Section 3

CSE 444

Introduction to Databases

Announcements

- Project 1 was due yesterday (10/14/2009)
- Homework 1 was released, due 10/28/2009

From Last time…

- DELETE FROM Table WHERE column = value
  - Don’t forget the WHERE clause
  - Otherwise this empties the content of the table

Today

- E/R Diagrams (Brief overview)
  - English requirements to E/R Diagram
  - E/R diagram to Tables
- BCNF
  - FDs, Closure
  - Examples

E/R basics

- Know and symbols
  - Entity
  - Attributes
  - Relationship
  - Arrows
- ISA
  - Difference from OOP in C++/Java

E/R (English requirements to diagram)

- Each project is managed by one professor (principal investigator)
- Professor can manage multiple projects

Example courtesy: Database Management Systems, 3rd E, R. Ramakrishnan and J. Gehrke

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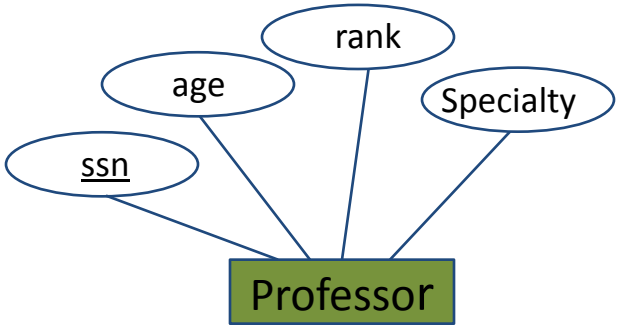

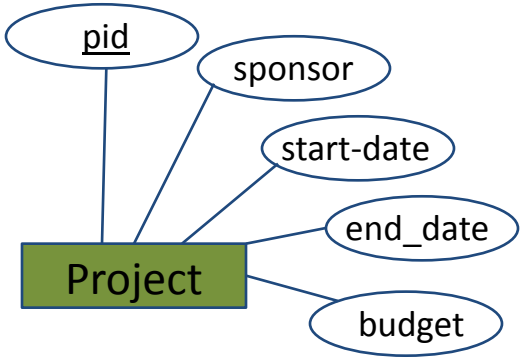

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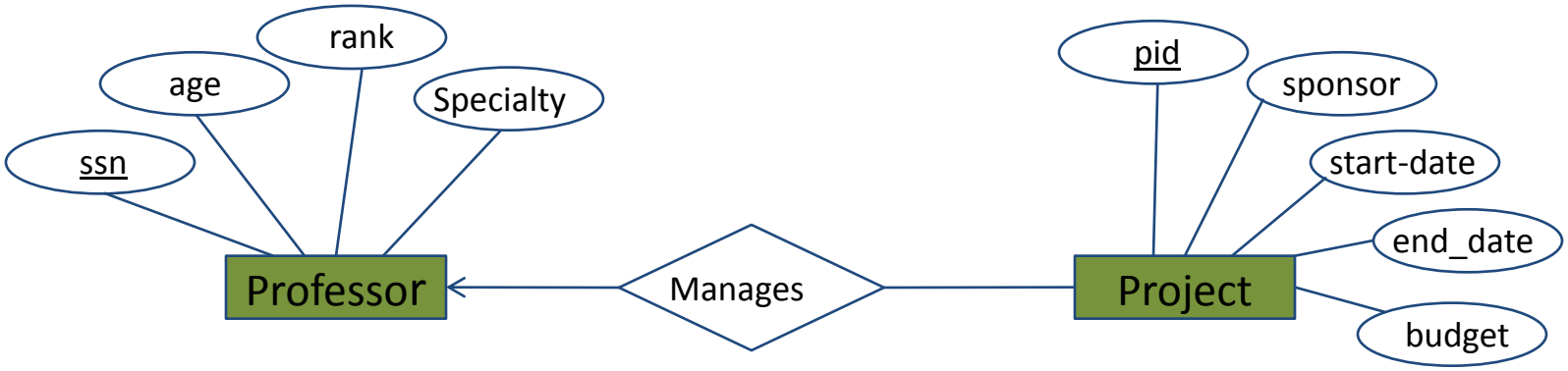

