

ECS 165A

Database Systems

Discussion Session 2

The Entity-Relationship Model

Today ?

- Doubts
- Basic Concepts
- Constraints, Keys, and Design Issues
- Entity-Relationship Diagram
- Extended E-R Features
- Design of an E-R Database Schema
- Examples
- Introducing some tools for drawing ER diagrams

Database Design Process

- Requirement collection and analysis
 - DB requirements and functional requirements
- Conceptual DB design using a high-level model
 - Easier to understand and communicate with others
- Logical DB design (data model mapping)
 - Conceptual schema is transformed from a high-level data model into implementation data model
- Physical DB design
 - Internal data structures and file organizations for DB are specified

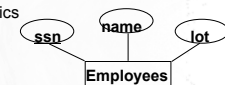
Overview of Database Design

- Conceptual design: (*ER Model is used at this stage.*)
 - What are the *entities* and *relationships* in the enterprise?
 - What information about these entities and relationships should we store in the database?
 - What are the *integrity constraints* or *business rules* that hold?
 - A database 'schema' in the ER Model can be represented pictorially (*ER diagrams*).
 - An ER diagram can be mapped into a relational schema.

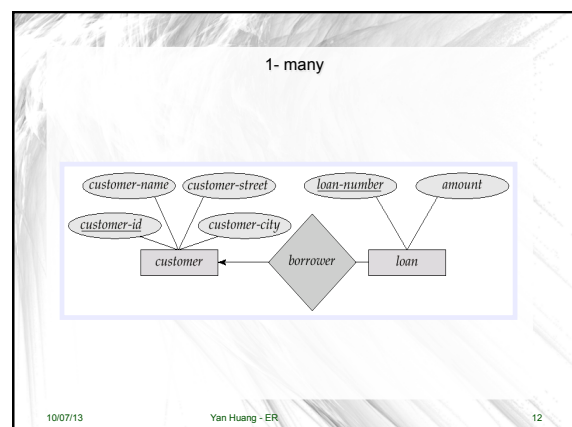
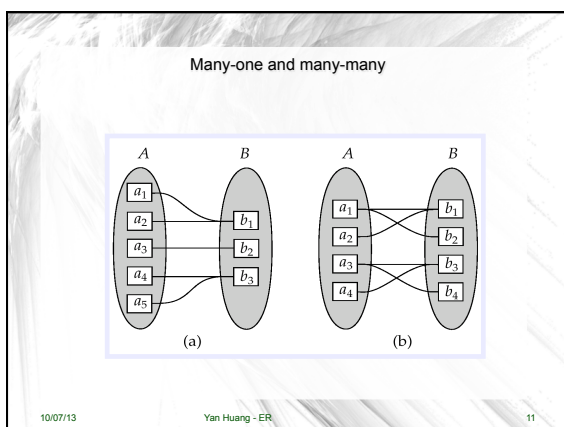
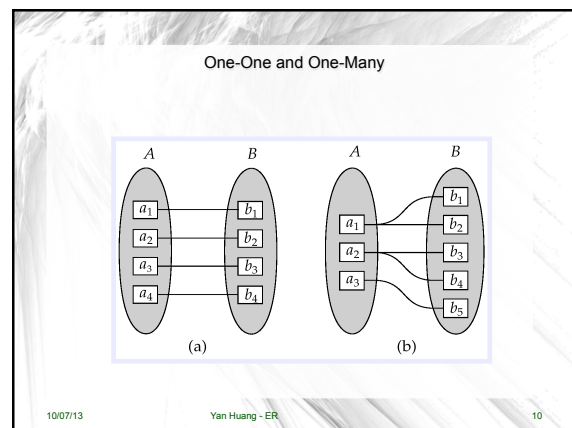
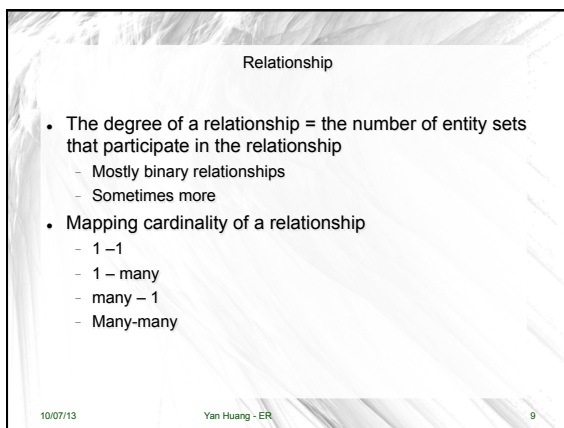
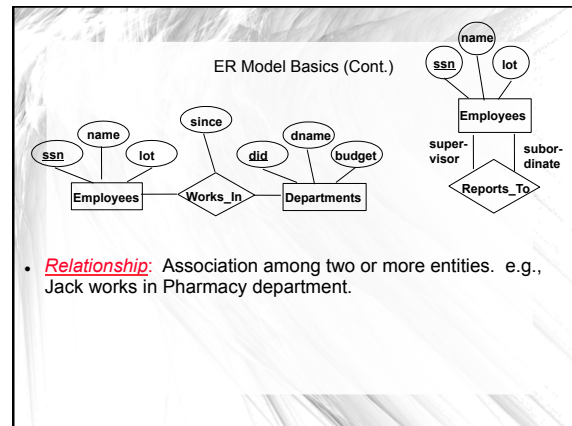
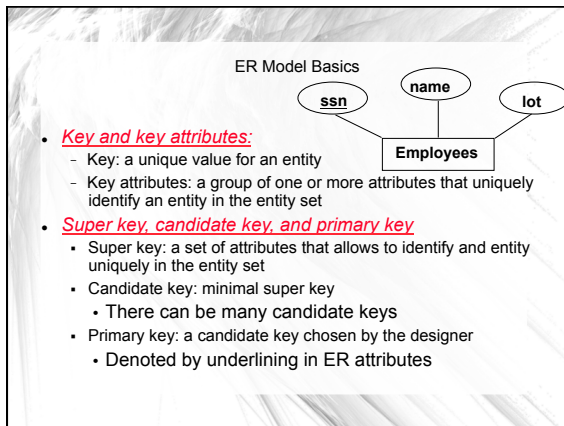
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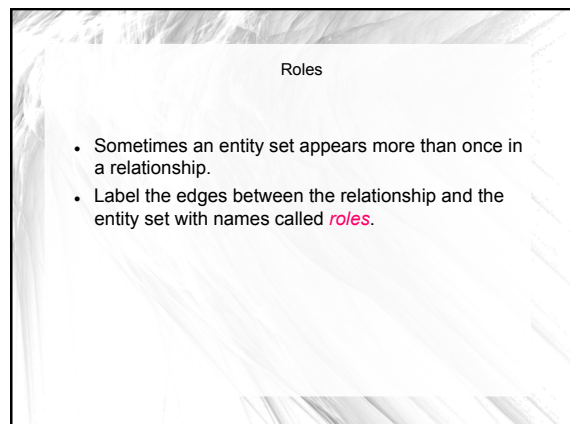
