CSIT115 Data Management and Security

Conceptual Modeling

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Conceptual Modeling

Outline

Methodology

Input: Specification of the requirements (usually a natural language description of a database domain)

Tools: Object Modeling graphical notation

Methods: Systematic transformation of individual components of specification of requirements into the components of Object Modeling notation

Output: Conceptual schema - simplified object class diagram

Methodology

The transformations of specifications are performed in the following sequence of steps:

- Step 1: Creating classes of objects
- Step 2: Creating associations and association classes
- Step 3: Creating attributes and link attributes
- Step 4: Creating identifiers
- Step 5: Creating qualifications
- Step 6: Creating generalizations

Conceptual Modeling

Outline

Example 1

An objective is to create a conceptual schema of a small database that contains information about employees and projects

A detailed specification is the following:

- A group of employees works on the projects
- Some of employees supervise other employees
- An employee is described by an employee number and full name
- A project is described by a project title, completion date, and budget
- Employees are identified by the employee numbers and projects are identified by the titles

Example 1

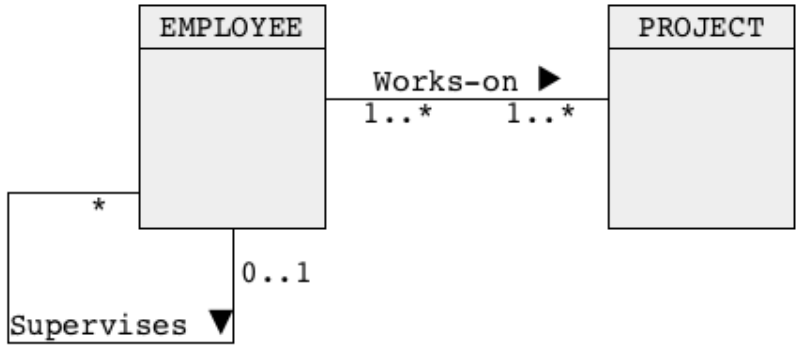
Step 1: Creating classes of objects

A group of employees works on the projects. Some of employees supervise other employees. An employee is described by an employee number and full name. A project is described by a project title, completion date, and budget. Employees are identified by the employee numbers and projects are identified by the titles

Example 1

Step 2: Creating associations and association classes

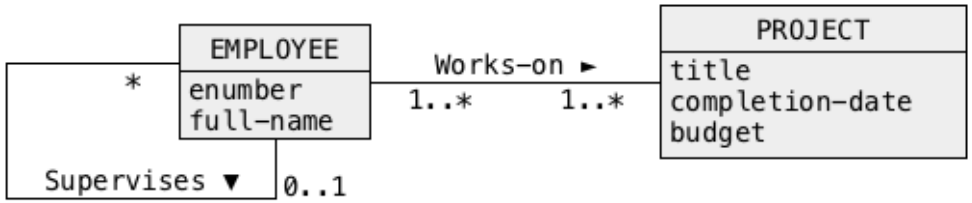
A group of employees works on the projects. Some of employees supervise other employees. An employee is described by an employee number and full name. A project is described by a project title, completion date, and budget. Employees are identified by the employee numbers and projects are identified by the titles



Example 1

Step 3: Creating attributes and link attributes

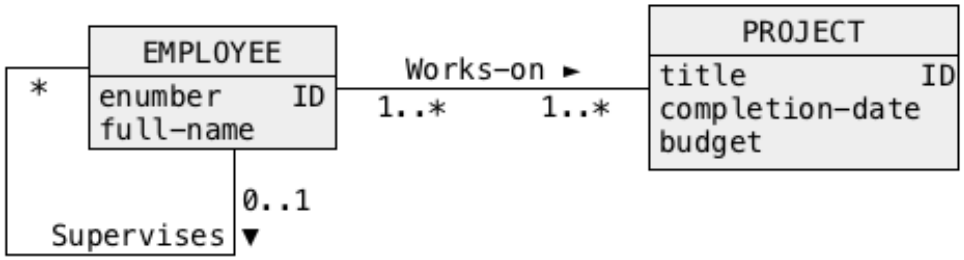
A group of employees works on the projects. Some of employees supervise other employees. An employee is described by an employee number and full name. A project is described by a project title, completion date, and budget. Employees are identified by the employee numbers and projects are identified by the titles