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E/R (English requirements to diagram)

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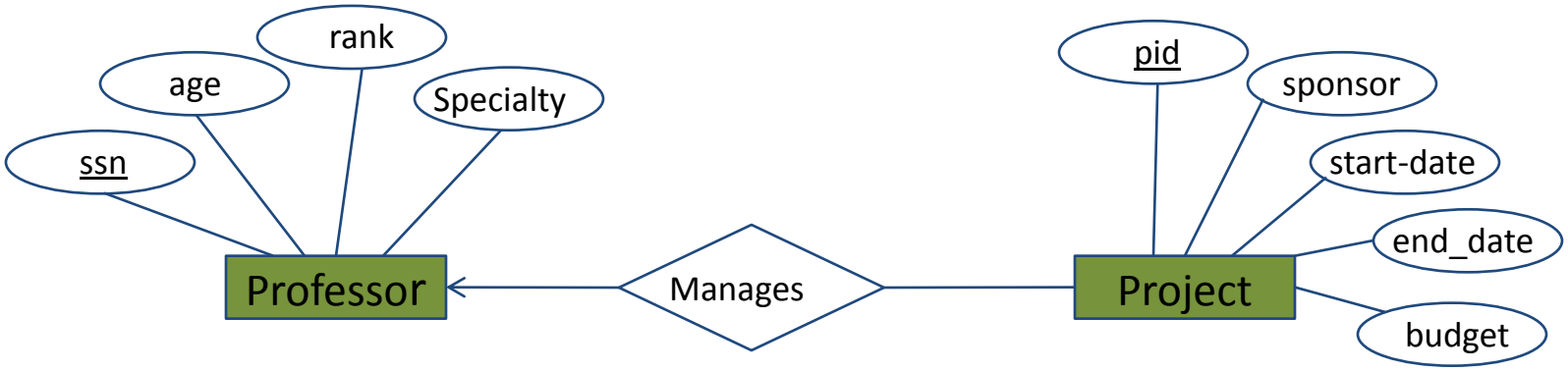

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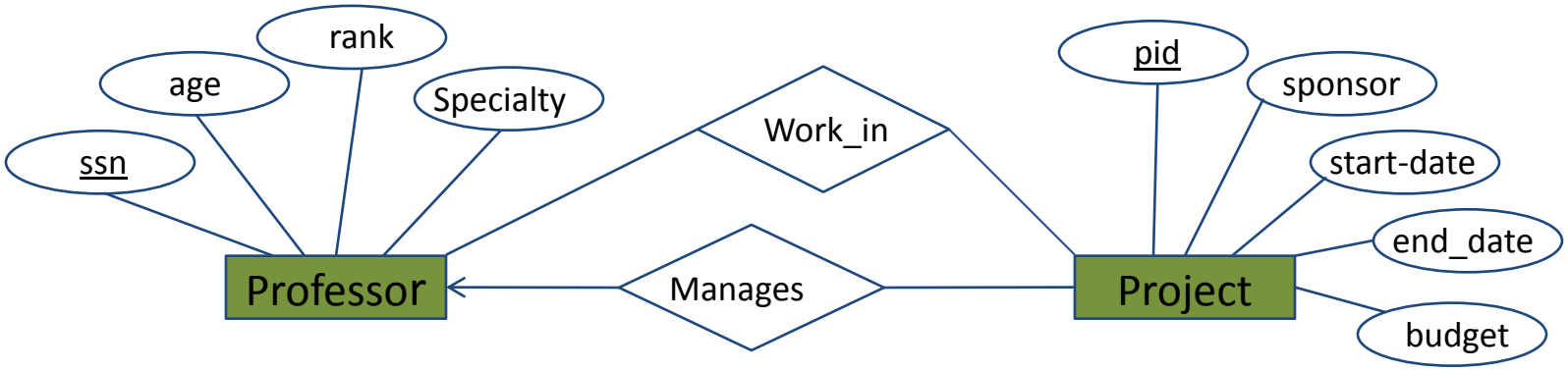

