

COMP 353 - Databases

Last time...

- Continued database modifications (DML)
 - INSERT, DELETE, UPDATE
- Database definition statements (DDL)
 - CREATE TABLE, ALTER TABLE, DROP TABLE

Tiny pop quiz

- How many tuples remain in **Hero** after the deletion?

name	gameTitle	class	level	hitPoints
Mario	Super Mario 64	Plumber	4	1
Link	Legend of Zelda: Wind Waker	Warrior	1	3
Olimar	Pikmin 2	Thief	2	100
Kirby	Kirby 64: The Crystal Shards	Shapeshifter	5	50
Leon	Resident Evil 4	Gunner	3	200
Luigi	Luigi's Mansion	Ghostbuster	0	5
Louie	Pikmin 2	Assistant	0	100

```
DELETE FROM Hero(name, gameTitle, class, level, hitPoints)
WHERE Hero.level <= 1 OR Hero.class = 'Thief' OR Hero.name = 'Leon' ;
```

Questions needing answers:

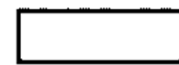
- VARCHAR(n) exceeding n: depending on your strictness setting in SQL, either the value is truncated with a warning or the transaction is rejected
- ALTER table to change column type: it can be done, but data can be lost and anything referring to that table may stop working as expected

```
ALTER TABLE x ALTER COLUMN y NEW_DATA_TYPE;
```

Today

- Continue E/R diagrams
- Start how to convert E/R diagram to Relational Model
- Assignment-oriented practice problem