Example 1

Step 4: Creating identifiers

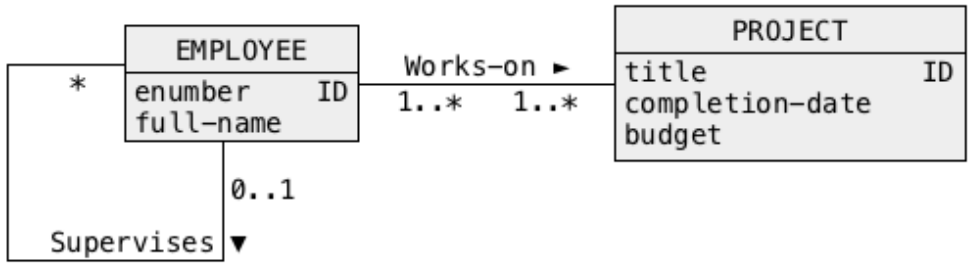
A group of employees works on the projects. Some of employees supervise other employees. An employee is described by an employee number and full name. A project is described by a project title, completion date, and budget. Employees are identified by the employee numbers and projects are identified by the titles



Example 1

Step 5: Creating qualifications

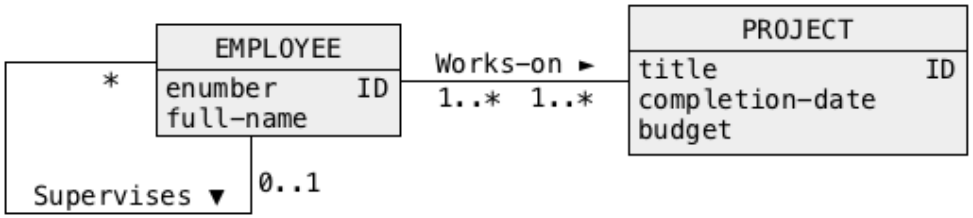
A group of employees works on the projects. Some of employees supervise other employees. An employee is described by an employee number and full name. A project is described by a project title, completion date, and budget. Employees are identified by the employee numbers and projects are identified by the titles



Example 1

Step 6: Creating generalizations

A group of employees works on the projects. Some of employees supervise other employees. An employee is described by an employee number and full name. A project is described by a project title, completion date, and budget. Employees are identified by the employee numbers and projects are identified by the titles



Conceptual Modeling

Outline

Example 2

An objective is to create a conceptual schema of a small database that contains information about publications such as journals and conference proceedings, published research papers, and authors

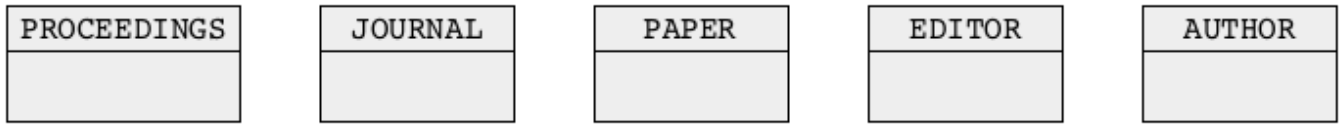
A detailed specification is the following:

- A publishing company publishes the journals and conference proceedings
- The research papers are included in the journals and proceedings
- The company employs the general editors who take responsibility for the editing research papers
- A research paper is written by one or more authors

