Exam 2 Review

Lecture 11

Format

- 3 problems, with multiple sub-parts
- No notes, calculators, books, computers, phones, etc. may be used

Content

Conceptual/Logical database design…

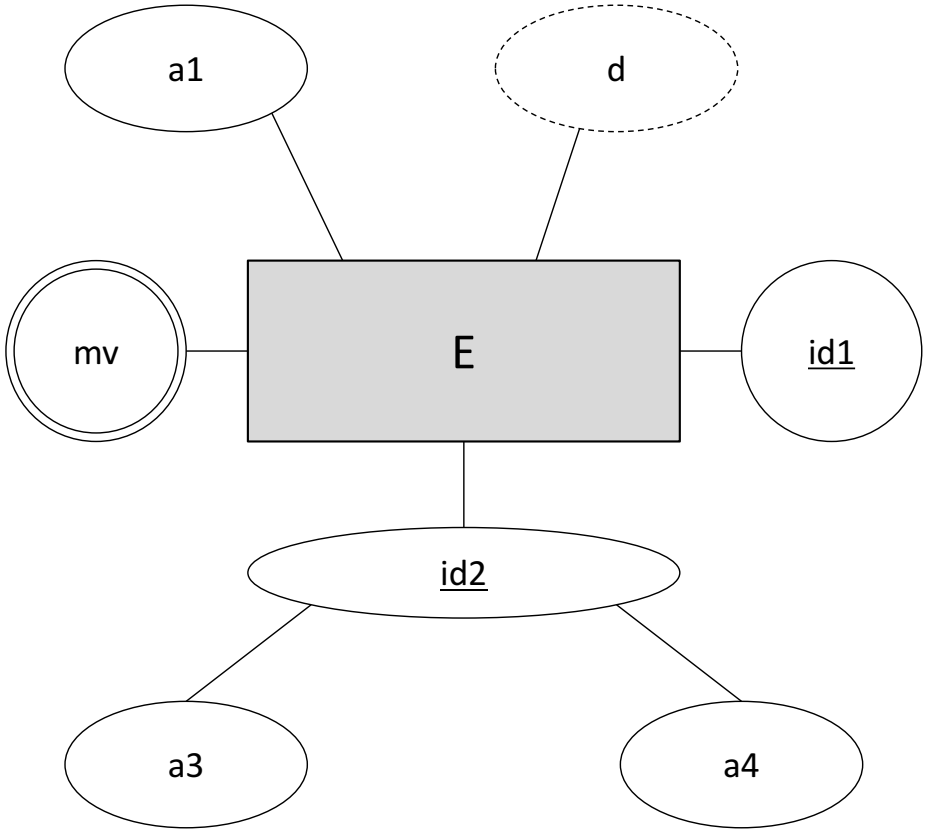
- ER Diagrams
- Mapping ER Diagrams to Relations
- Normalization

ER Diagrams & Mapping

- Conceptual design: goals, approaches
- All the notation we covered
  - Entities: weak/strong
  - Attributes: composite, multi-valued, derived, keys
  - Relationships: cardinality, structural, attributes
  - Specialization/Generalization
  - When to use!
- Mapping to tables
  - Multiple methods for specialization/generalization