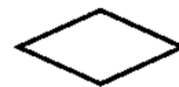
Creating E/R diagrams



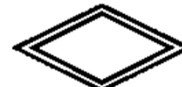
Entity set



Weak entity set



Relationship set



Weak relationship set



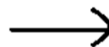
Attribute



Inheritance



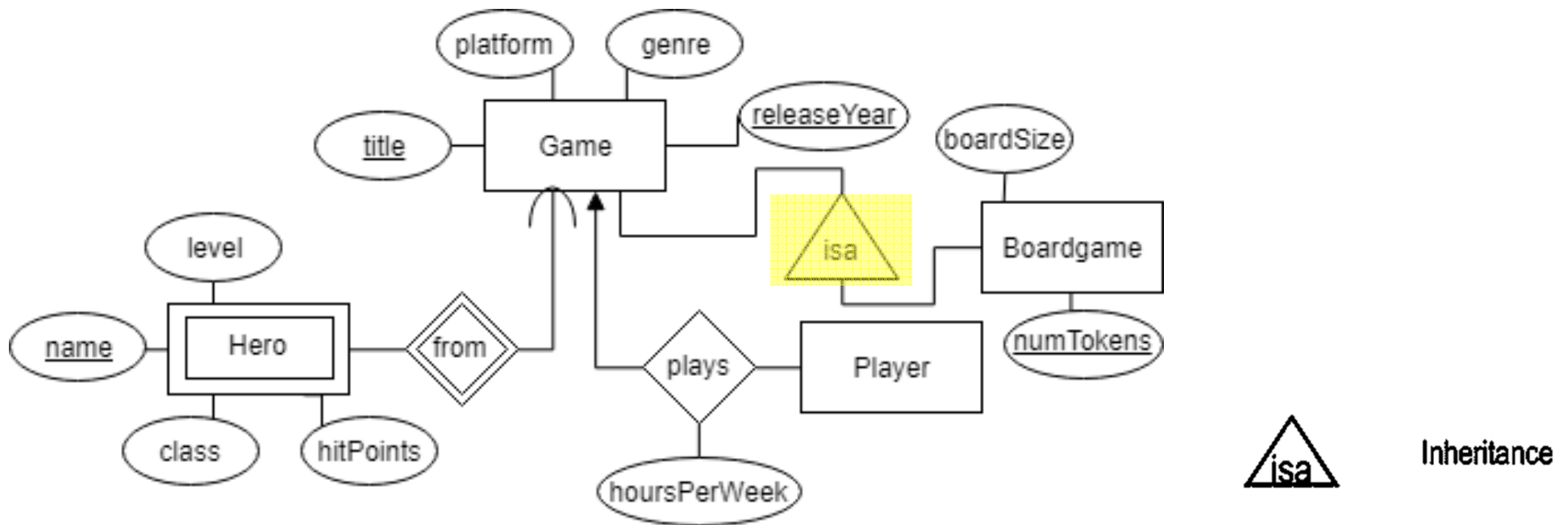
Multiplicity of relationships



Referential integrity

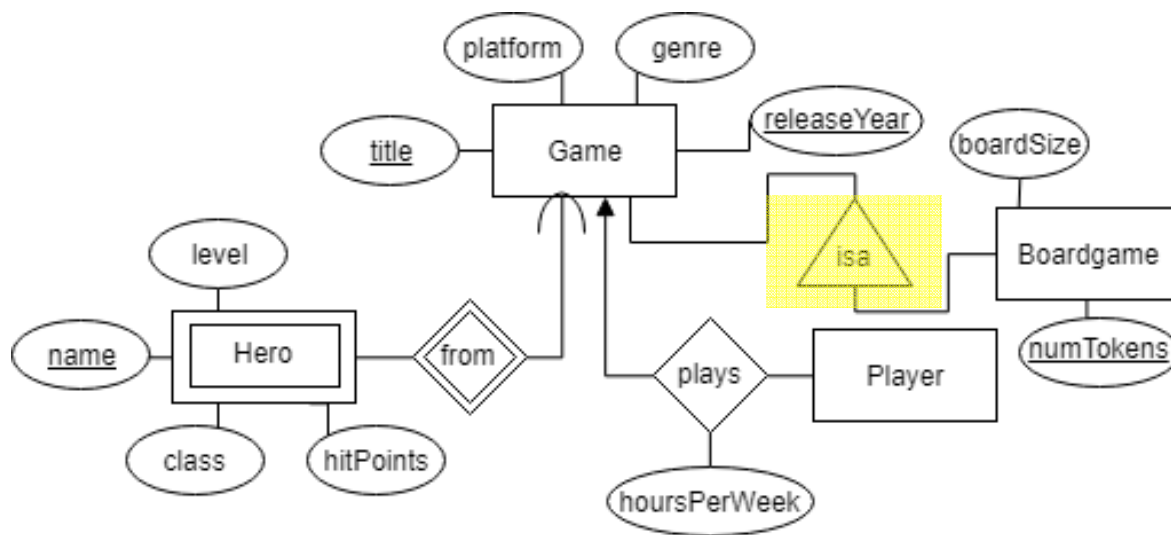
Inheritance in E/R

- An entity has whatever attributes and relationships any of its components from an isa-hierarchy has



Inheritance in E/R

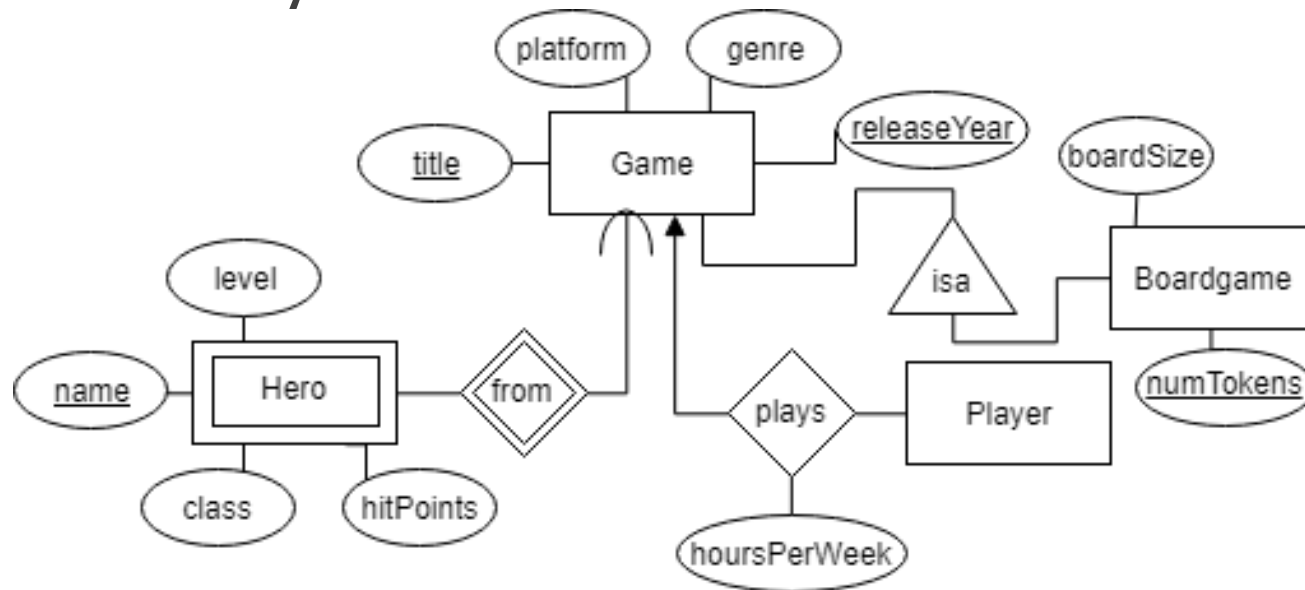
- One side of the triangle is attached to the subclass, and the opposite point is connected to the superclass. Every isa relationship is one-one, it's not necessary to draw the multiplicity arrows.



