

1

$$\pi_{PersonID, Name, Age} \left(\sigma_{DietaryPref = \text{"Vegan"} \vee DietaryPref = \text{"Vegetarian"}} \left(\sigma_{age \geq 20 \wedge age \leq 30} (Passenger) \bowtie Person \right) \right)$$

2a

$$\pi_{Model, cnt} (\gamma_{model, COUNT(model) \rightarrow cnt})$$

2b

$$\pi_{Name, Model, cnt} (\gamma_{Name, Model, COUNT(Model) \rightarrow cnt} \left(\sigma_{Name = \text{"Air Canada"} \vee Name = \text{"Etihad Airways"} \vee Name = \text{"United Airways"}} (Airplane \bowtie_{Airline.Alias = Airplane.AirlineAlias} Airline) \right))$$

3a

$$\pi_{TicketNo, avg_baggage_weight} (\gamma_{TicketNo, AVG(TotalWeight) \rightarrow avg_baggage_weight} \left(\sigma_{name = \text{"Air Canada"}} (\rho_b(Baggage) \bowtie_{u.AirlineAlias = AirlineAlias \wedge u.RouteID = RouteID} (Route \bowtie (\rho_t(Ticket) \bowtie_{t.FlightNo = sf.FlightNo \wedge t.FlightDepDate = sf.DepDate} \rho_{sf}(ScheduledFlight))))))$$

3b

$$\pi_{TicketNo, Total_weight} (\sigma_{Total_Weight > 90} (\gamma_{TicketNo, SUM(TotalWeight) \rightarrow Total_Weight} \left(\sigma_{BagType = \text{"Oversized"} \wedge Fragile = \text{"False"}} \left(Baggage \bowtie \rho_t(Ticket) \bowtie_{sf.FlightNo = t.FlightNo \wedge sf.DepDate = t.FlightDepDate} \rho_{sf}(\pi_{FlightNo, DepDate} (\sigma_{ArrDate \geq \text{"2023-12-10"} \wedge Depdate \leq \text{"2024-01-03"}} (ScheduledFlights))) \right) \right) \right))$$

4

$$\begin{aligned} Min_Price = & \left(\pi_{min_price} (\gamma_{MIN(price) \rightarrow min_price} \left(\rho_{t1}(Ticket) \bowtie_{t1.FlightNo = sf1.FlightNo \wedge t1.FlightDepDate = sf1.DepDate} \rho_{sf1}(ScheduledFlight) \right. \right. \\ & \left. \left. \bowtie_{r1.srcAirport = \text{"YYZ"} \wedge r1.dstAirport = \text{"MCO"}} \rho_{r1}(Route) \bowtie \rho_{b1}(Book) \right) \right) \\ & \left. \right) \\ & \left. \right) \end{aligned}$$

$$\pi_{TicketNo, FlightDepDate, Price, Website} \left(\sigma_{price = Min_Price} \left(\rho_t(Ticket) \bowtie_{t.FlightNo = sf.FlightNo \wedge t.FlightDepDate = sf.DepDate} \rho_{sf}(ScheduledFlight) \right. \right. \\ \left. \left. \bowtie_{r.srcAirport = \text{"YYZ"} \wedge r.dstAirport = \text{"MCO"}} \rho_r(Route) \bowtie \rho_b(Book) \right) \right)$$

5a

$$\pi_{RouteID,airlines}(\tau_{airlines \text{ DESC}}(\sigma_{airlines \geq 3}(\gamma_{RouteID,COUNT(airlineAlias) \rightarrow airlines}(Uses)))$$

5b

$$Used_Routes = \pi_{RouteID}(Used) \\ \pi_{RouteID,srcAirport,dstAirport}(Route) - \pi_{RouteID,srcAirport,dstAirport}(\sigma_{RouteID \in Used_Routes}(Route))$$

6a

$$P = \pi_{PersonID}(Pilot) \cup \pi_{PersonID}(CabinCrew) \cup \pi_{PersonID}(GroundStaff) \\ \pi_{NumStaffPassengers}(\gamma_{COUNT(PersonID) \rightarrow NumStaffPassengers}(P \bowtie Passenger))$$

6b

$$\gamma_{Alias,COUNT(PersonID) \rightarrow cnt}(\pi_{PersonID,AirlineAlias}(CabinCrew) \cup \pi_{PilotID \rightarrow PersonID,AirlineAlias}(Flies \bowtie_{AirplaneSNo=SerialNo} Airplane) \bowtie_{AirlineAlias=Alias} Airline) \bowtie Passenger)$$