Example 2

Step 1: Creating classes of objects

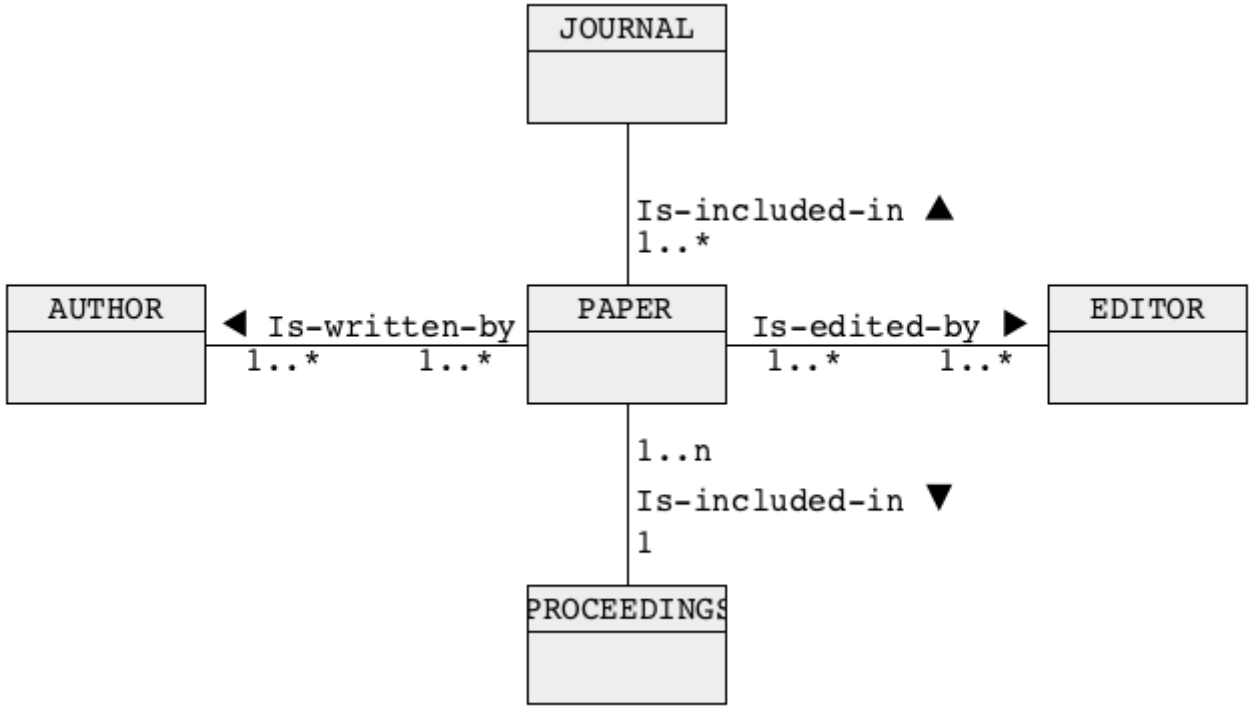
A publishing company publishes the journals and conference proceedings. The research papers are included in the journals and proceedings. The company employs the general editors who take responsibility for the editing research papers. A research paper is written by one or more authors



Example 2

Step 2: Creating associations and association classes

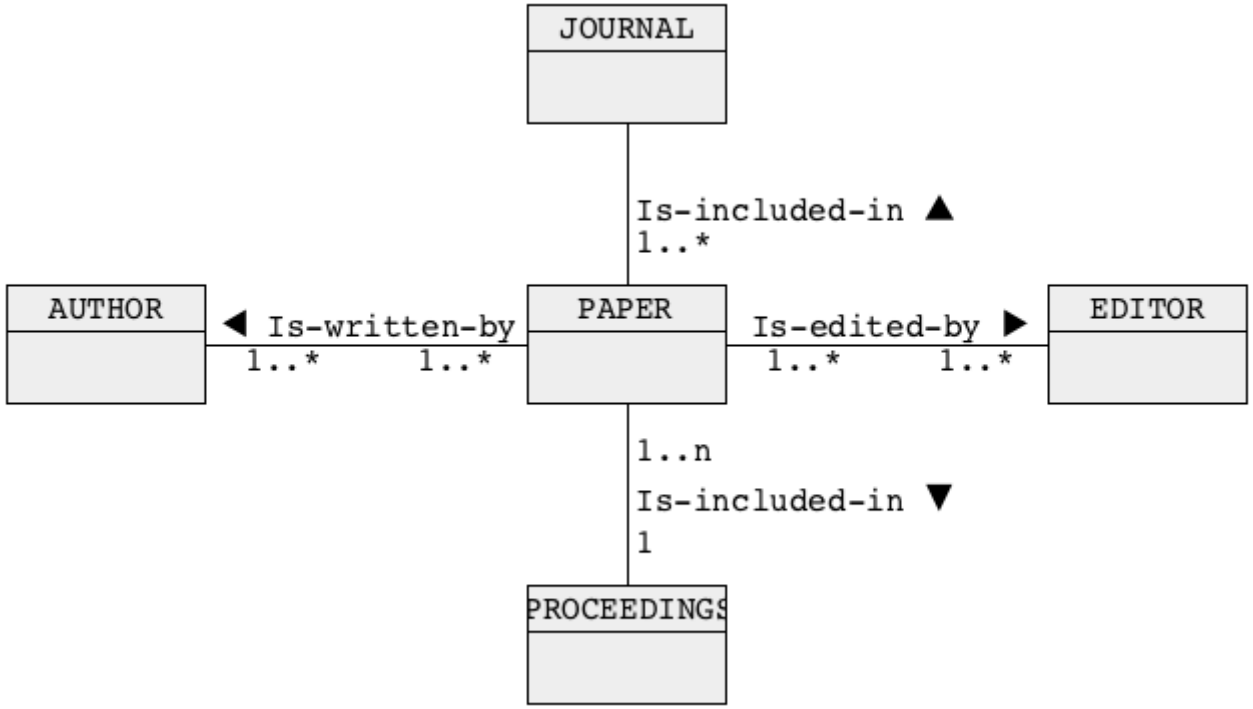
A publishing company publishes the journals and conference proceedings. The research papers are included in the journals and proceedings. The company employs the general editors who take responsibility for the editing research papers. A research paper is written by one or more authors