- So an entity in the isa hierarchy can either be a **Game**, or a **BoardgameGame**, the latter having the attributes from both sets

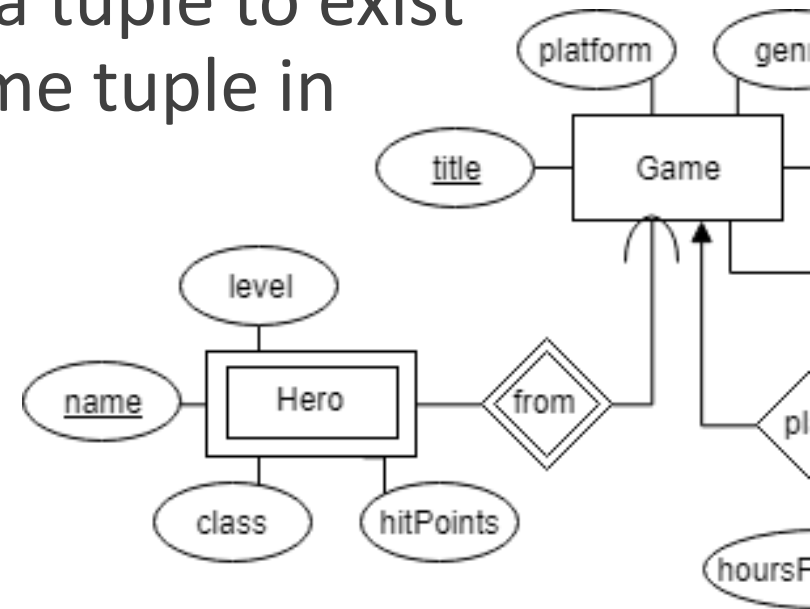
Weak Entity/Relationship sets

- The key of a weak entity set is formed from the linked strong entity's key plus the distinguishing features of the weak entity itself

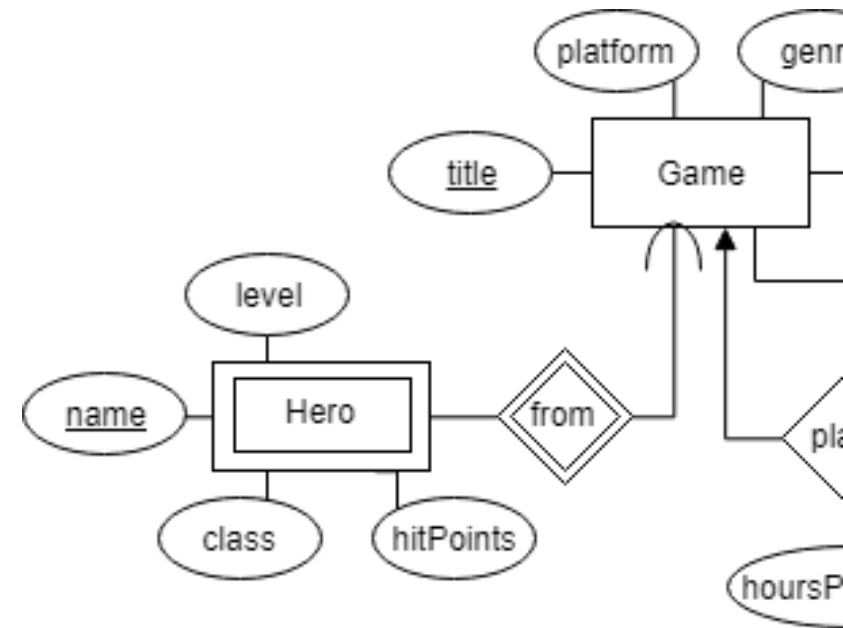


Weak Entity vs Referential integrity

- With referential integrity we are placing a constraint on the entries to the database: for a tuple to exist in the set **Hero**, it *must* refer to some tuple in **Game** or else it cannot be in data
- Expressed as a foreign key in SQL, the **consistency** of the DBMS prevents the deletion of a tuple in use as a foreign key (DELETE transaction fails if you try)



