Database assignment 2

Daniel Lin and Robert Arntzenius

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1 Relational Algebra

Exercize 1 -

1.

$\pi_{\text{mid}}\sigma_{\text{"title" = "Not clickbait"} \wedge \text{"likecount"} > 9000} messages$

2.

$\rho(invited, \pi_{\text{id}}((\pi_{\text{eid}}\sigma_{\text{name="Cheap sunglasses check description"}} event) \bowtie_{eid} invitedToEvent)) \bowtie_{\text{id}} user)$

$\rho(users, \pi_{\text{id}} user)$

$\pi_{\text{id}}(invited \bowtie_{\text{invited.id} \neq \text{user.id}} users)$

3.

$\rho(mes1, message)$

$\rho(mes2, message)$

$\rho(res, \pi_{\text{mes1.mid}}((message \times message) - \sigma_{\text{mes1.likecount<mes2.likecount}}(mes1 \times mes2)))$

$\pi_{\text{id}}(\pi_{\text{mid}}(res) \bowtie_{\text{mid}} messageLikes) \bowtie_{\text{id}} user$

4.

$\rho(invited, \pi_{\text{id}}(\sigma_{\text{accepted = "true"}}(\pi_{\text{eid}}\sigma_{\text{name="Nude painting"}} event) \bowtie_{eid} invitedToEvent)) \bowtie_{\text{id}} user)$

$\rho(users, \pi_{\text{id}} user)$

$\rho(friends, \pi_{\text{id}}(\pi_{fid} friend) \bowtie_{id} user)$

$\pi_{\text{name}}(invited \bowtie_{\text{invited.id = user.id}} users \cup friends)$

5.

$\rho(friends, \pi_{\text{id}}(\pi_{fid} friend) \bowtie_{id} user)$

$\rho(othergender, \pi_{\text{id}} friends - \pi_{\text{id}}(\pi_{\text{id}} friends) \bowtie_{\text{gender}} user)$

$\rho(otherage, \pi_{\text{id}}(\pi_{\text{id}} friends) \bowtie_{\text{friends.age<user.age}} user)$

$\pi_{\text{name}}(friends/(othergender \cap otherage))user$

6.

$\rho(one, \pi_{\text{id}}\sigma_{\text{name = "Crazy Cosplay Caroline"}} user)$

$\rho(onemessages, \pi_{\text{mid}}\rho_{\text{creator=one}} message)$

$\rho(messageliked, \pi_{\text{id}}\sigma_{\text{mid=onemessages}} messageLikes)$

$\pi_{\text{name}}((messageliked)/(\pi_{\text{id, name}} user))$

7.

$\rho(mes1, \sigma_{likecount>999} message)$

$\rho(mes2, \sigma_{likecount>999} message)$

$\rho(mes3, \sigma_{likecount>999} message)$

$\rho(res1, \pi_{\text{mes1.creator}}(\sigma_{\text{mes1.mid}\neq\text{mes2.mid}\wedge\text{mes2.mid}\neq\text{mes3.mid}\wedge\text{mes1.mid}\neq\text{mes3.mid}}(mes1 \times mes2 \times mes3)))$

$\rho(res2, \pi_{\text{mes2.creator}}(\sigma_{\text{mes1.mid}\neq\text{mes2.mid}\wedge\text{mes2.mid}\neq\text{mes3.mid}\wedge\text{mes1.mid}\neq\text{mes3.mid}}(mes1 \times mes2 \times mes3)))$

$\rho(res3, \pi_{\text{mes3.creator}}(\sigma_{\text{mes1.mid}\neq\text{mes2.mid}\wedge\text{mes2.mid}\neq\text{mes3.mid}\wedge\text{mes1.mid}\neq\text{mes3.mid}}(mes1 \times mes2 \times mes3)))$

$\pi_{\text{id}}(\sigma_{\text{res1.creator=res2.creator}\wedge\text{res2.creator=res3.creator}\wedge\text{res1.creator=res3.creator}}(res1 \times res2 \times res3)) \bowtie_{res.creator=user.id} user$

2 Shema Normalization

Exercize 2 -

1.

Determine all the functional dependencies (F) that are derivable from the points mentioned above.

V $\rightarrow TUCSD$(A video ID implies all video attributes)

UT $\rightarrow V$(Since an uploader cannot upload more than one video with the same title,
these attributes implie the video ID)

S $\rightarrow C$(Since subcategories are unique per category, there are no subcategories placed in more than one

category)
N $\rightarrow BA$(Since a comment number is unique, it implies all comment attributes)
N $\rightarrow U$(Since a comment number is unique and used by the same account used for uploading, it implies the uploader)
N $\rightarrow V$(Since every comment is linked via its number to a single video ID, the comment number implies the video ID)

2. Determine the key(s) in this table
N $\rightarrow V, V \rightarrow TUCSD$
implies N $\rightarrow TUCSD(Transitivity)$
N $\rightarrow BA, N \rightarrow U, N \rightarrow V, N \rightarrow TUCSD$
implies N $\rightarrow BAUVTUCSD(Union)$

Since N is never on the right side,
N is certainly part of all existing keys and since N is a key of itself,
N must be the only existing key.
3. Derive a minimal cover (G) for R
First, we listed all FD's:
V $\rightarrow T$
V $\rightarrow U$
V $\rightarrow C$
V $\rightarrow S$
V $\rightarrow D$
UT $\rightarrow V$
S $\rightarrow C$
N $\rightarrow A$
N $\rightarrow B$
N $\rightarrow U$
N $\rightarrow V$
Then we try to derive existing FD's from others:
N V, V U implies N U (Transitivity)
So, we delete N U from the list
Finally, we write down the minimal cover: V $\rightarrow TUCSDUT \rightarrow VS \rightarrow CN \rightarrow ABV$

4.

Using your minimal cover, derive a lossless join decomposition in BCNF and indicate a primary key for each table in the decomposition.

VTUCSDNBA
$\Downarrow \Rightarrow NVBA$
VTUCSD
The resulting lossless join decomposition in BCNF is: VTUCSD, NVBA

5.

Is your decomposition also dependency preserving? Why is or isn't it? If it is not, derive a dependency preserving decomposition in 3NF.

The decomposition is not dependency preserving, because not all FD's in the minimal cover have their own table
To make it dependency preserving, we add a table for all other FD's, the resulting decomposition is:
VTUCSD, NVBA, UTV, SC

6.

Prove, if XY $\rightarrow BandX \rightarrow YthenX \rightarrow B$
XY $\rightarrow B$
X $\rightarrow Y$
XX $\rightarrow XY(AugmentationX)$
XX $\rightarrow B(TransitivityXYB)$
X $\rightarrow B(Union)$

Exercize 3 -

1.

https://preview.ibb.co/gm0R67/graph.jpg

2.

The graph is not conflict serializable because there exists a cycle inbetween T1 and T2.

3.

T1:	S(C)R(C)					S(B)R(B)	X(C)W(C)	X(A)W(A)		
T2:			S(B)R(B)		X(B)W(B)					
T3:		S(A)R(A)		X(A)W(A)						S(A)R(A)
T4:									S(C)R(C)	