Homework #5
CS486
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Avenger Data

Row	*GID*	*GDate*	*Trn*	*PID*	*PName*	*VID*	*VName*	*VPts*	*PType*	*Hero*	*HeroAct*	*DefVID*	*DefVName*
A	*6*	*10/21/18*	*5*	*417*	*George*	*212*	*Maestro*	*6*	*Fight*	*Hulk*	*Smash*	*205*	*Savage*
B	*6*	*10/21/18*	*6*	*412*	*Mary*	*213*	*Ninja*	*3*	*Recruit*	*Gambit*	*Shark*	*NULL*	*NULL*
C	*6*	*10/21/18*	*7*	*421*	*Fred*	*211*	*Doombot*	*3*	*Fight*	*Hawkeye*	*Draw*	*220*	*Hydra*
D	*7*	*10/20/18*	*5*	*412*	*Mary*	*208*	*Skrull*	*4*	*Recruit*	*Storm*	*Cyclone*	*NULL*	*NULL*
E	*7*	*10/20/18*	*6*	*420*	*Sarah*	*205*	*Giant*	*4*	*Fight*	*Hulk*	*Smash*	*221*	*Zemo*
F	*5*	*10/19/18*	*4*	*421*	*Fred*	*211*	*Doombot*	*3*	*Fight*	*Hulk*	*Rampage*	*220*	*Hydra*
G	*5*	*10/19/18*	*5*	*419*	*Sue*	*220*	*Hydra*	*6*	*Recruit*	*Gambit*	*Jackpot*	*NULL*	*NULL*
H	*5*	*10/19/18*	*6*	*425*	*George*	*221*	*Zemo*	*6*	*Recruit*	*Hulk*	*Smash*	*NULL*	*NULL*

Exercise 1

For each functional dependency,say whether the instance above satisfies it. If not, indicate the rows that violate the functional dependency.

a) $DefVID \rightarrow DefVName$

Yes. The only duplicate `DefVID`s are 220 (which always points to Hydra) and NULL (which always points to NULL).

b) $Trn \rightarrow PID$

No. A `Trn` of 6 points to both a `PID` of 412,420,and 425.

c) $VPts \rightarrow VName$

No. A `VPts` of 3 points to both a `VName` of Ninja and Doombot.

d) $PName \rightarrow PID$

No. The `PName` George points to both a `PID` of 417 and a `PID` of 425.

e) $PID \rightarrow PType$

Yes. Each instance of the same `PID` points to the same `PType`.

Exercise 2

Using notation <column A> → <column B>,determine 10 non-trivial functional dependencies that the instance above satisfies. Determine 7 FD's that are likely true for all valid data instances,and 3 FD's that just happen to be true for this data set,but are probably not always true for this domain. Include the probable primary key of the table in one of your FDs that are likely true for all valid data instances.

1. `GID` → `GDate`
2. `VID` → `VName`
3. `VID` → `VPts`
4. `VName` → `VPts`
5. `PID` → `PName`
6. `VName` → `VID`
7. `DefVName` → `DefVID`
8. `GID, Trn` → `PID`

1. `VID` → `PName`
2. `VName` → `PName`
3. `VName` → `PID`

Normalization

Consider the following relational schema that holds store and product information. The names are short for Inventory,Store Numner,Store Address,Store City,Store State,Store Zone,Department ID,Department Name,Product Code,Product Description,Aisle,Price,Unit,Supplier ID,Supplier Name,Supplier Rating,Cost.
Assume that the following functional dependencies hold:

```
inv(SNu,SA,SC,SS,Z,DID,DNa,PC,Pd,A,Pr,U,SuID,SuN,SuR,C)
```

1. `SNu,PC,SuID` → `SA,SC,SS,Z,DID,DNa,PD,A,Pr,U,SuN,SuR,C`
2. `SNu` → `SA,SC,SS,Z`
3. `SC,SS` → `Z`
4. `DID` → `DNa`
5. `DNa` → `DID`
6. `PC` → `PD,U`
7. `SNu,DID` → `A`
8. `SNu,PC` → `DID,Pr`
9. `SuID` → `SuN,SuR`
10. `SuID,PC` → `C`

Exercise 3

Show a decomposition of ***inv*** *into BCNF. Show each step in your decomposition and the keys for each relation schema. Give a name for each table that describes what that table is for.*

Extracted Rel	New table	Inventory
None	–	[SNu,SA,SC,SS,Z,DID,DNa,PC,Pd,A,Pr,U,SuID,SuN,SuR,C]
SNu → SA,SC,SZ	[SNu,SA,SC,SS]	[SNu,DID,DNa,PC,Pd,A,Pr,U,SuID,SuN,SuR,C]
SC+SS → Z	[SC,SS,Z]	[SNu,DID,DNa,PC,Pd,A,Pr,U,SuID,SuN,SuR,C]
DID ↔ DNa	[DID,DNa]	[SNu,DID,PC,Pd,A,Pr,U,SuID,SuN,SuR,C]
PC → PD,U	[PC,PD,U]	[SNu,DID,PC,A,Pr,SuID,SuN,SuR,C]
SNu+DID → A	[SNu,DID,A]	[SNu,DID,PC,Pr,SuID,SuN,SuR,C]
SNu+PC → DID,Pr	[SNu,PC,DID,Pr]	[SNu,PC,SuID,SuN,SuR,C]
SuID → SuN,SuR	[SuID,SuN,SuR]	[SNu,PC,DID,Pr]
SuID+PC → C	[SuID,PC,C]	[SNu,SuID,PC]

