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Database Design

4-1

Supertypes and Subtypes

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Objectives

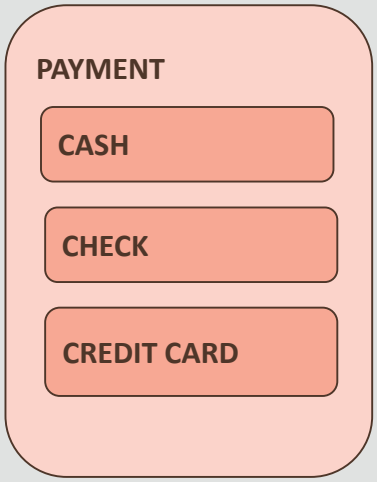
- This lesson covers the following objectives:
  - Define and give an example of a subtype
  - Define and give an example of a supertype
  - State the rules relating to entities and subtypes, and give examples of each
  - Apply the rules of supertype and subtype by evaluating the accuracy of ER diagrams that represent them
  - Apply the rules of supertype and subtype and include them in a diagram when appropriate

Purpose

- Supertypes and subtypes occur frequently in the real world:
  - food order types (eat in, to go)
  - grocery bag types (paper, plastic)
  - payment types (check, cash, credit)
- You can typically associate 'choices' of something with supertypes and subtypes
- For example, what will be the method of payment – cash, check or credit card?
- Understanding real world examples helps us understand how and when to model them

Evaluating Entities

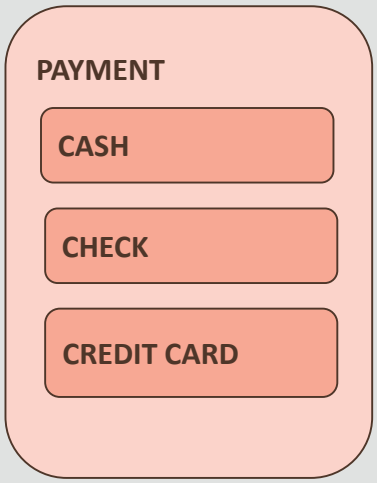
- Often some instances of an entity have attributes and/or relationships that other instances do not have
- Imagine a business which needs to track payments from customers
- Customers can pay by cash, by check, or by credit card



PAYMENT SUPERTYPE

Evaluating Entities

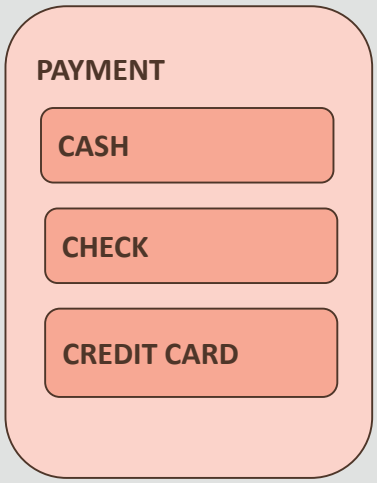
- All payments have some common attributes: payment date, payment amount, and so on
- But only credit cards would have a “card number” attribute
- And for credit card and check payments, we may need to know which CUSTOMER made the payment, while this is not needed for cash payments



PAYMENT SUPERTYPE

Evaluating Entities

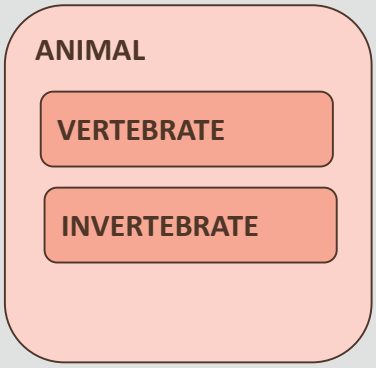
- Should we create a single PAYMENT entity or three separate entities CASH, CHECK, and CREDIT CARD?
- And what happens if in the future we introduce a fourth method of payment?