Example 2

Step 3: Creating attributes and link attributes

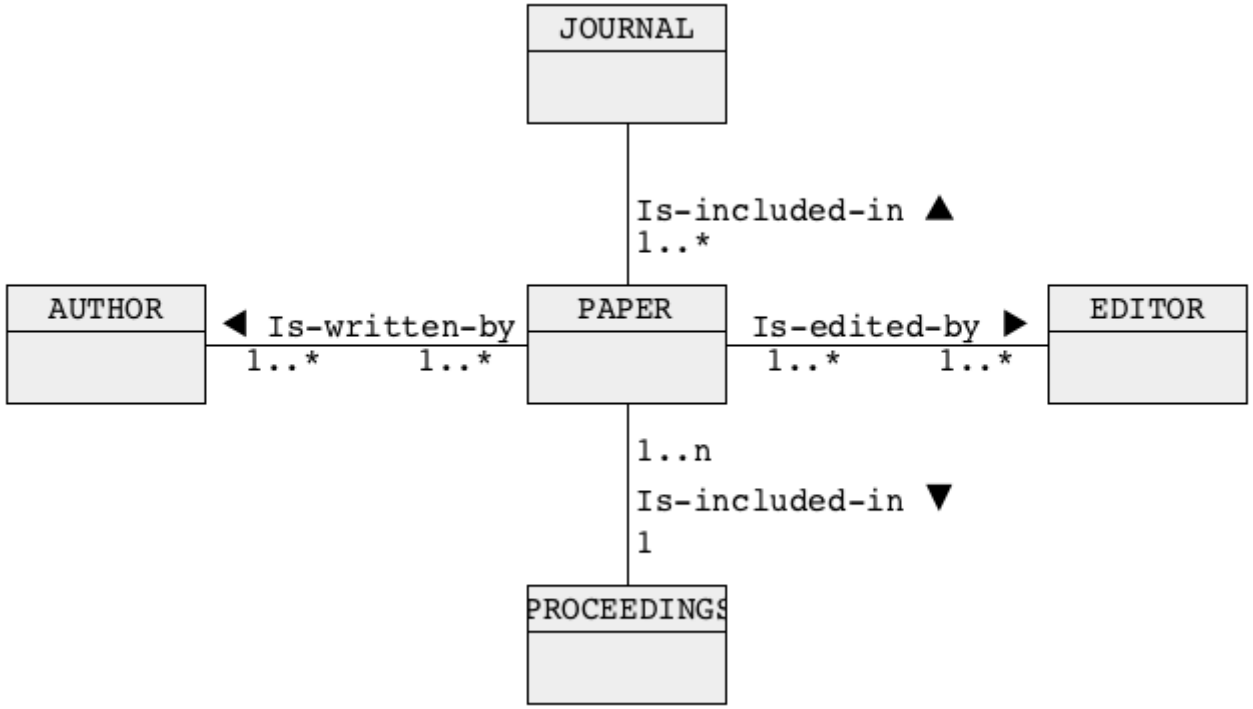
A publishing company publishes the journals and conference proceedings. The research papers are included in the journals and proceedings. The company employs the general editors who take responsibility for the editing research papers. A research paper is written by one or more authors