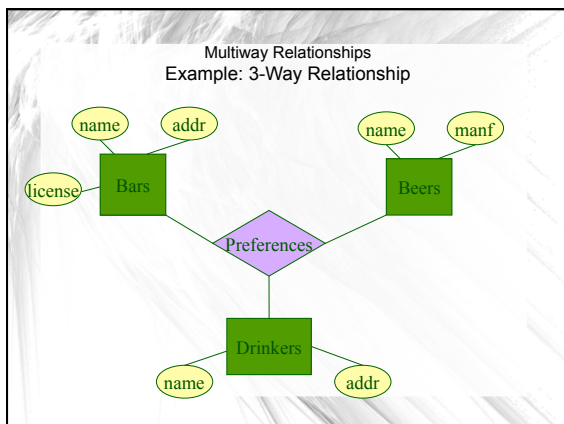
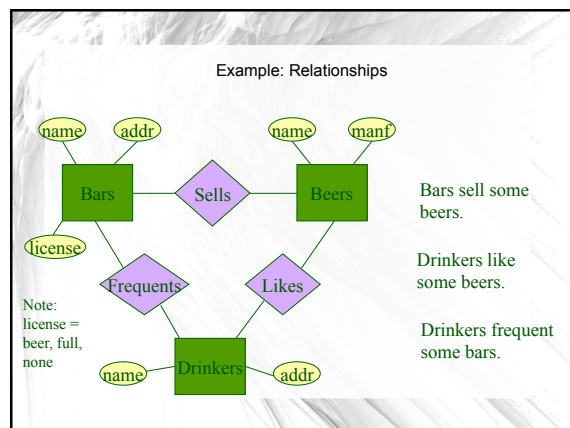
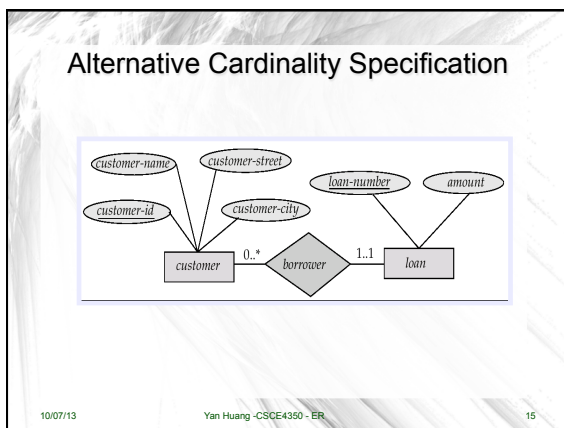
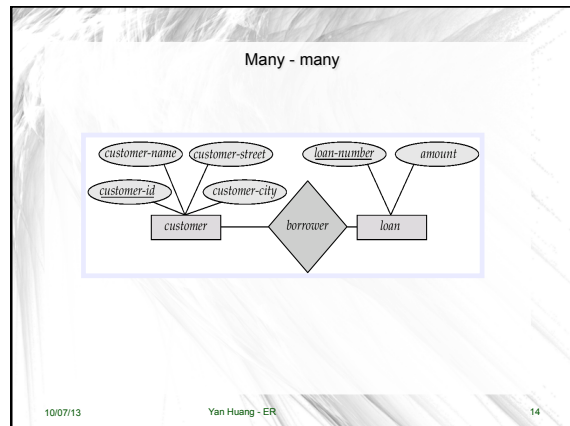
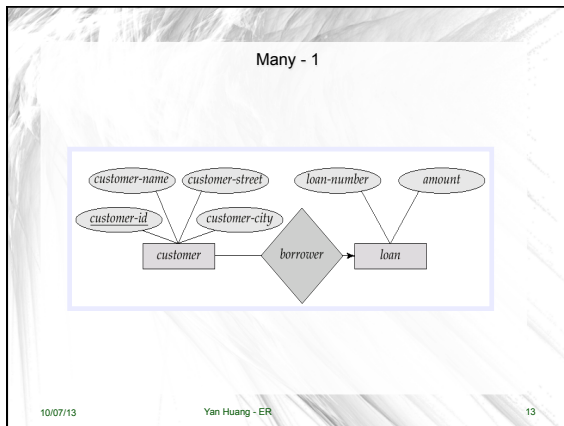
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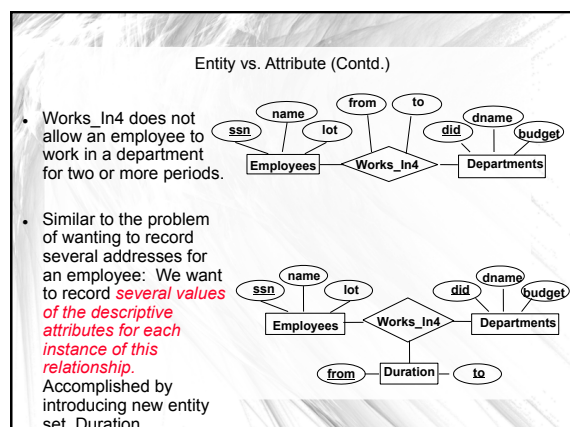
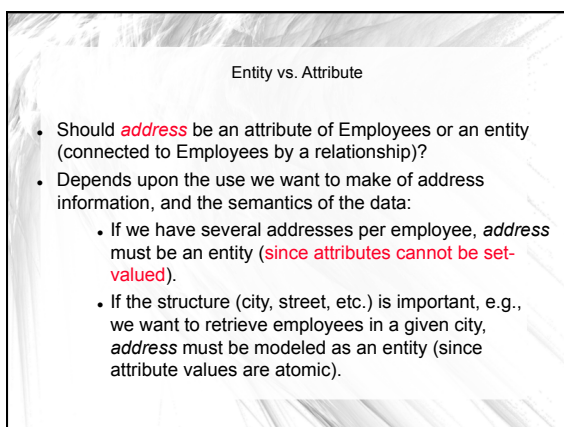
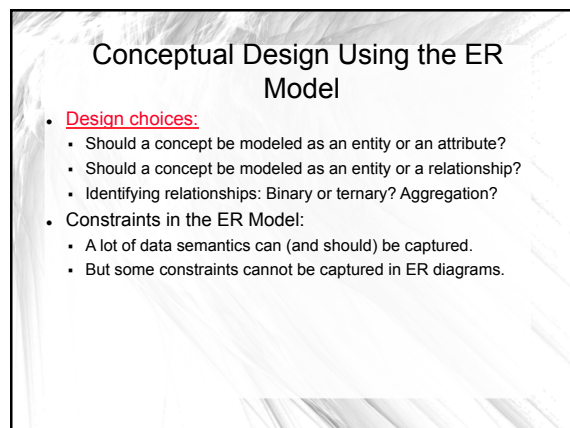
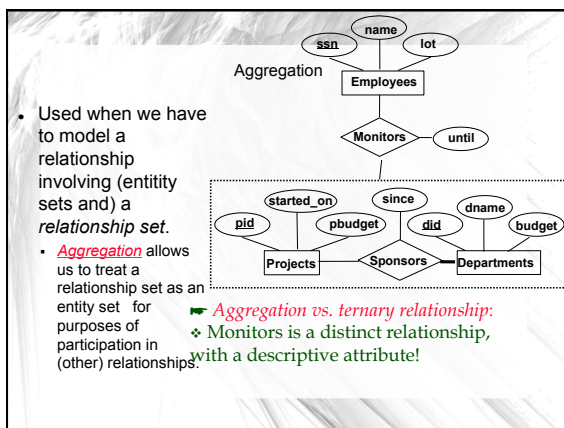
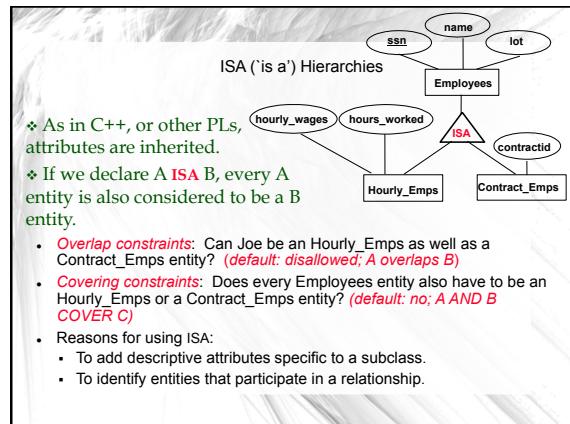
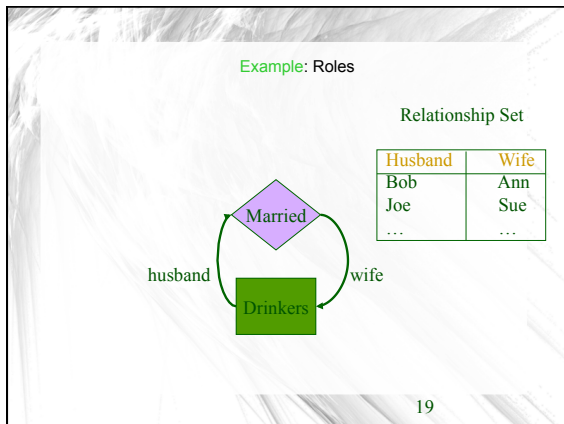
ER Model Basics