Converting E/R diagram to relational database schema



Relational model terminology

- Relation schema:

- Relation name and a set of attribute names
- **Hero** = (**name**, **gameTitle**, **class**, **level**, **hitPoints**)

- Relation instance :

- The set of “current” tuples

name	gameTitle	class	level	hitPoints
Mario	Super Mario 64	Plumber	4	1
Link	Legend of Zelda: Wind Waker	Warrior	1	3

- Database schema :

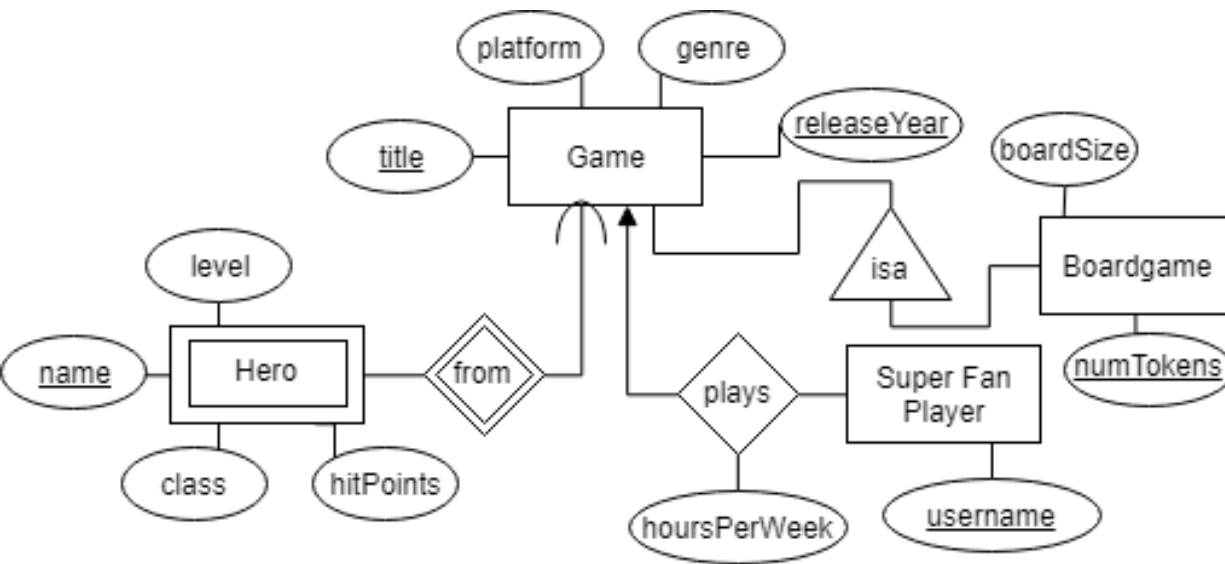
- A set of relation schemas $D = \{\text{Hero}, \text{Game}, \text{Player}, \dots\}$

- Database instance :