PAYMENT SUPERTYPE

Subdivide an Entity

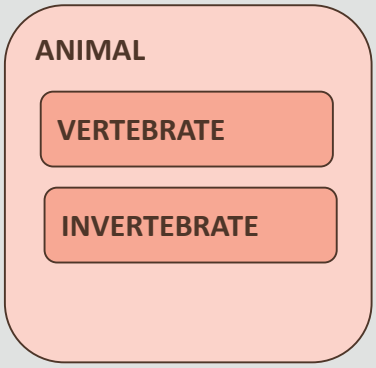
- Sometimes it makes sense to subdivide an entity into subtypes
- This may be the case when a group of instances has special properties, such as attributes or relationships that exist only for that group
- In this case, the entity is called a “supertype” and each group is called a “subtype”



ANIMAL SUPERTYPE

Subtype Characteristics

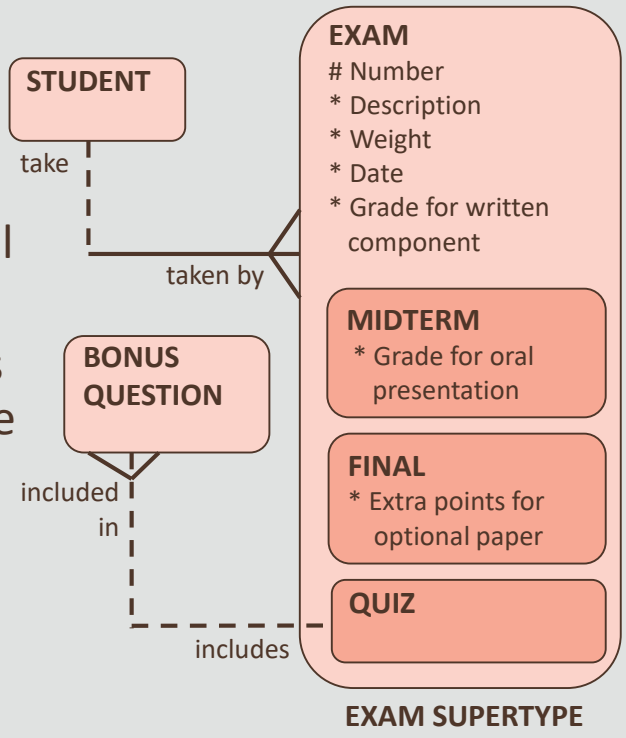
- A subtype:
  - Inherits all attributes of the supertype
  - Inherits all relationships of the supertype
  - Usually has its own attributes or relationships
  - Is drawn within the supertype
  - Never exists alone
  - May have subtypes of its own



ANIMAL SUPERTYPE

Supertype Example

- EXAM is a supertype of QUIZ, MIDTERM, and FINAL
- The subtypes have several attributes in common
- These common attributes are listed at the supertype level



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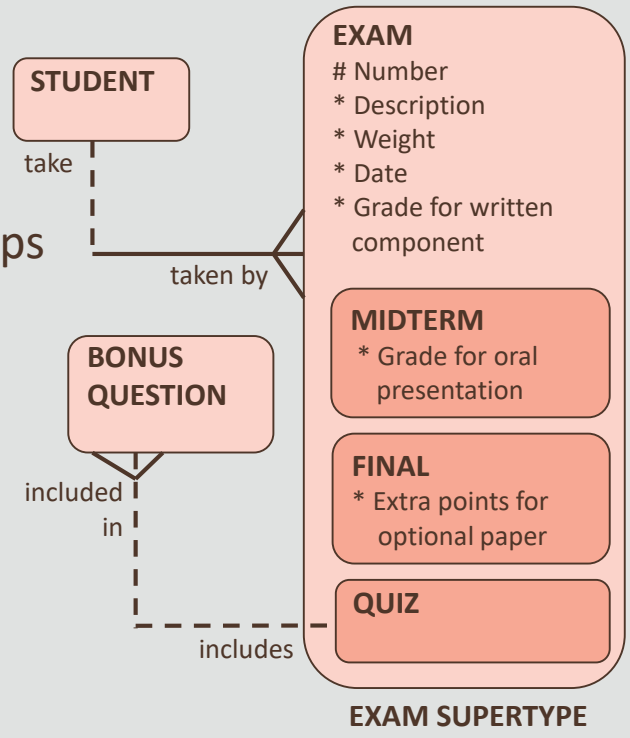
Read the diagram as:
Every QUIZ, MIDTERM, or FINAL is an EXAM
(and thus has attributes such as description, weight, date, and grade).
Conversely:
Every EXAM is either a QUIZ, a MIDTERM, or a FINAL.