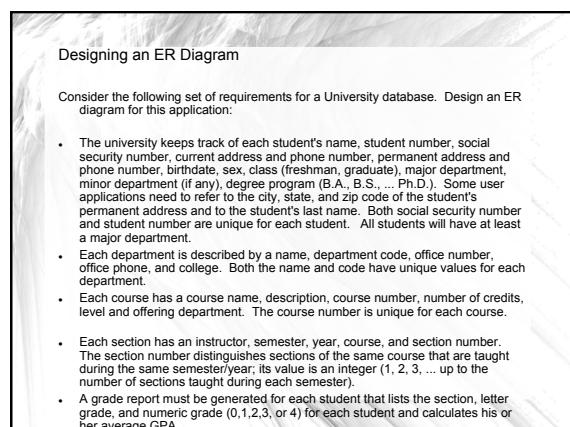
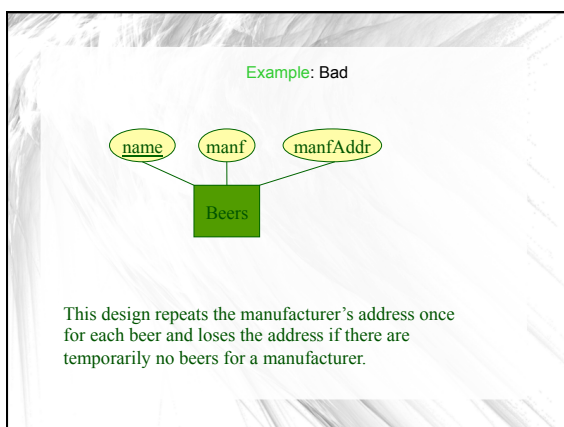
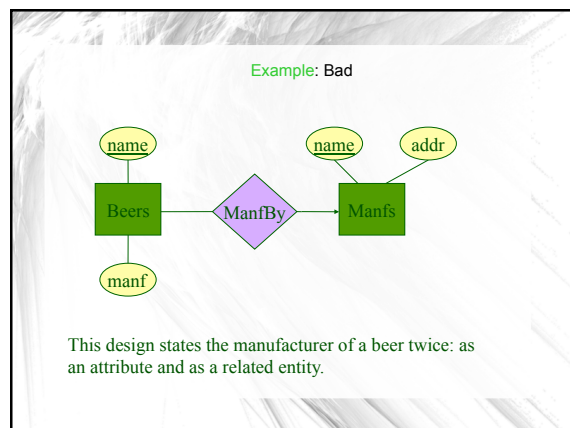
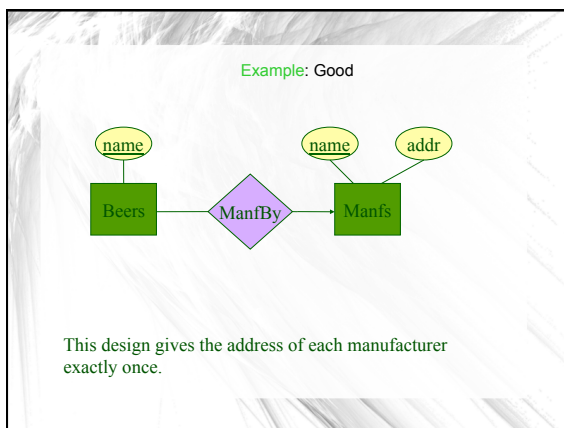
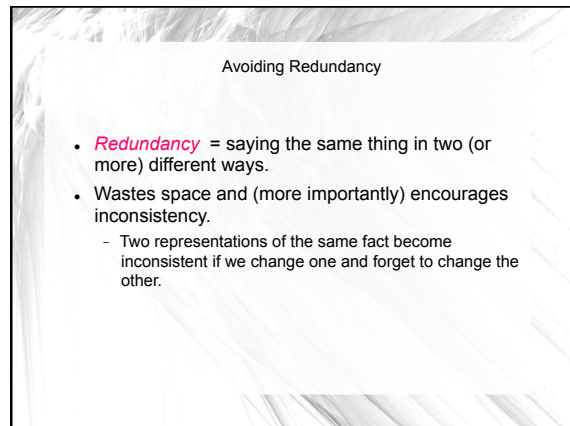
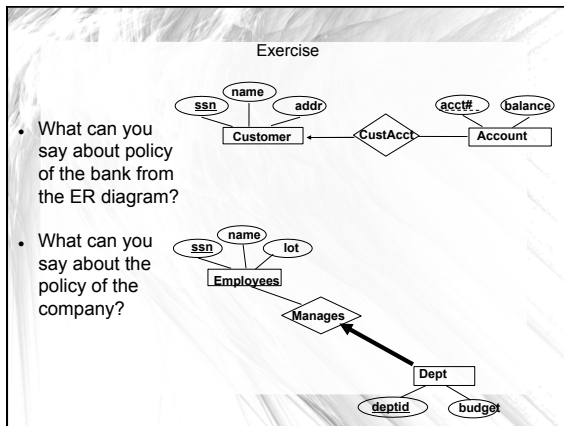