Example 2

Step 4: Creating identifiers

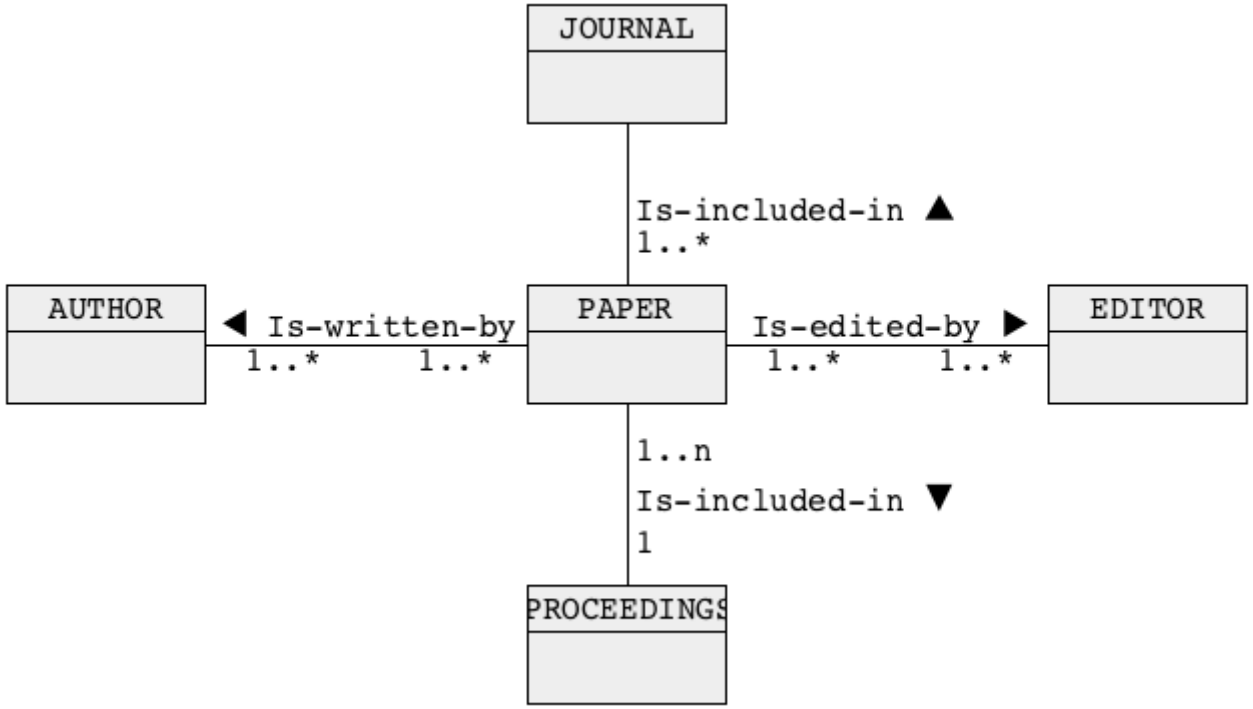
A publishing company publishes the journals and conference proceedings. The research papers are included in the journals and proceedings. The company employs the general editors who take responsibility for the editing research papers. A research paper is written by one or more authors



Example 2

Step 5: Creating qualifications

A publishing company publishes the journals and conference proceedings. The research papers are included in the journals and proceedings. The company employs the general editors who take responsibility for the editing research papers. A research paper is written by one or more authors