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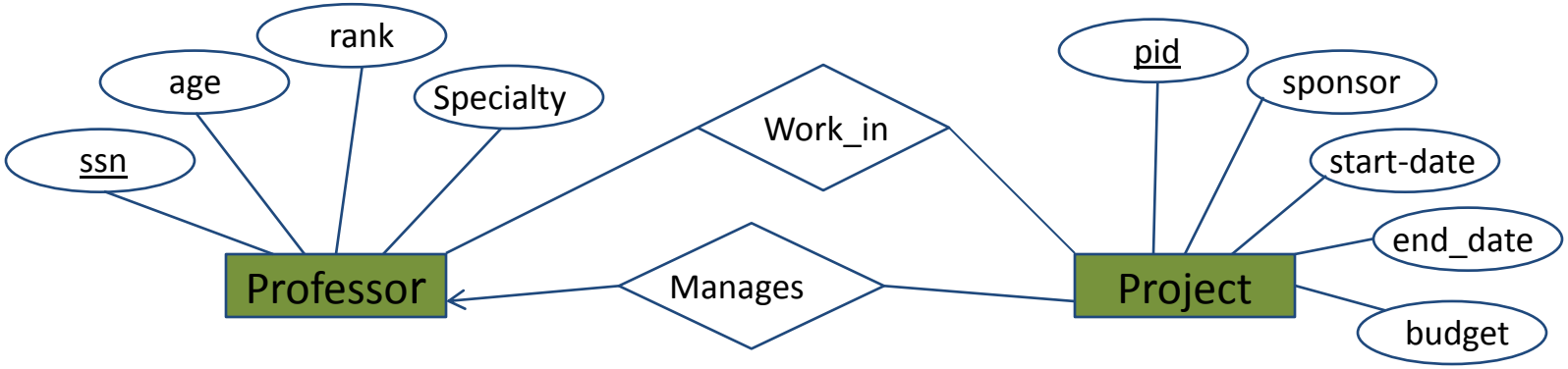
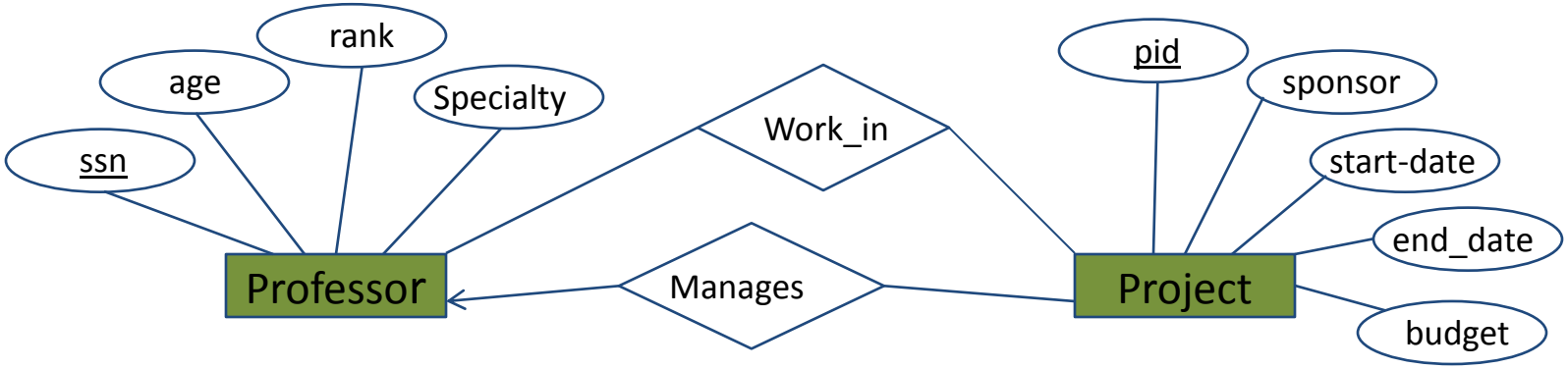
Convert to tables