Supertype Example

- The same applies to relationships
- Subtypes inherit all attributes and relationships of the supertype entity



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Read the diagram as:
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Conversely:
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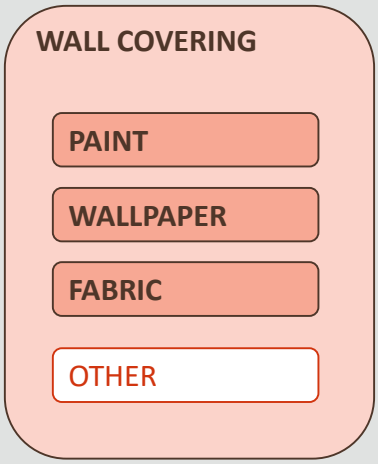
Always More Than One Subtype

- When an ER model is complete, subtypes never stand alone
- In other words, if an entity has a subtype, a second subtype must also exist, this makes sense
- A single subtype is exactly the same as the supertype
- This idea leads to the two subtype rules:
  - Exhaustive: Every instance of the supertype is also an instance of one of the subtypes. All subtypes are listed without omission
  - Mutually Exclusive: Each instance of a supertype is an instance of only one possible subtype

Always More Than One Subtype

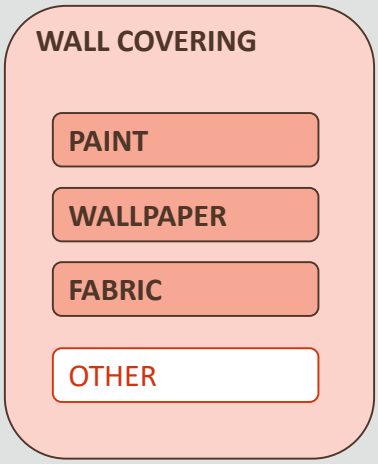
- At the conceptual modeling stage, it is good practice to include an OTHER subtype to make sure that your subtypes are exhaustive -- that you are handling every instance of the supertype



WALLCOVERING SUPERTYPE

Subtypes Always Exist

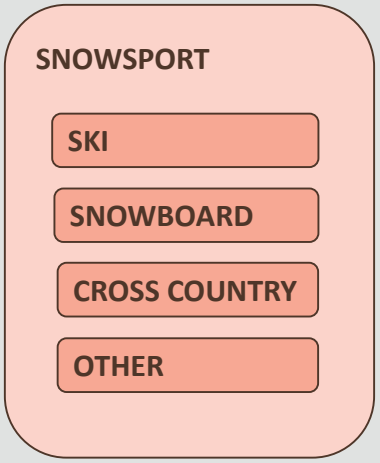
- Any entity can be subtyped by making up a rule that subdivides the instances into groups
- But being able to subtype is not the issue—having a reason to subtype is the issue
- When a need exists within the business to show similarities and differences between instances, then subtype



WALLCOVERING SUPERTYPE

Correctly Identifying Subtypes

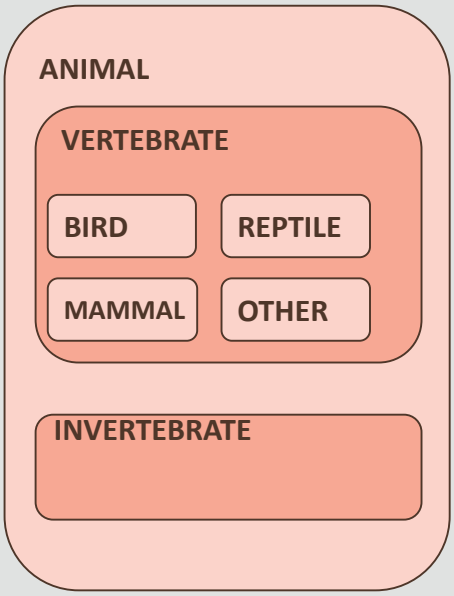
- When modeling supertypes and subtypes, you can use three questions to see if the subtype is correctly identified:
  - Is this subtype a kind of supertype?
  - Have I covered all possible cases? (exhaustive)
  - Does each instance fit into one and only one subtype? (mutually exclusive)



SNOWSPORT SUPERTYPE

Nested Subtypes

- You can nest subtypes
- For ease of reading – "readability" -- you would usually show subtypes with only two levels, but there is no rule that would stop you from going beyond two levels



NESTED ANIMAL SUPERTYPE

Terminology

- Key terms used in this lesson included:
  - Exhaustive
  - Mutually exclusive
  - Subtype
  - Supertype

Summary

- In this lesson, you should have learned how to:
  - Define and give an example of a subtype
  - Define and give an example of a supertype
  - State the rules relating to entities and subtypes, and give examples of each
  - Apply the rules of supertype and subtype by evaluating the accuracy of ER diagrams that represent them
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