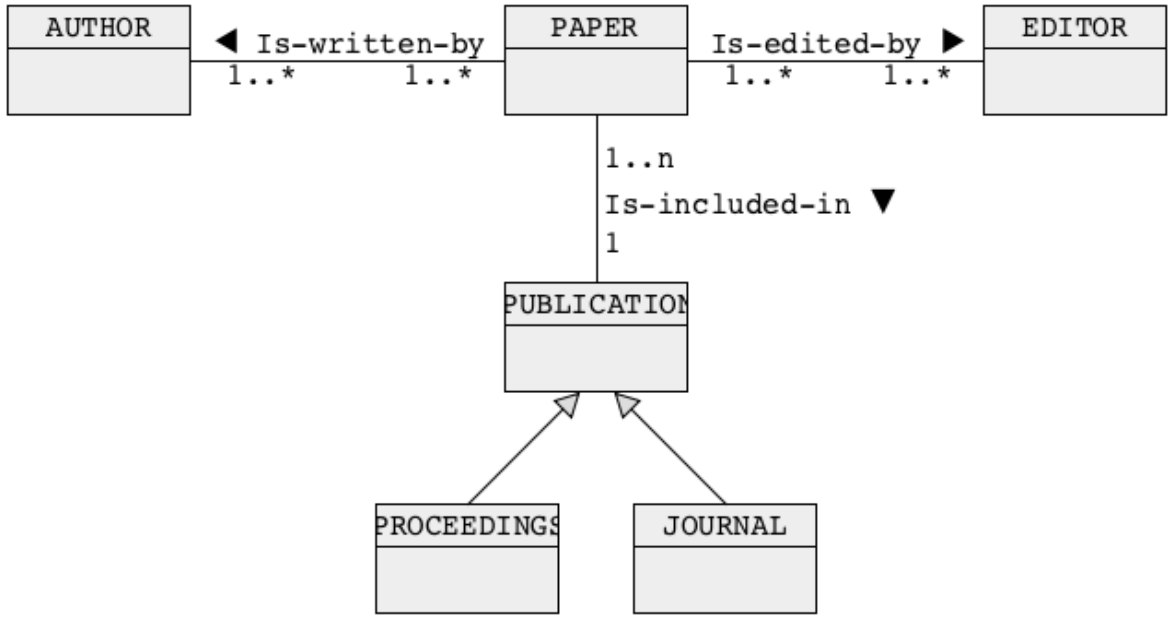


Example 2

Step 6: Creating generalizations

A publishing company publishes the journals and conference proceedings. The research papers are included in the journals and proceedings. The company employs the general editors who take responsibility for the editing research papers. A research paper is written by one or more authors

Journal, proceedings IS-A publication



Conceptual Modeling

Outline

Example 3

An objective is to create a conceptual schema of a small database that contains information about the construction companies and buildings built by the companies

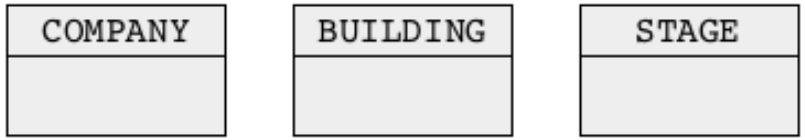
A detailed specification is the following:

- A group of construction companies is involved in construction of industrial buildings
- A building is located at a different address, it has a unique name, and completion date
- A number of construction stages apply to each building
- A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs
- A construction company is usually involved in many construction stages of the same building
- Many construction companies are involved in one construction stage

Example 3

Step 1: Creating classes of objects

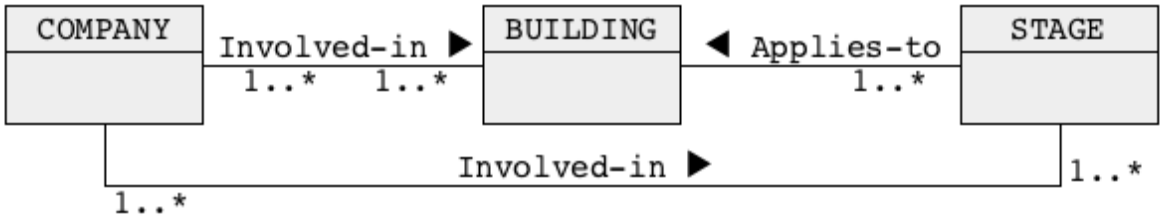
A group of construction companies is involved in construction of industrial buildings. A building is located at a different address, it has a unique name, and completion date. A number of construction stages apply to each building. A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs. A construction company is usually involved in many construction stages of the same building. Many construction companies are involved in one construction stage