- Many relation instances (tables) -- one per relation in the database schema

Converting entity sets

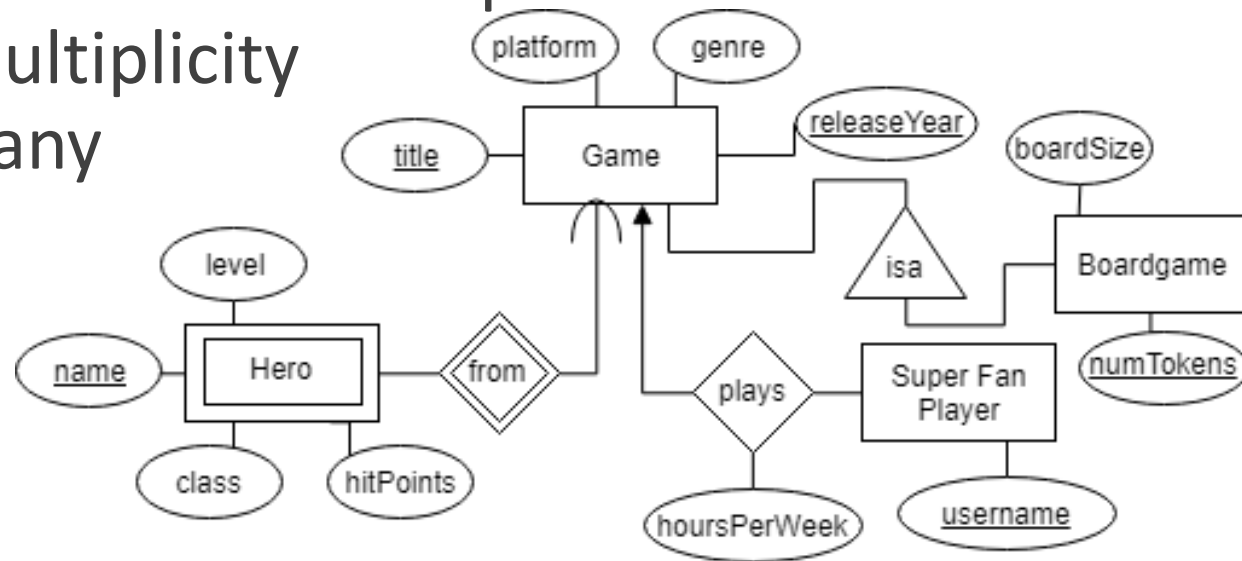
- For each strong entity set create a relation with the same name and attributes



- **Game** (title, platform, genre, releaseYear)
- **BoardGame** (boardSize, numTokens)
- **SuperFanPlayer** (username)

Converting relationships

- For each simple relationship set (not weak or isa hierarchy relations yet), create a relation (table) with the same name, some of the key attribute(s) of each entity set involved in the relationship (depending on the multiplicity of the relation), and any attributes belonging to the relation in the first place.

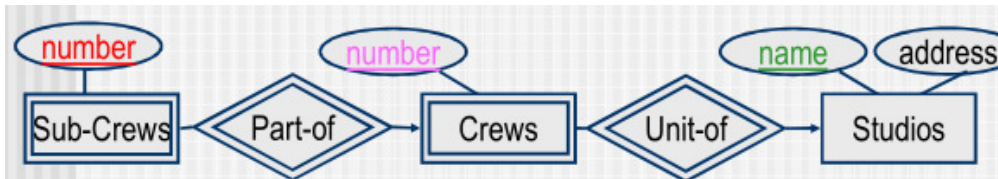


Converting relationships: finding the key

- If R is a binary relationship between entity sets A and B, then the multiplicity of this relationship determines the key of R:
 - If R is M-M, then the keys of A and B together contribute to the key of R
 - If R is M-1 from A to B, then the key of A is part of the key of R **Plays** (**title**, **releaseYear**, **username**, **hoursPerWeek**)
 - If R is 1-1, then choose either A or B (but not both) to contribute to the key of R

Converting weak entity sets and relations

- The relation/table for the weak entity set W must include all the attributes of W as well as the key attributes of the strong entity set(s) to which W is associated.
- This propagates into any other weak set that is weakly related to W

