Introduction to Data Management CSE 344

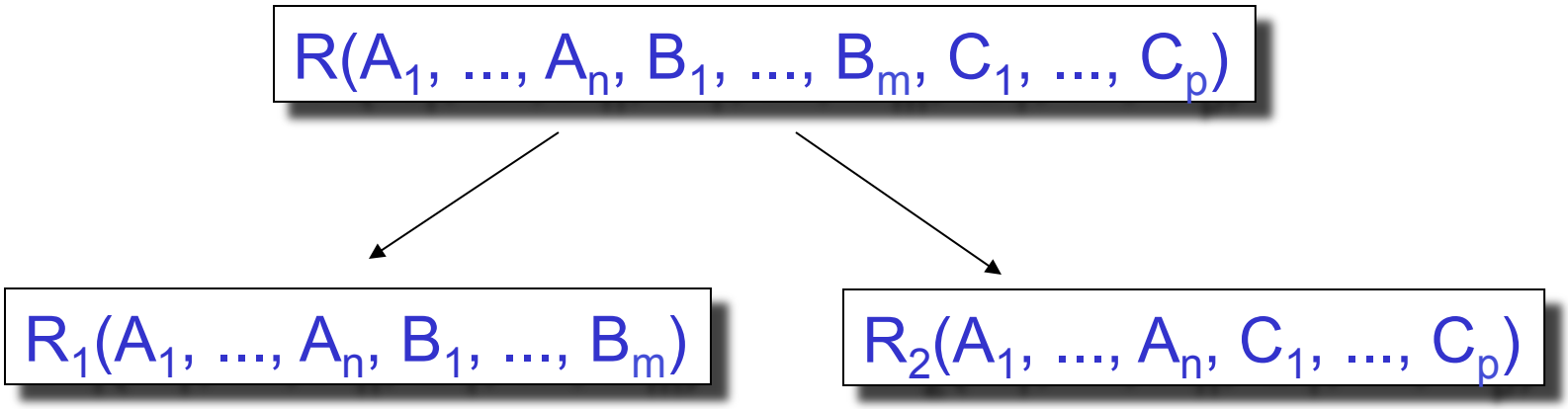
Lecture 18: Lossless Decomposition

(Supplement needed for Webquiz)

Announcements

- Webquiz due tomorrow! (last one)
- No lecture on Monday (Presidents' day)
- Homework 5 due next Friday

Decompositions in General



R_1 = projection of R on $A_1, ..., A_n, B_1, ..., B_m$
R_2 = projection of R on $A_1, ..., A_n, C_1, ..., C_p$

Lossless Join Decomposition

Name	Price	Category
Gizmo	19.99	Gadget
OneClick	24.99	Camera
Gizmo	19.99	Camera

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Gizmo	19.99
OneClick	24.99
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Name	Category
Gizmo	Gadget
OneClick	Camera
Gizmo	Camera

Lossy Join Decomposition

Sometimes it is not:

Name	Price	Category
Gizmo	19.99	Gadget
OneClick	24.99	Camera
Gizmo	19.99	Camera

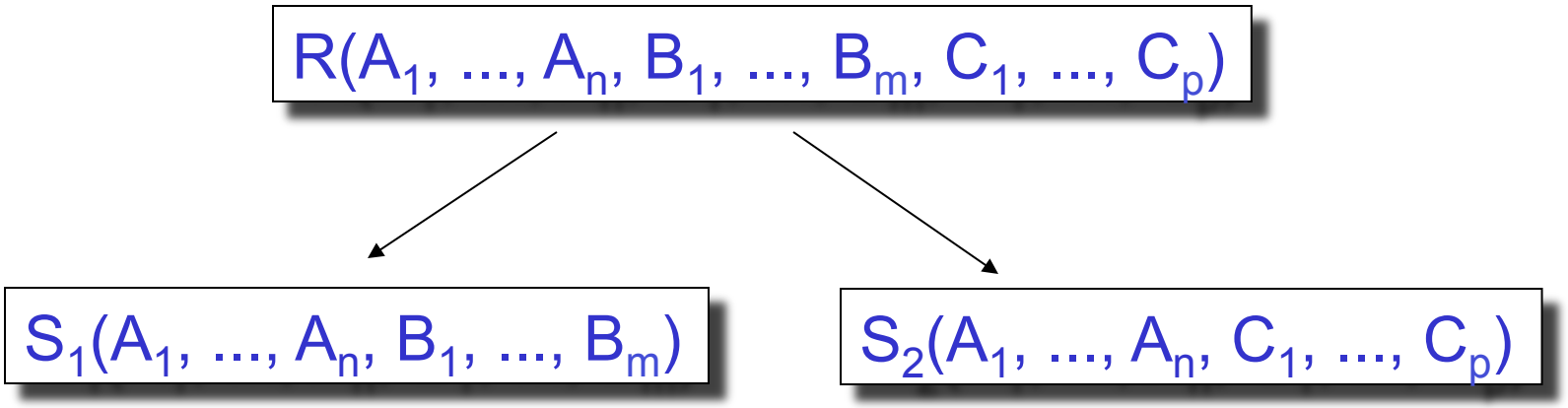
What's incorrect ??

Name	Category
Gizmo	Gadget
OneClick	Camera
Gizmo	Camera

Price	Category
19.99	Gadget
24.99	Camera
19.99	Camera

Lossy decomposition

Decomposition in General



$R = S_1 \bowtie S_2$

Fact: If $A_1, ..., A_n \rightarrow B_1, ..., B_m$ then the decomposition is lossless

It follows that every BCNF decomposition is losselss

In general: $R = S_1 \bowtie \ldots \bowtie S_n$

Example from textbook Ch. 3.4.2

The Chase Test for Lossless Join

$R(A,B,C,D) = S1(A,D) \bowtie S2(A,C) \bowtie S3(B,C,D)$
R satisfies: A→B, B→C, CD→A

$S1 = \Pi_{AD}(R)$, $S2 = \Pi_{AC}(R)$, $S3 = \Pi_{BCD}(R)$,
hence $R \subseteq S1 \bowtie S2 \bowtie S3$
Need to check: $R \supseteq S1 \bowtie S2 \bowtie S3$
Suppose $(a,b,c,d) \in S1 \bowtie S2 \bowtie S3$ Is it also in R?
R must contain the following tuples:

A	B	C	D	Why ?
a	b1	c1	d	$(a,d) \in S1 = \Pi_{AD}(R)$
a	b2	c	d2	$(a,c) \in S2 = \Pi_{BD}(R)$
a3	b	c	d	$(b,c,d) \in S3 = \Pi_{BCD}(R)$

"Chase" them (apply FDs):

A	B	C	D
a	b1	c1	d
a	b1	c	d2
a3	b	c	d

A	B	C	D
a	b1	c	d
a	b1	c	d2
a3	b	c	d

A	B	C	D
a	b1	c	d
a	b1	c	d2
a	b	c	d

Hence R contains (a,b,c,d)