This results in the final set of tables:

store_location = [SNu,SA,SC,SS]
zone_by_city_state = [SC,SS,Z]
dept_id_and_name = [DID,DNa]
product = [PC,PD,U]
aisle_per_store_and_department = [SNu,DID,A]
item_price_and_department = [SNu,PC,DID,Pr]
supplier = [SuID,SuN,SuR]
supply_cost = [SuID,PC,C]
inventory = [SNu,SuID,PC]

Exercise 4

Describe a transitive functional dependency in your normalized scheme for Exercise 3.

Every store has a location in a city state which determines that store's zone.
SNu → SC+SS → Z.

Exercise 5

Decompose relation R into BCNF. Show your work. Your answer should consist of a list of table names and attributes and an indication of the keys in each table.
R(A,B,C,D,E,F,G)

1. *B* → *A*
2. *F* → *F,G*
3. *C,D* → *A,B,E,F*
4. *E,F* → *A,B*
5. *G* → *G,F*

Row	Relation	New Table	Source Table	Keep New Table
1	[-] →[-]	[–]	[A,B,C,D,E,F,G]	No
2	[B] →[A]	[B,A]	[A,B,C,D,E,F,G]	No
3	[-] →[-]	[B,A]	[B,A]	Yes
4	[F] →[G]	[F,G]	[B,C,D,E,F,G]	No
5	[G] →[F]	[F,G]	[F,G]	No
6	[C,D] →[A,B,E,F]	[C,D,A,B,E,F]	[B,C,D,E,F]	No
7	[-] →[-]	[F,G]	[F,G]	Yes
8	[B] →[A]	[duplicate]	[C,D,A,B,E,F]	No
9	[-] →[-]	[C,D]	[C,D]	No
10	[E,F] →[A,B]	[E,F,A,B]	[C,D,B,E,F]	No
11	[B] →[A]	[E,F,B]	[E,F,A,B]	No
12	[-] →[-]	[C,D,E,F]	[C,D,E,F]	Yes
13	[-] →[-]	[E,F,B]	[E,F,B]	Yes

The final set of tables is :

$$\begin{aligned} \texttt{B\_A\_Rel} &= [\underline{\texttt{B}},\texttt{A}] \\ \texttt{F\_G\_Rel} &= [\underline{\texttt{F}},\underline{\texttt{G}}] \\ \texttt{original} &= [\underline{\texttt{C}},\underline{\texttt{D}},\texttt{E},\texttt{F}] \\ \texttt{EF\_B\_Rel} &= [\underline{\texttt{E}},\underline{\texttt{F}},\texttt{B}] \end{aligned}$$

Exercise 6

Explain 5 different types of JOINs and how they return different rows to the answer.

- `INNER JOIN`: Merge tables on a key.
- `LEFT JOIN`: Merge tables on a key,but keep all records in the `LEFT` table,even if they don't have a corresponding match in the `RIGHT` table (missing columns are set to `NULL`).
- `RIGHT JOIN`: Merge tables on a key,but keep everything in the `RIGHT` table,even if they don't have a corresponding match in the `LEFT` table (missing columns are set to `NULL`).
- `FULL JOIN`: Merge tables on a key,keeping everything in both the `LEFT` and `RIGHT` tables,even if they have no match (missing columns are set to `NULL`).
- `SELF JOIN`: Merge a table with itself.
- `CARTESIAN JOIN`: Merge every record in table 1 with every record in table 2.

Exercise 7

Pick two topics that you need to review for the midterm. Write a summary of each,including the key concepts and what I'm likely to ask about it on the midterm.

a) *Views*

Views are virtual tables where each column points to another table. They'll update as the actual data is changed. You can query views as if they were real tables.

```
# creation
CREATE VIEW name AS
SELECT col1, col2
FROM table
WHERE condition
;

# updating/overwriting
CREATE OR REPLACE VIEW name AS
SELECT col1, col2
FROM table
WHERE condition
;

# deletion
DROP VIEW name;
```

b) *Relational algebra.*

Operator	Symbol	SQL
Selection	σ	WHERE
Project	π	SELECT DISTINCT
Cartesian Product	x	FROM A, B
Rename	ρ	AS
Join	$\bowtie$	INNER JOIN
Union	$\cup$	UNION
Intersection	$\cap$	INTERSECT
Difference	$-$	MINUS