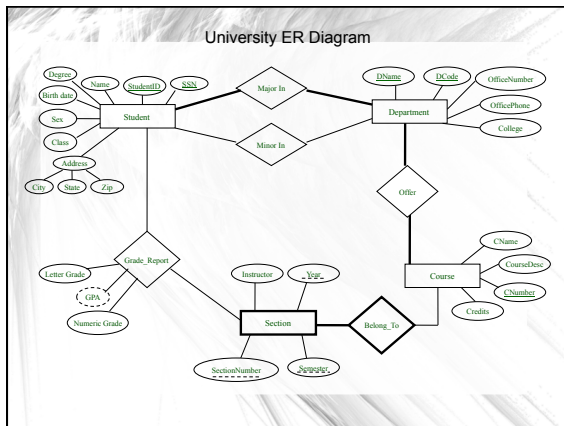
- Entity: Real-world object distinguishable from other objects. An entity is described (in DB) using a set of *attributes*.
- Entity Set: A collection of similar entities. E.g., all employees.
 - All entities in an entity set have the same set of attributes. (Until we consider ISA hierarchies, anyway!)
 - Each entity set has a *key*.
 - Each attribute has a *domain*.











Free Tools for drawing ER diagrams

- Edraw Max
- Dia
- www.diagram.ly
- GLIFFY !!!

Also check the Wikipedia to find out about more DB design tools:

http://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model#ER_diagramming_tools

References

- ER Model slides from CS-145, Stanford, Fall 2007 (Jeff Ullman)
<http://infolab.stanford.edu/~ulman/dsb.html>
- ER Model slides from CS662, University of Virginia, Fall 2008 (Sang H. Son)
<http://www.cs.virginia.edu/~son/cs662.f08/ch2m.ppt>

Back up Slides

White Powder Ski Resort

- There are lifts (getting skiers and snowboarders uphill) and runs (for downhill fun). A lift is identified by name and has a bottom and a top elevation, an opening and a closing time, and a capacity (persons per hour). A run is identified by name and has a start and a finish elevation, a length, and a last patrol time. Both lifts and runs have a vertical (the vertical difference between their upper and lower elevations).

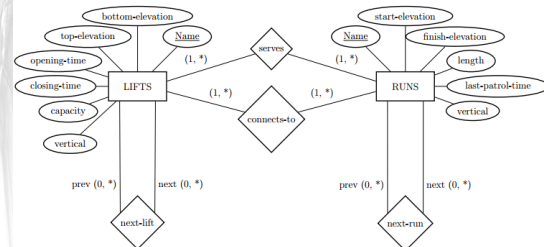
White Powder Ski Resort (2)

- A lift serves one or more runs, i.e., the start of the run is easily and directly reachable from the top of the lift. A run connects to one or more lifts, i.e., those lifts whose entry points at the bottom are directly reachable from the bottom of a run.

White Powder Ski Resort (3)

- Lifts may be connected via the next-lift relation, (i.e., the bottom of the next lift is directly reachable from the top of another lift). Similarly, runs may be connected via the next-run relation (i.e., the top of the next run is directly reachable from the bottom of another run).

White Powder Ski Resort: ER diagram



constraints that you are unable to capture using the ER modeling constructs

- The last patrol time of a run should be greater than the closing time of any lift that serves it.
- If a lift serves a run, then the start elevation of the run should be at most the end elevation of the lift.
- For a lift or a run, vertical should equal top elevation minus bottom elevation.
- The closing time of a lift should be greater than the opening time.

White Powder Ski Resort: relational schema

```
LIFTS(Name, bottom-elevation, top-elevation, opening-time, closing-time,
capacity, vertical)
RUNS(Name, start-elevation, finish-elevation, length, last-patrol-time,
vertical)
serves(LName → LIFTS, RName → RUNS)
connects-to(LName → LIFTS, RName → RUNS)
next-run(PName → RUNS, NName → RUNS)
next-lift(PName → LIFTS, NName → LIFTS)
```