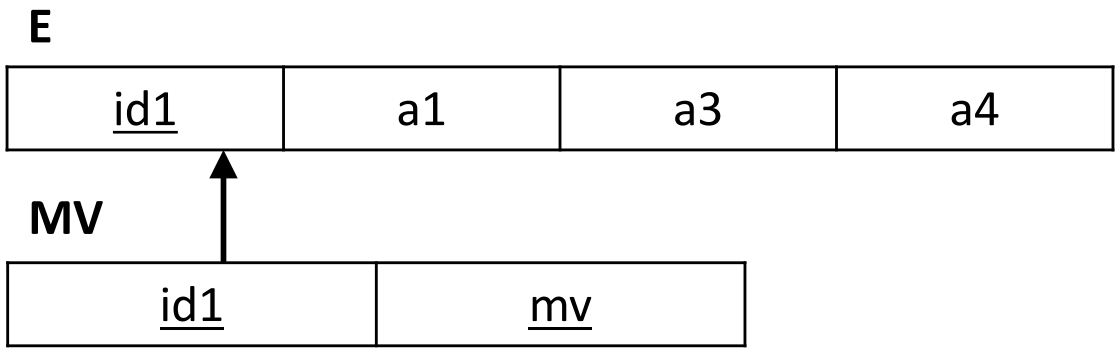
Exercise

- Describe in words the following ERD
  - How can you identify an instance of *E*?
- Map E to relation(s)
  - What are the primary key(s)?
  - What happens to other key(s)?



Answer

- All E's have an a1, an id1, an id2 composed of a3 and a4, and some number of mv's. By combining these you can determine the E's d.
- An E can be uniquely identified by either its id1, or the combination of a3 and a4.