- Professor(ssn, age, rank, specialty)
- Project(pid, sponsor, start_date, end_date, budget)
- Work_in(ssn, pid)
- Manages(ssn, pid)

Example courtesy: Database Management Systems, 3rd E, R. Ramakrishnan and J. Gehrke

Convert to tables



- Professor(ssn, age, rank, specialty)
- Project(pid, sponsor, start_date, end_date, budget, ssn)
- Work_in(ssn, pid)

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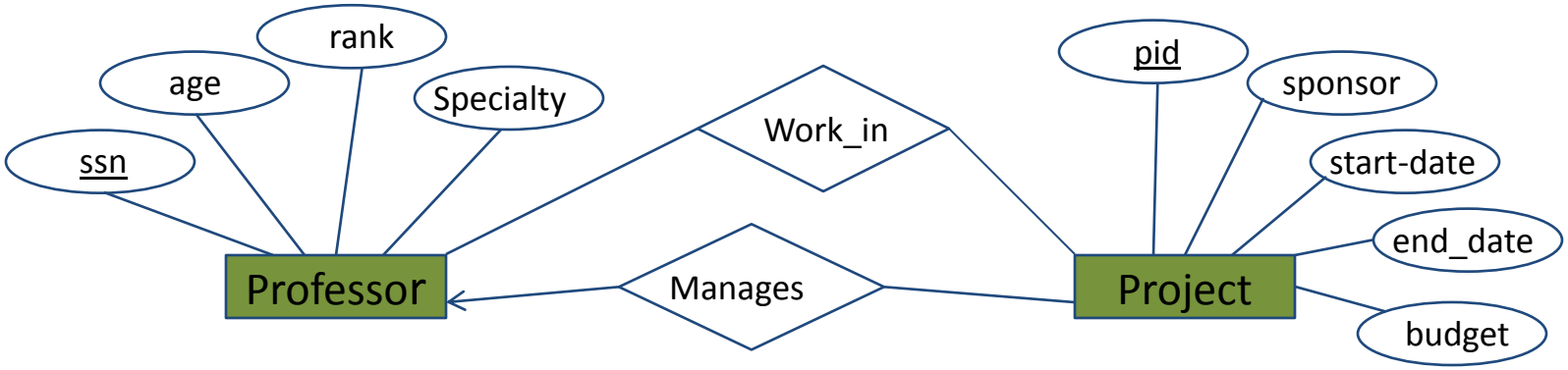
Convert to tables




```
CREATE TABLE Professor (
        ssn INT PRIMARY KEY,
        age INT,
        urank VARCHAR(30),
        specialty VARCHAR(30)
);

CREATE TABLE Project (
        pid INT PRIMARY KEY,
        sponser INT,
        start_date DATE,
        end_date DATE,
        budget FLOAT,
        ssn INT REFERENCES Professor(ssn)
);
```

```
CREATE TABLE Work_In (
        ssn INT REFERENCES Professor(ssn),
        pid INT REFERENCES Project(pid),
        PRIMARY KEY (ssn, pid)
);
```

- Professor(ssn, age, rank, specialty)
- Project(pid, sponsor, start_date, end_date, budget, ssn)
- Work_in(ssn, pid)

Data Anomalies

- Redundancy is Bad, why?

