Homework 1

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Foundations of Databases

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Part 1: Set Theory

Given: Let $A = \{1, 2, 3, 4\}, B = \{1, 3, 5, 7\}, C = \{2, 4, 6, 8\}$, and $D = \{p, q\}$.
Question 1

1. $(A \cup B) = \{1, 2, 3, 4, 5, 7\}$
2. $(B \cap C) - A = \emptyset$
3. $(A \times D) \cap (B \times D) = \{(1, p), (1, q), (3, p), (3, q)\}$
4. $(A \cap B) \times C$ - $\{(1, 2), (1, 4), (1, 6), (1, 8), (3, 2), (3, 4), (3, 6), (3, 8)\}$

Part 2: Relational Algebra Interpretation

Question 2

Rel_1		
A	B	C
10	saturn	9
5	pluto	7
17	mercury	3
19	earth	5

Rel_2	
F	C
large	10
medium	5
small	3
dwarf	7

Rel_3	
A	M
10	74897
13	7.92
19	7926
17	3032

1. $\sigma_{(C<7)}(Rel_2) \bowtie \sigma_{A>12}(Rel_1)$

A	B	F	C
17	mercury	small	3
19	earth	medium	5

2. $Rel_2 \bowtie_{(Rel_2.C=Rel_3.A)} Rel_3$

F	C	A	M
large	10	10	74897

3. $\pi_{(B,C)}(Rel_1 \bowtie Rel_3)$

B	C
saturn	9
mercury	3
earth	5

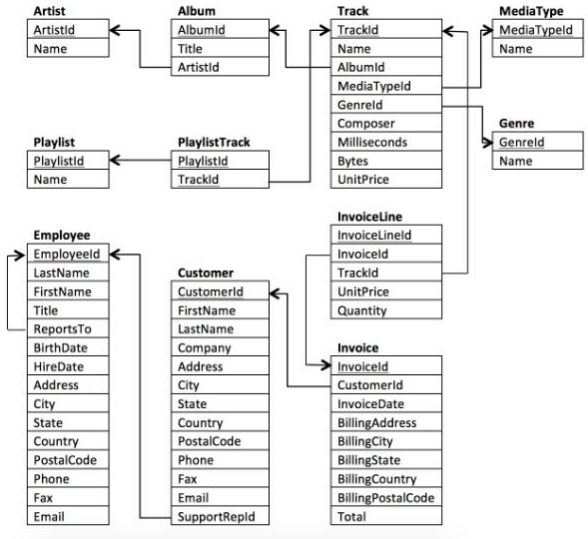
4. $(\pi_{(A)}(Rel_1)) \times (\sigma_{C\geq 7}(Rel_2))$

A	F	C
10	large	10
5	large	10
17	large	10
19	large	10
10	dwarf	7
5	dwarf	7
17	dwarf	7
19	dwarf	7

Question 3

1. $\sigma_{(C<7)}(Rel_2) \bowtie \sigma_{A>12}(Rel_1)$
   $\pi_{Rel_1.A,Rel_1.B,Rel_2.F,Rel_2.C}(\sigma_{Rel_2.C=Rel_1.C \wedge Rel_2.C<7 \wedge Rel_1.A>12}(Rel_2 \times Rel_1))$
2. $Rel_2 \bowtie_{(Rel_2.C=Rel_3.A)} Rel_3$
   $\pi_{Rel_2.F,Rel_2.C,Rel_3.A,Rel_3.M}(\sigma_{Rel_2.C=Rel_3.A}(Rel_2 \times Rel_3))$

Part 3: Relational Algebra Query Generation



Question 4
Management needs a list of the first names, last names, and email addresses of all customers from Massachusetts and Connecticut. You were told that the database stores the regular two character code for each state.

$\pi_{Customer.FirstName,Customer.LastName,Customer.Email}(\sigma_{Customer.State=MA \vee Customer.State=CT}(Customer))$

Question 5
We need to encourage artists to broaden their appeal by producing tracks in the 'Rock' genre. Provide a list of artist names whose tracks only fall in the 'Rock' genre.

$\pi_{Artist.Name}(Artist.name - (Album \bowtie_{Almbum.AlbumId=Track.Albumid}$
$(Track \bowtie_{Track.Genreid=Genre.Genreid} \sigma_{\neg Genre.Name=Rock}(Genre)))$

Question 6

Chinook is pushing the use of playlists by having sales reps reach out to customers.
Provide a list of the names and email addresses of all employees that represent customers who have purchased tracks that do not appear on any playlist. (Note, the customer may have also purchased tracks that appear on a playlist in addition to some that don't appear on a playlist).

$\pi_{FirstName,LastName,Email}(Customer \bowtie_{Customer.CustomerId=Invoice.CustomerId}$
$(Invoice \bowtie_{Invoice.InvoiceId=InvoiceLine.InvoiceId} (InvoiceLine \bowtie_{InvoiceLine.TrackId=Track.TrackId}$
$\sigma_{Track.TrackId-PlaylistTrack.TrackId}(Track))))$

Question 7

Provide a list of names, titles, and email addresses of the managers of any employee that represents a customer that has placed at least 1 individual order with a total in excess of $250.00.

$\pi_{ReportsTo}(Employee \bowtie_{Employee.EmployeeId=Customer.SupportRepId}$
$(Customer \bowtie_{Customer.CustomerId=Invoice.CustomerId} \sigma_{Invoice.Total>250}(Invoice)))$