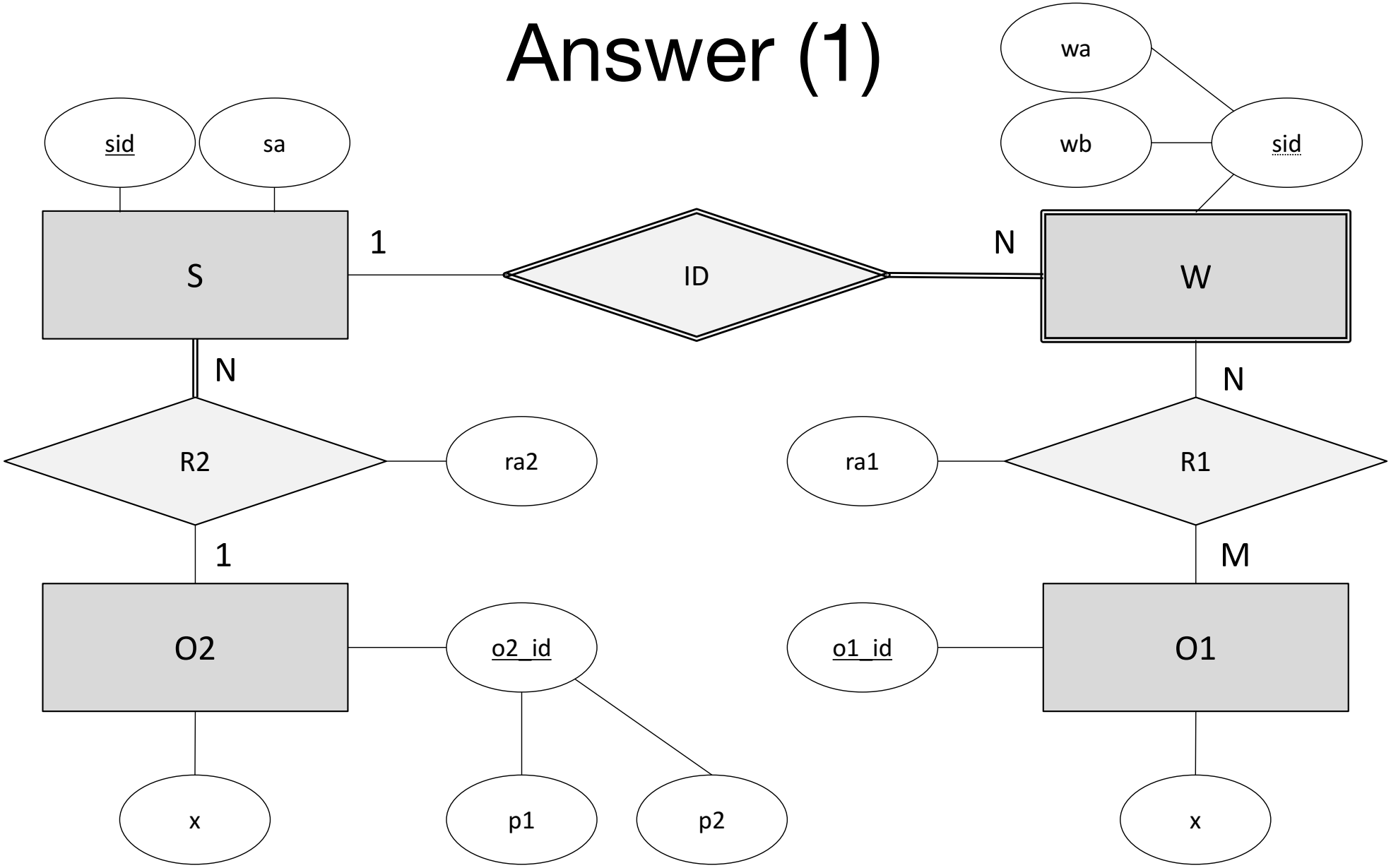


Exercise