- Redundancy
- Update
- Delete

Functional Dependencies

R	A	B	C	D	E	F
	a1	b1	c1	d1	e1	f1
	a1	b1	c2	d1	e2	f3
	a2	b1	c2	d3	e2	f3
	a3	b2	c3	d4	e3	f2
	a2	b1	c3	d3	e4	f4
	a4	b1	c1	d5	e1	f1

- Dependencies for this relation:
  - $A \rightarrow B$
  - $A \rightarrow D$
  - $B,C \rightarrow E,F$
- Do they all hold in this instance of the relation R?

- How would you go by finding these in an unknown table?
- Functional dependencies are specified by the database programmer based on the intended meaning of the attributes.

Keys

- Keys, what?
  - Superkey
  - Key

BCNF

- What is it?

BCNF Decomposition Algorithm

BCNF_Decompose(R)

find X s.t.: X ≠X^+ ≠ [all attributes]

if (not found) **then** "R is in BCNF"

let Y = X^+ - X
let Z = [all attributes] - X^+
decompose R into R1(X ∪ Y) and R2(X ∪ Z)
continue to decompose recursively R1 and R2

A table R(A,B,C,D,E) : Example 1

Consider the following FDs:

- CD → E BAD
- D → B BAD
- A → CD

Which one are the bad dependences?

CD+ = BCDE

CD is not a superkey

D+ = BD

D is not a superkey

A+ = ABCDE

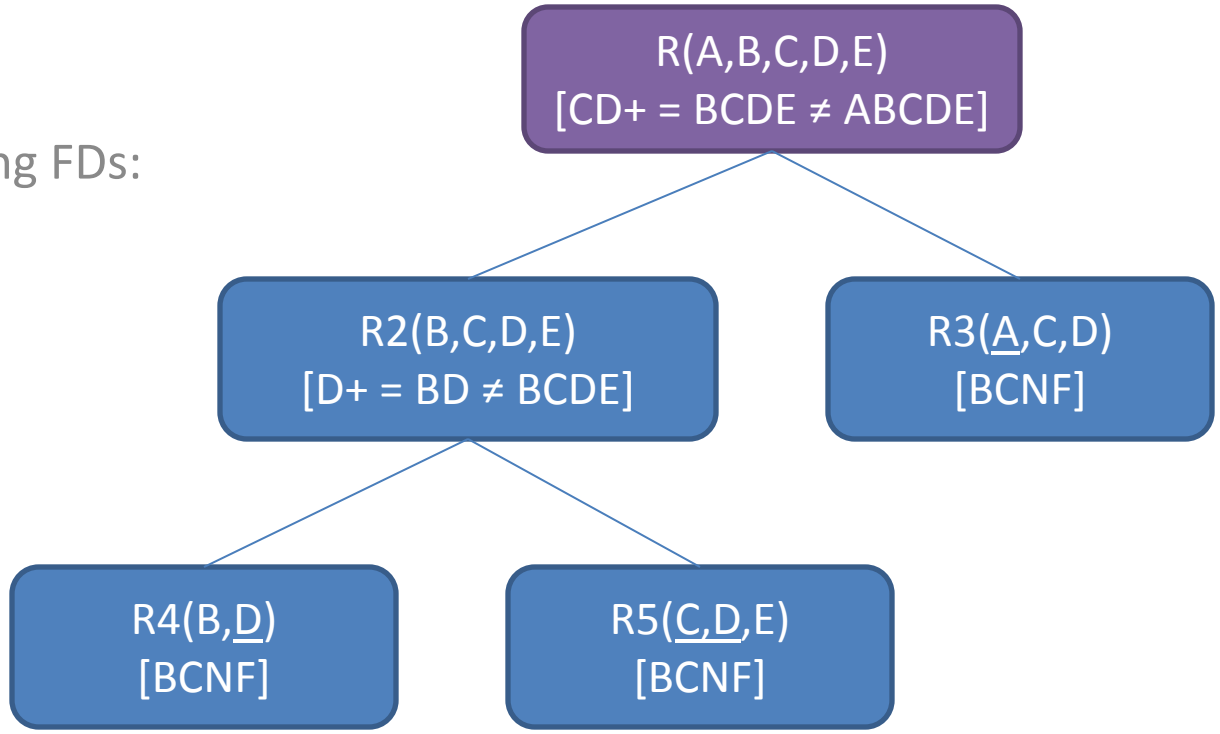
A is a superkey

Note: a set of attributes X is a superkey if X+ = ABCDE

A table R(A,B,C,D,E) : Example 1

Consider the following FDs:

- CD → E BAD
- D → B BAD
- A → CD

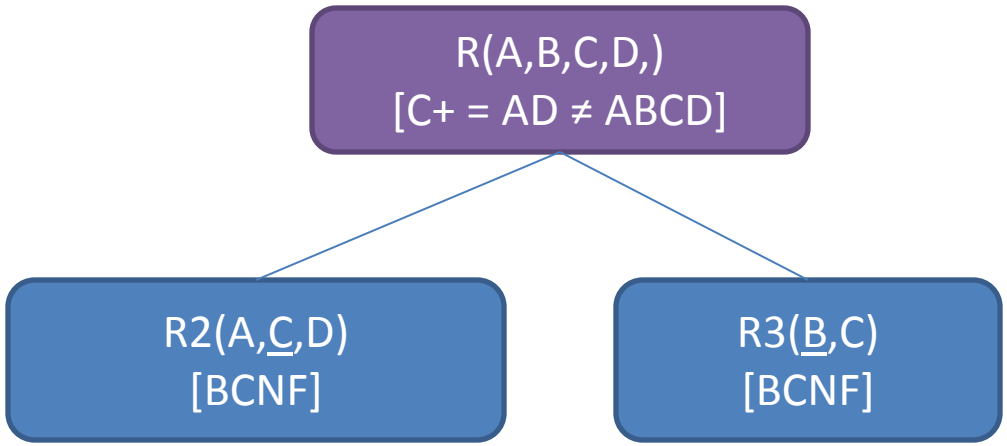


Note: a set of attributes X is a superkey if X+ = ABCDE

A table R(A,B,C,D) : Example 2

Consider the following FDs:

- C → D, C+ = AD BAD
- C → A, C+ = AD BAD
- B → C, B+ = ABCD



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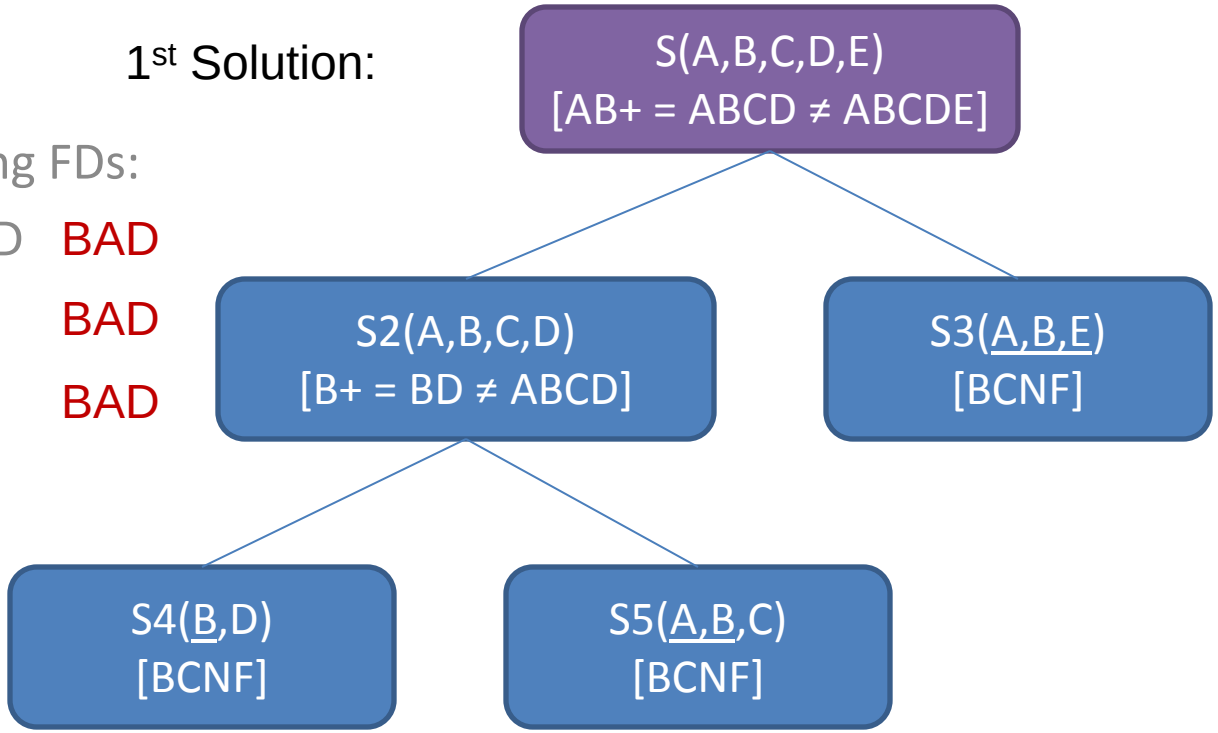
A table S(A,B,C,D,E) : Example 3

