

Homework 1 - Solutions

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1 Question 1

- 1.a List the publication year of books ordered from zipcode 02125.

$$\pi_{year}((\sigma_{zipcode=02125}(Customers) \bowtie Orders) \bowtie Books)$$

- 1.b Find the zipcodes of customers who bought in a single order at least 10 copies of a book that costs more than \$100.

$$\pi_{zipcode}(((\sigma_{price=100}Books) \bowtie (\sigma_{quantity=10}Orders)) \bowtie Customers)$$

- 1.c Find the names of customers who bought only books published in or after 1990 (implies they bought at least a book).

$$\rho(tmp1, (Books \bowtie Orders))$$

$$\pi_{cname}((\pi_{cid}(\sigma_{year \geq 1990}(tmp1)) - \pi_{cid}(\sigma_{year < 1990}(tmp1))) \bowtie Customers)$$

- 1.d Find the names of customers who bought at least a copy of a book by author 'Edgar Codd', or at least 10 copies of a book called 'Databases'.

$$\pi_{cname}(\sigma_{author='EdgarCodd' \wedge quantity > 0}(Books \bowtie Orders \bowtie Customers)) \cup$$

$$\pi_{cname}((\sigma_{quantity=10 \wedge bname='Databases'}(Books \bowtie Orders \bowtie Customers)))$$

- 1.e Find the names of customers who placed an order with a total payment of more than \$1,000

$$\pi_{cname}(\sigma_{quantity * price \geq 1000}(Books \bowtie Orders \bowtie Customer))$$

- 1.f Find the author(s) of book(s) for which there is a single order placed.

$$\begin{aligned} & \rho(tmp1, (Orders \bowtie Books)) \\ & \rho(tmp2, tmp1) \\ & \rho(tmp3, (tmp1 \bowtie_{tmp1.bid=tmp2.bid \wedge tmp1.cid <> tmp2.cid} tmp2)) \\ & \pi_{author}((\pi_{bid}Orders) - (\pi_{bid}tmp3)) \bowtie Books \end{aligned}$$

- 1.g CS630 Only - Find the names of books ordered by those customers who are the only ones in their particular zipcode who placed an order.

$$\begin{aligned} & \rho(tmp1, (Customer \bowtie Orders)) \\ & \rho(tmp2, tmp1) \\ & \rho(tmp3, (\pi_{cid}(tmp1 \bowtie_{tmp1.cid <> tmp2.cid \wedge tmp1.zipcode=tmp2.zipcode} tmp2))) \\ & \pi_{bname}(((\pi_{cid}Customers) - tmp3) \bowtie Orders \bowtie Books) \end{aligned}$$

2 Question 2

- 2.a Find the names of passengers who travelled on a B787 aircraft and paid at most \$800 for that ticket.

$$\pi_{pname}((\sigma_{price \leq 800}((\sigma_{aircraft=B787}Flights) \bowtie Tickets)) \bowtie Passengers)$$

- 2.b Find the ages of passengers who travelled only on flights in or out of BOS.

$$\begin{aligned} & \rho(tmp1, (\pi_{pid}(\sigma_{To='BOS' \vee From='BOS'}Flights \bowtie Tickets) - \pi_{pid}(\sigma_{To <> 'BOS' \wedge From <> 'BOS'}Flights \bowtie Tickets))) \\ & \pi_{age}(tmp1 \bowtie Passengers) \end{aligned}$$

- 2.c List the prices of all tickets for aircrafts of type B777

$$\pi_{price}((\sigma_{aircraft='B777'}Flights) \bowtie Tickets)$$

- 2.d Find the residence city of passengers who travelled on a flight longer than 500 miles or who paid at most \$500 for a ticket

$$\pi_{city}(((\sigma_{price \leq 500}(Flights \bowtie Tickets)) \cup (\sigma_{miles \geq 500}(Flights \bowtie Tickets))) \bowtie Passengers)$$

2.e Find the origin of flights that had both passengers who reside in Boston and passengers who reside in Chicago

$$\rho(tmp1, (\pi_{fid}(\sigma_{city='Boston'} Passengers \bowtie Tickets) \cap \pi_{fid}(\sigma_{city='Chicago'} Passengers \bowtie Tickets))) \\ \pi_{From}(tmp1 \bowtie Tickets \bowtie Flights)$$

2.f Find the names of passengers who had connecting flights, defined as two flights where the origin of the second flight is the same as the destination of the first. Note that return flights do not count as connecting flights.

$$\rho(tmp1, (Flights \bowtie Tickets)) \\ \rho(tmp2, tmp1) \\ \rho(tmp3, (\pi_{pid}(tmp1 \bowtie_{tmp1.pid=tmp2.pid \wedge tmp1.to=tmp2.from \wedge tmp1.from <> tmp2.to} tmp2))) \\ \pi_{pname}(tmp3 \bowtie Passengers)$$

2.g CS630 Only - Find the names of "suspicious" passengers, defined as passengers who took a trip consisting of three segments even though there are direct flights connecting the source and the destination

$$\rho(tmp1, (Flights \bowtie Tickets)) \\ \rho(tmp2, tmp1) \\ \rho(tmp3, tmp1) \\ \rho(tmp4[tmp1.from \rightarrow f1, tmp2.to \rightarrow f2, tmp1.pid \rightarrow f3], \\ (tmp1 \bowtie_{tmp1.pid=tmp2.pid \wedge tmp1.to=tmp2.from} tmp2)) \\ \rho(tmp5[f1 \rightarrow g1, tmp3.to \rightarrow g2, tmp3.pid \rightarrow g3], \pi_{g1,g2,g3}(tmp4 \bowtie_{f2=tmp3.from \wedge f3=tmp3.pid} tmp3)) \\ \pi_{pname}((\pi_{g3}(Flights \bowtie_{g2=flights.to \wedge g1=flights.from} tmp5) \bowtie Passengers))$$