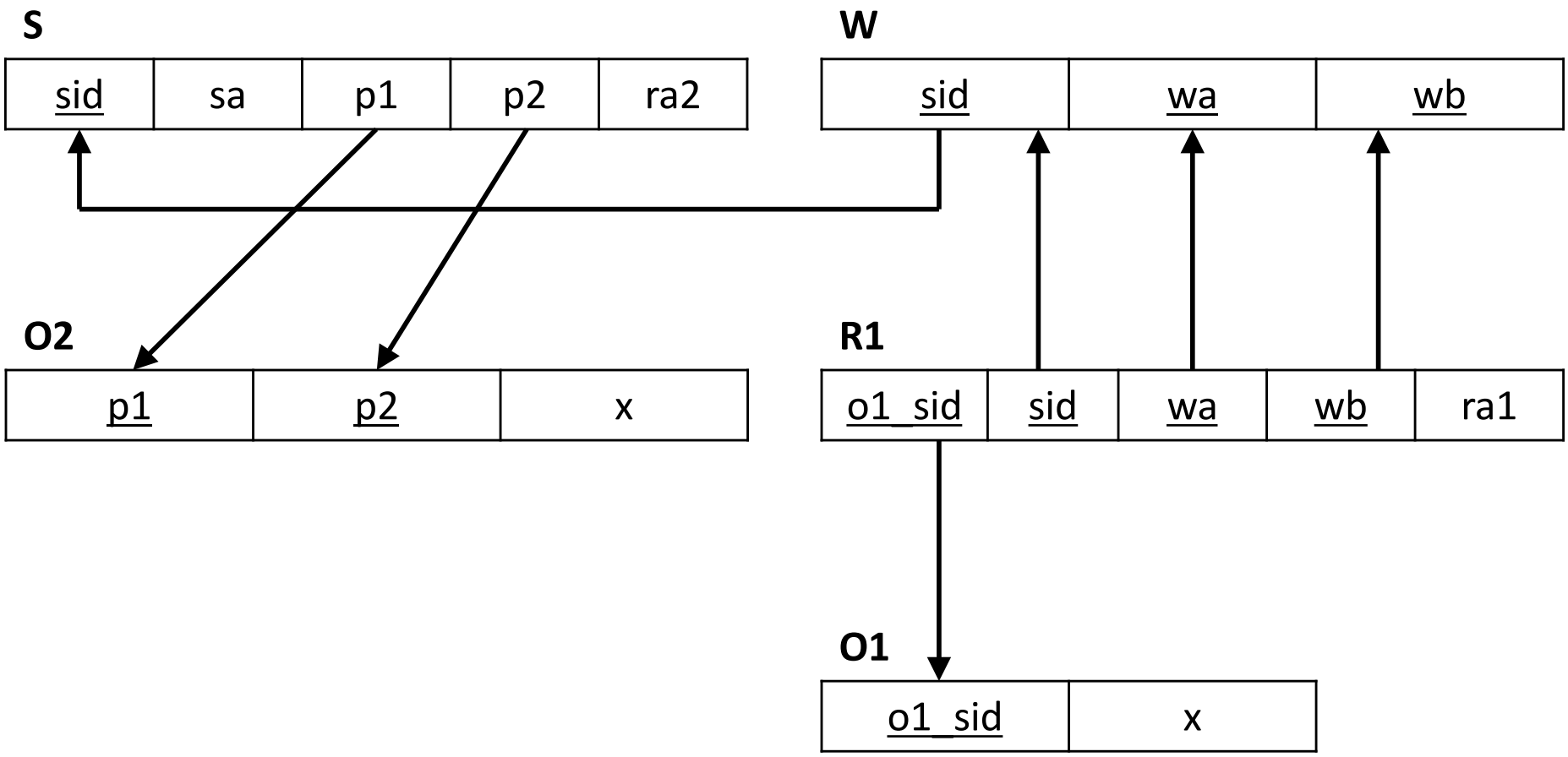
Produce an ERD & corresponding relational schema