1st Solution:



Consider the following FDs:

- AB → C, AB+ = ABCD BAD
- DE → C, DE+ = CDE BAD
- B → D, B+ = BD BAD

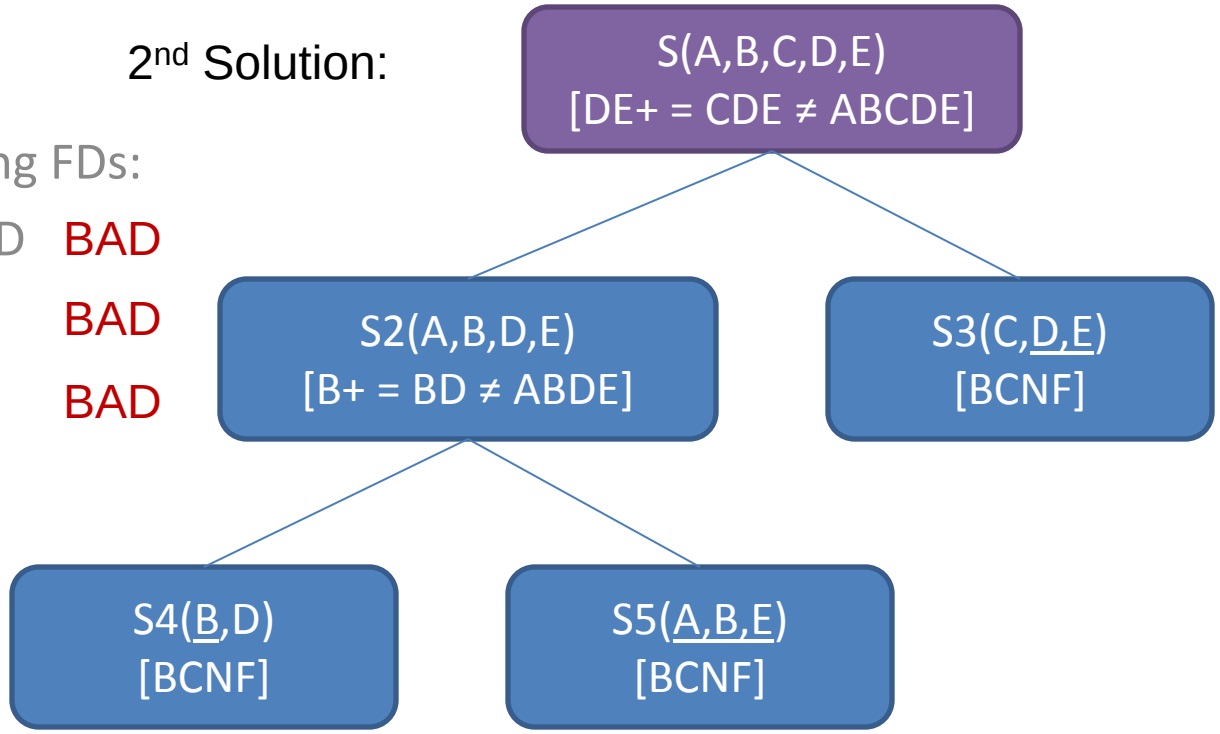
Note: a set of attributes X is a superkey if X+ = ABCDE

