Database assignment 2

Daniel Lin and Robert Arntzenius

May 4, 2018

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.

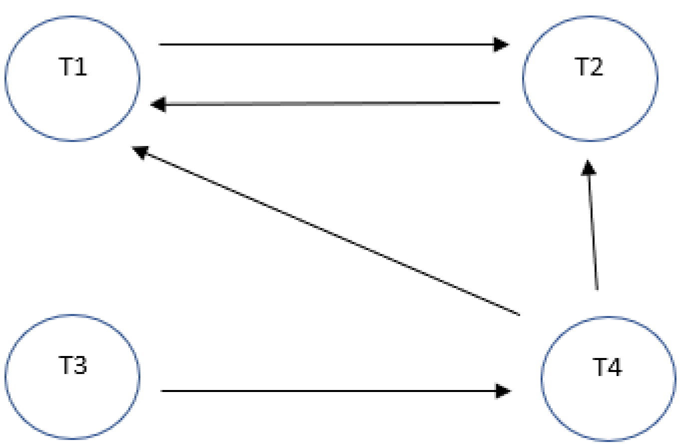
VTUCSDNBA
$\Downarrow \Rightarrow NVBA$
VTUCSD
The resulting lossless join decomposition in BCNF is: VTUCSD, NVBA
5.

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.

T2 contains W(B) and T1 contains R(B), so there is an edge from T2 to T1
T3 contains R(A) and T4 contains W(A), so there is an edge from T3 to T4
T4 contains R(C) and T1 contains W(C), so there is an edge from T4 to T1
T1 contains R(B) and T2 contains W(B), so there is an edge from T1 to T2
T4 contains W(A) and T2 contains R(A), so there is an edge from T4 to T2



2.
The graph is not conflict serializable because there exists a cycle inbetween T1 and T2.
3.

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