- An **S** has an **sa** and can be uniquely identified by its **sid**
- Each **S** must **R2** with a single **O2**, whereas each **O2** may **R2** with any number of **S**'s. When an **S** **R2**'s an **O2**, it is important to note the corresponding **ra2**
- An **O2** has an **x** and can be uniquely identified by its **o2_id**, which is comprised of **p1** and **p2**
- A **W** is identified by its corresponding **S**, in combination with its own **wid**, consisting of a **wa** and **wb**
- Each **W** can **R1** with any number of **O1**'s, and likewise each **O1** can **R1** with any number of **W**'s. Each **R1** interaction has a corresponding **ra1**
- An **O1** is uniquely identified by its **o1_id** and also has an **x**

Answer (1)

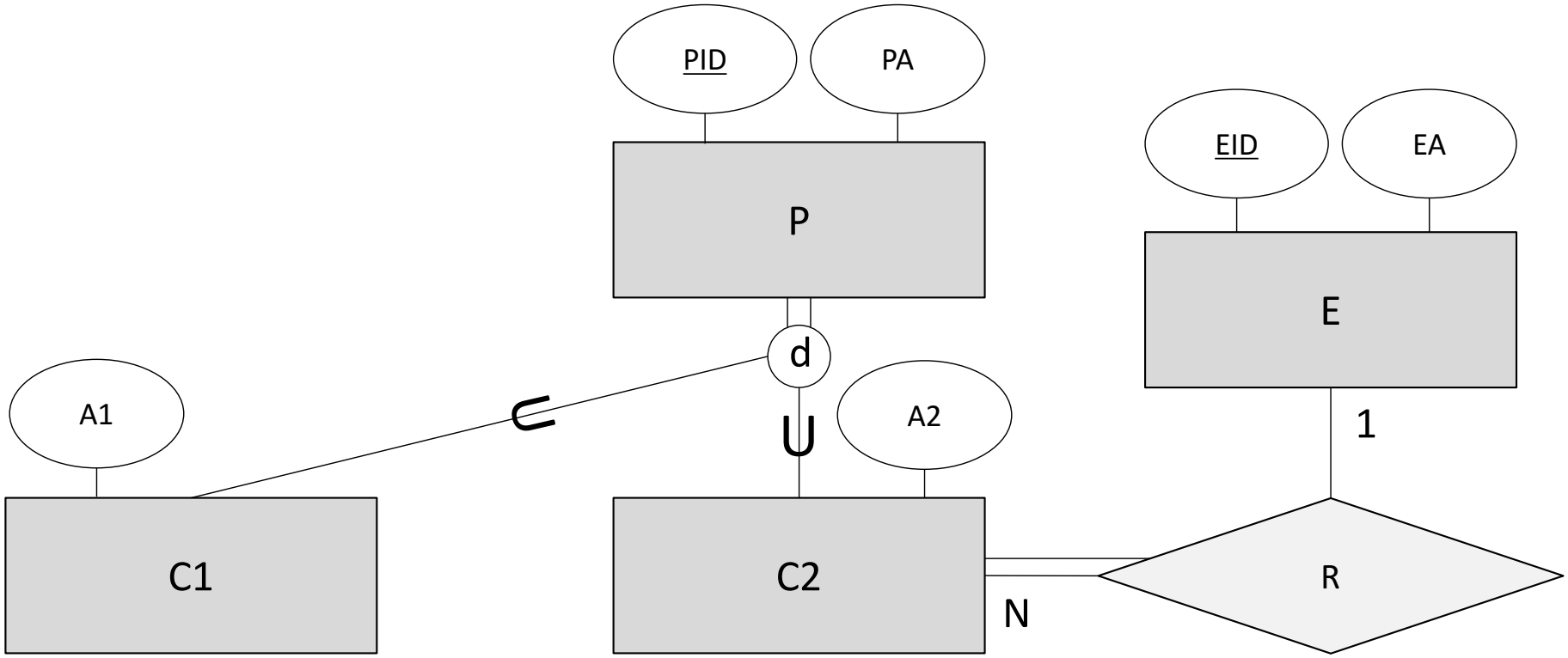

wa
wb
sid
sid
sa
S
1
ID
N
W
N
N
R2
ra2
ra1
R1
1
M
O2
o2_id
o1_id
O1
x
p1
p2
x

Answer (2)

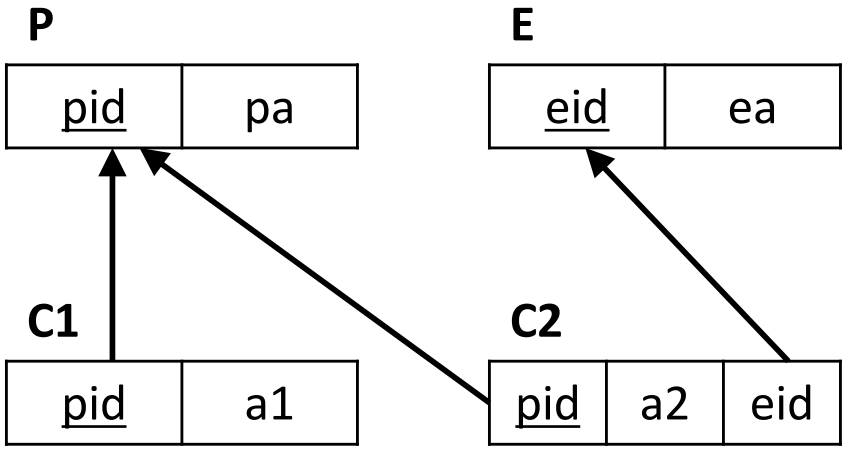

S
sid
sa
p1
p2
ra2
W
sid
wa
wb
O2
p1
p2
x
R1
o1_sid
sid
wa
wb
ra1
O1
o1_sid
x

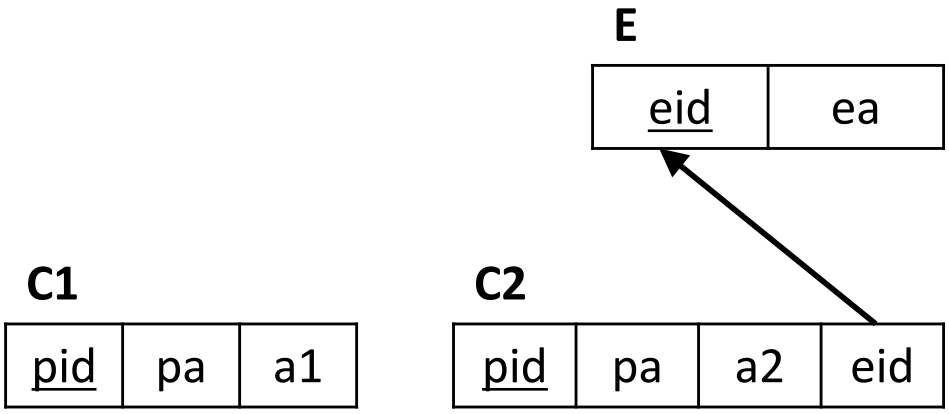
Exercise

Map this ERD to relations in **two** different ways. Pros and cons of each?