A table S(A,B,C,D,E) : Example 3

2nd Solution:

Consider the following FDs:

- AB → C, AB+ = ABCD BAD
- DE → C, DE+ = CDE BAD
- B → D, B+ = BD BAD



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A table S(A,B,C,D,E) : Example 3

3rd Solution:

Consider the following FDs:

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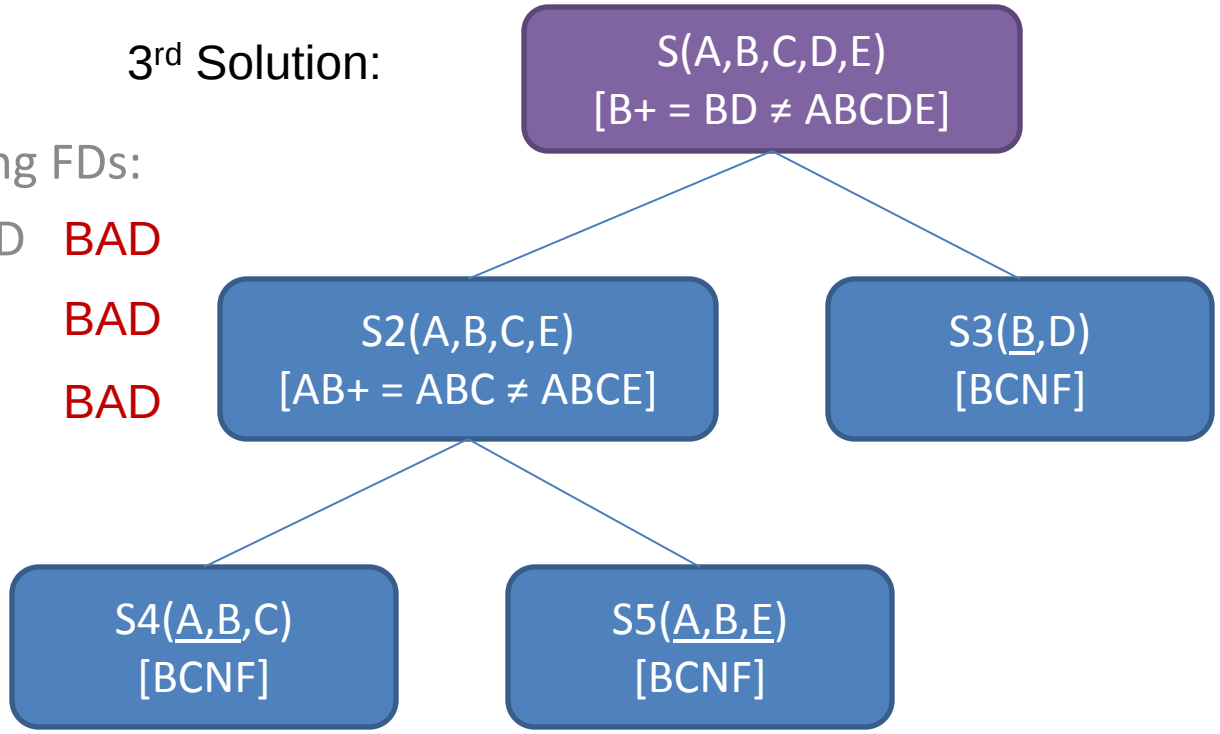

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