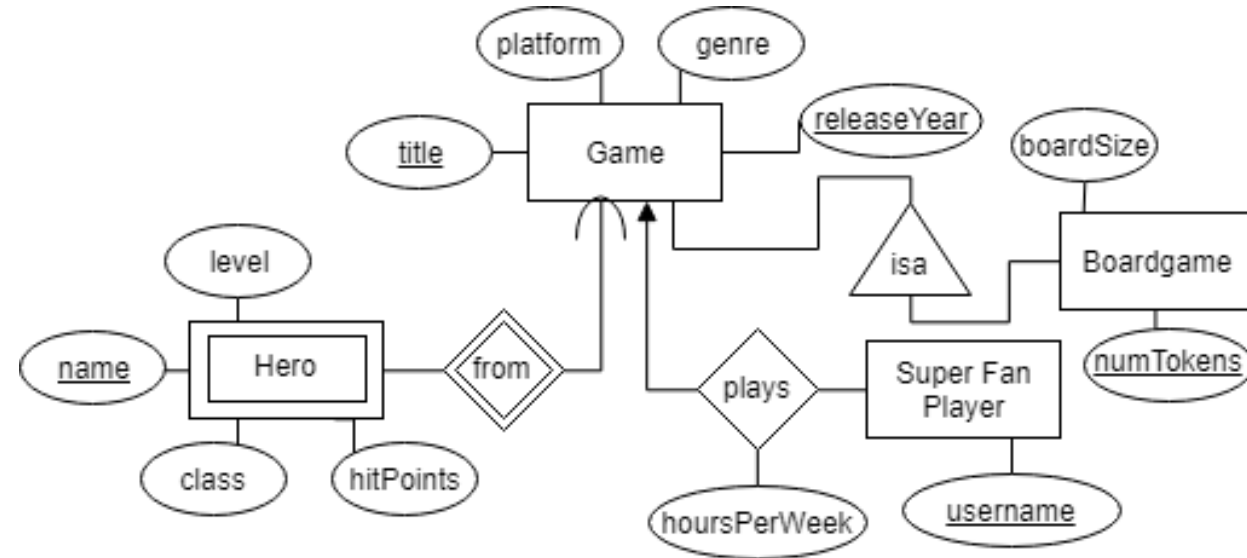


- Studios (name, address)
- Crews (number, name)
- Sub-Crews (number, crewNumber, name)

- The weak relation (double diamond) from W to its strong set does not need its own table

Converting weak entity sets and relations

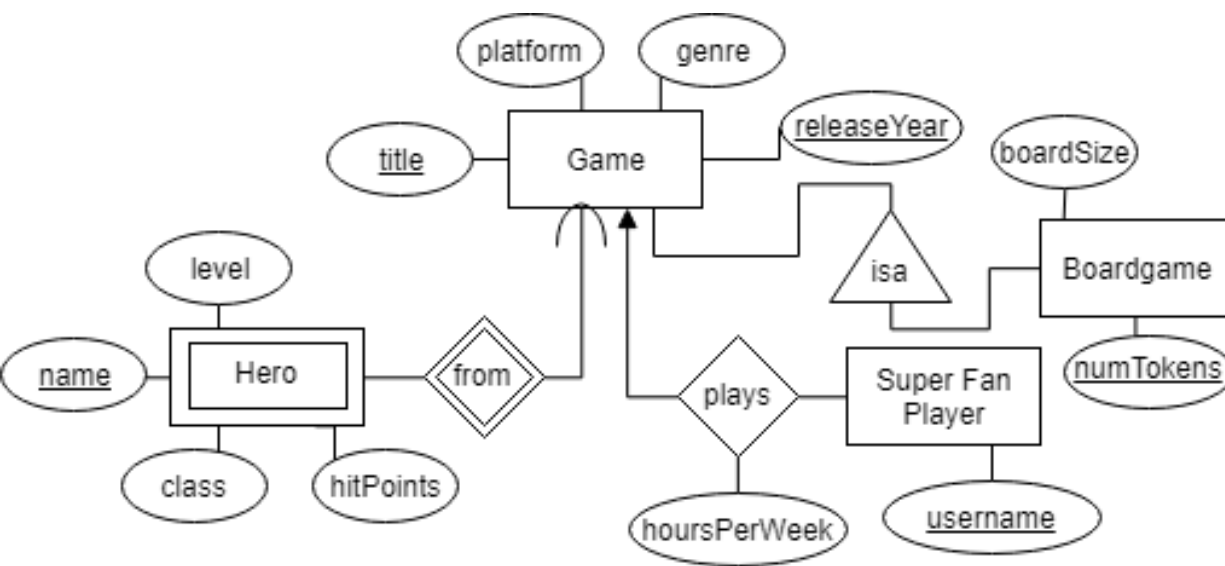
- We can now define the relation for **Hero** :



- **Hero** (name, title, releaseYear, class, level, hitPoints)

Converting E/R to relational database schema

- Good start on the relational schema, next week we will cover a few ways to convert the *isa-hierarchy* into relations

