigma_{color='red' \text{ v } color = 'green'}$ (Boats) ⋈ Reserves)]
   ⋈ Sailors)

5. π_{sid} (σage < 19 (Sailors) ⋈ ($\sigma_{color='red'}$(Boats) ⋈ Reserves))

6. πsname [($\sigma_{\text{Reserves.sid=R2.sid} \wedge \text{Reserves.bid} \neq \text{R2.bid}}$ (Reserves × ρ(R2, Reserves))
   ⋈ Sailors]

7. π_{sname} ([$\pi_{sid,bid}$ (Reserves) / π_{bid} (Boats)] ⋈ Sailors)

8. π_{sname} ([$\pi_{sid,\ bid}$ (Reserves) / π_{bid} ($\sigma_{name='Titanic'}$ (Boats))] ⋈ Sailors)

9. π_{sid} (Sailors) – $\pi_{\text{S2.sid}}$ ($\sigma_{\text{S2.rating} < \text{Sailors.rating}}$ (ρ(S2, Sailors) × Sailors))

10. πS2.sid ($\sigma_{\text{S2.rating} > \text{Sailors.rating}}$ [ρ(S2, Sailors) × $\sigma_{sname='Ron'}$ (Sailors)])

11. π_{sid} (Sailors) – $\pi_{\text{S2.sid}}$ ($\sigma_{\text{S2.rating} <= \text{Sailors.rating}}$ [ρ(S2,Sailors) ×$\sigma_{sname='Ron'}$
    (Sailors)])

Part B

1) $\pi_{email}(\sigma_{firstName = "Mark"}(Customer)) \cup \pi_{email}(\sigma_{lastName = "Solar"}(Customer))$

   Equivalently: $\pi_{email}(\sigma_{firstName = "Mark" \vee lastName = "Solar"}(Customer))$

2) $\pi_{equipmentID}(\sigma_{purchasedDate < "2019-01-01"}(Equipment)) - \pi_{equipmentID}(EquipRental)$

3) $\pi_{lastName}([(\rho(c1, Reservation) \bowtie_{c1.customerID = c2.customerID \wedge c1.confirmationNumber \neq c2.confirmationNumber} \rho(c2, Reservation)] \bowtie_{c1.customerID = Customer.customerID} Customer))$

4) Find the start dates of reservations made in SuperRent branches in the city of Winnipeg which have as their end date: 2018-02-02.
   - Equivalently: Find the start dates of reservations made for any Winnipeg branch, where the end date of the reservation is February 2, 2018.

5) Find the street addresses of customers who have either made payments (on their reservation bills) of more than $100, or whose first name is Jeremy.

6) Find the start and end dates of equipment rentals which have earlier start date than that of any equipment rental performed by the customer who made the reservation with confirmation number 12345.