Answer


P
pid
pa
E
eid
ea
C1
pid
a1
C2
pid
a2
eid


E
eid
ea
C1
pid
pa
a1
C2
pid
pa
a2
eid

Normalization

- What are the goals of normalization?
  - Spurious tuples? Additive decomposition?
  - Modification anomalies? Examples!
- Functional dependencies
  - Definition, relationship to keys
  - Trivial, transitive, full
- Normal forms
  - What do 1NF/2NF/3NF require?
  - Decomposition algorithm

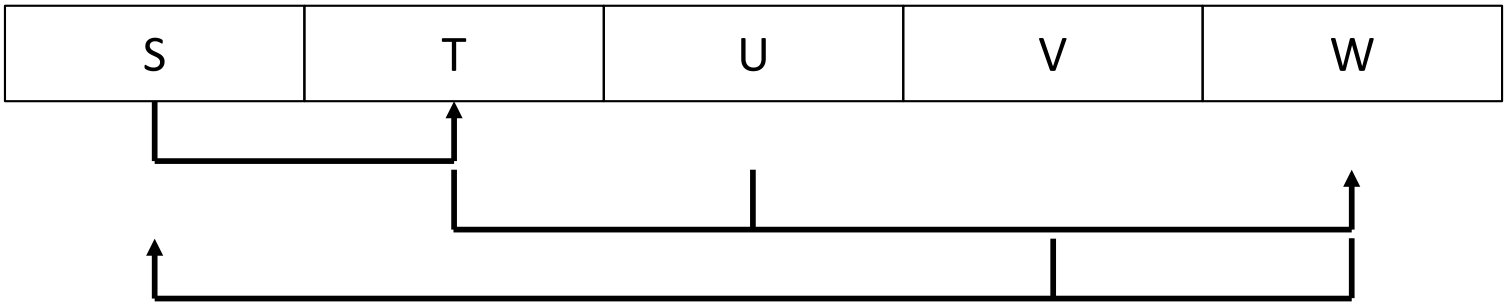
Exercise

Non-Trivial FDs

$$TU \rightarrow W$$
$$VW \rightarrow S$$
$$S \rightarrow T$$

Key(s)

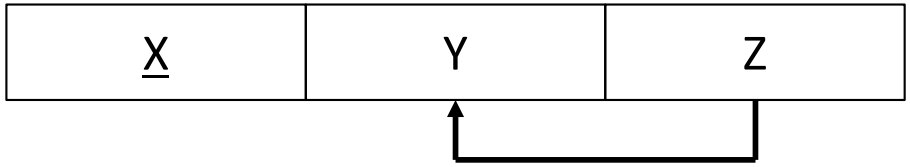
$$UVS$$
$$UVW$$
$$UVT$$



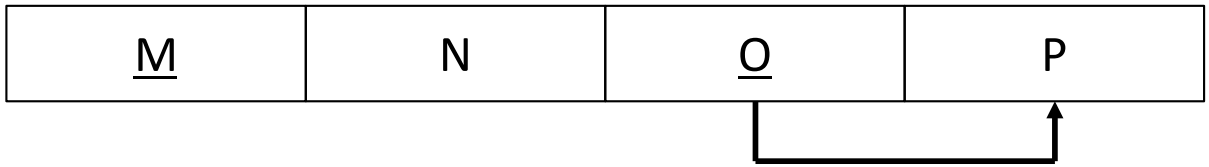
Exercise

Which NF? Why? Decompose to 3NF.

Foo

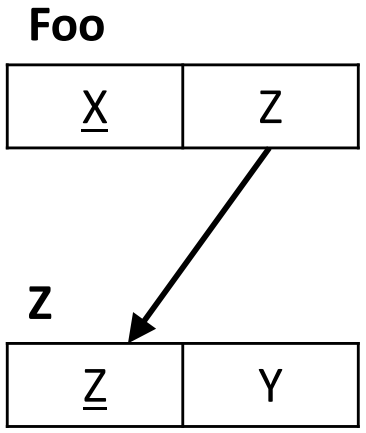


Bar



Answer

- Foo is in 2NF
  - 1NF (single PK attr)
  - Y is tFD on PK
  - Post: single PK/np



- Bar is in 1NF
  - P is not fFD on PK
  - Post:
    - Bar: N fFD on PK, single PK/np
    - O: single PK/np