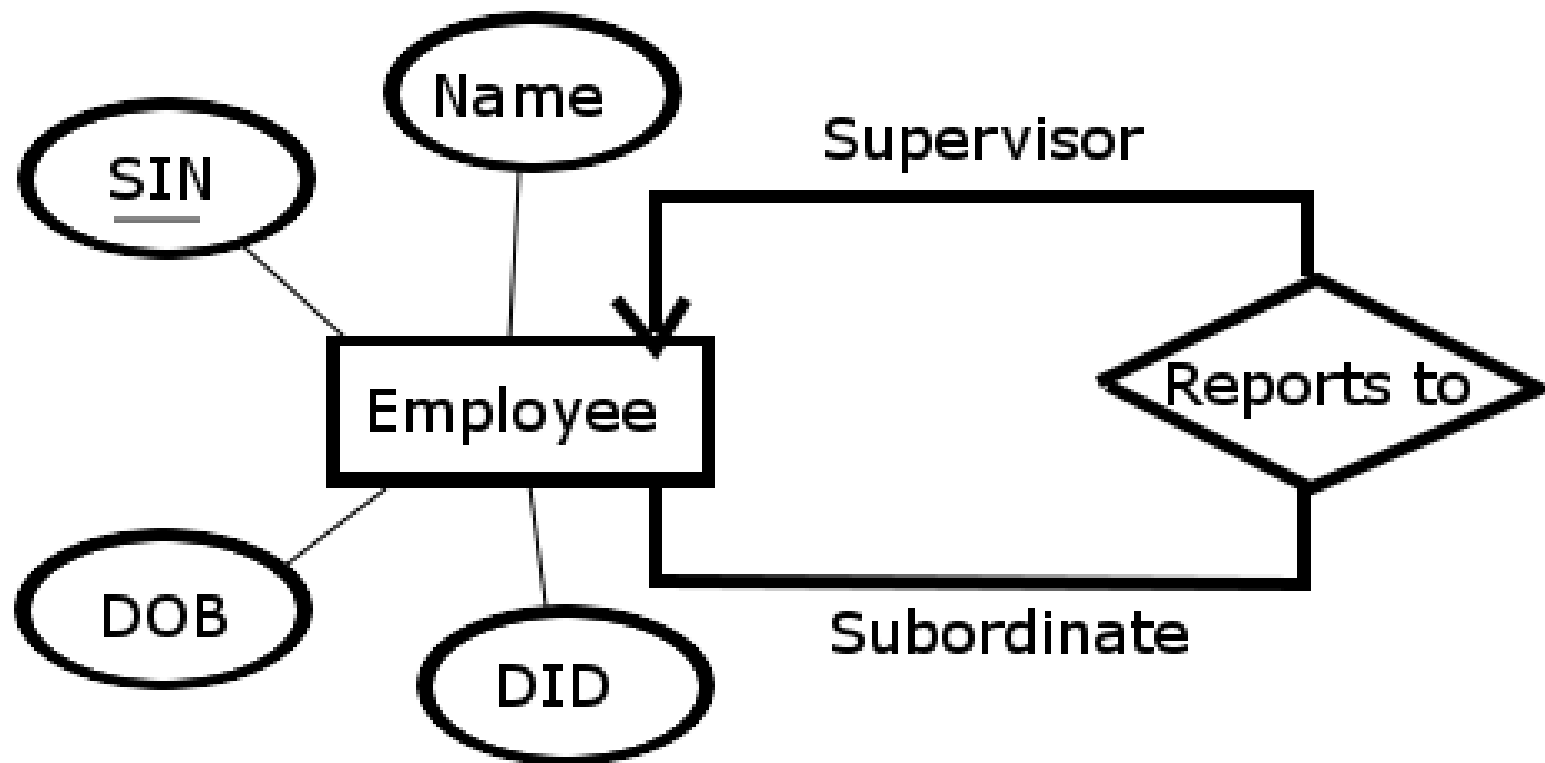


- Hero (name, title, releaseYear, class, level, hitPoints)
- Game (title, platform, genre, releaseYear)
- BoardGame (boardSize, numTokens)
- SuperFanPlayer (username)
- Plays (title, releaseYear, username, hoursPerWeek)

Practice problems

- Draw an E/R diagram for a database according to the following scenario, then convert your E/R diagram into a relational database schema, including keys.
- Consider an Employee relation with attributes including SIN, name, DOB (data of birth), and DID (the ID of the department in which she/he works). We also have the concepts of supervisor and subordinate which we wish to represent in the model. That is, each employee has a supervisor to whom she/he reports. Subordinate refers to an employee working under some supervisor. Convert this diagram into a relational database schema. For each entity or relationship set in the model (design), determine which attribute(s) form the key.

Practice problems



Practice problems

- Convert your E/R diagram from the previous question into a relational database schema, including keys.
- Employee = (SIN, name, DOB, DID)
- ReportsTo = (SupervisorSIN, SubordinateSIN)

- These slides were made referencing the course slides from Prof Shiri, as well as the textbook:
A First Course in Database Systems by Ullman and Widom, third edition

Good book for practice problems and longer explanations