Example 3

Step 2: Creating associations and association classes

A group of construction companies is involved in construction of industrial buildings. A building is located at a different address, it has a unique name, and completion date. A number of construction stages apply to each building. A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs. A construction company is usually involved in many construction stages of the same building. Many construction companies are involved in one construction stage



Example 3

Step 2 (improved): Creating associations and association classes

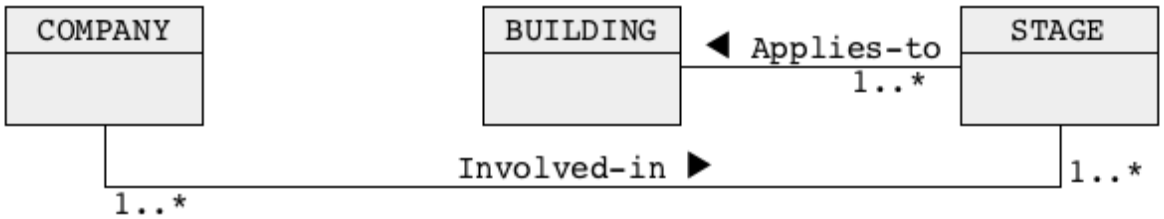
A group of construction companies is involved in construction of industrial buildings. A building is located at a different address, it has a unique name, and completion date. A number of construction stages apply to each building. A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs. A construction company is usually involved in many construction stages of the same building. Many construction companies are involved in one construction stage

If a company is involved in a construction stage that applies to a building then such company is involved in construction of the building

Example 3

Step 2 (improved): Creating associations and association classes

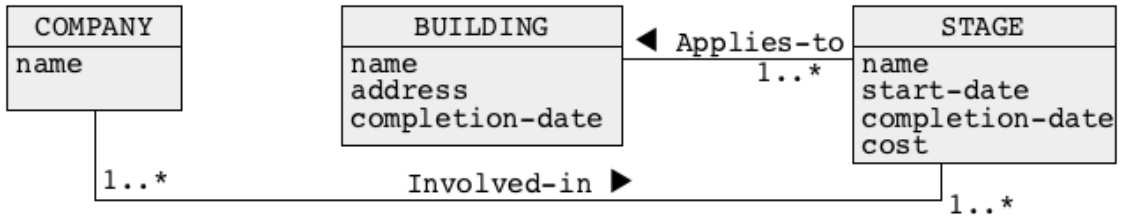
It means that we do not need an association `Involved-in` bettwen the classes `COMPANY` and `BUILDING` because such association can be derived from the other two associations



Example 3

Step 3: Creating attributes and link attributes

A group of construction companies is involved in construction of industrial buildings. A building is located at a different address, it has a unique name, and completion date. A number of construction stages apply to each building. A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs. A construction company is usually involved in many construction stages of the same building. Many construction companies are involved in one construction stage

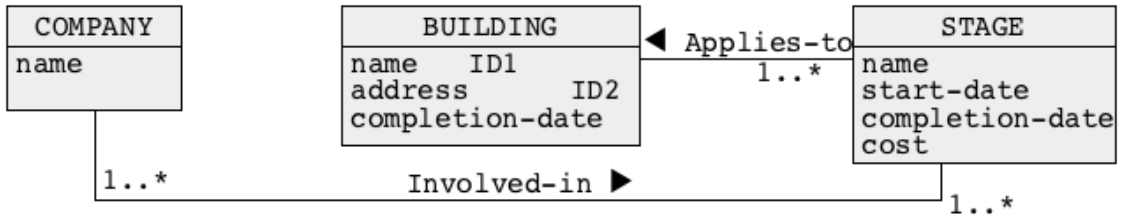


Example 3

Step 4: Creating identifiers

A group of construction companies is involved in construction of industrial buildings. A building is located at a different address, it has a unique name, and completion date. A number of construction stages apply to each building. A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs. A construction company is usually involved in many construction stages of the same building. Many construction companies are involved in one construction stage

What we know about the reality is that construction companies have unique names

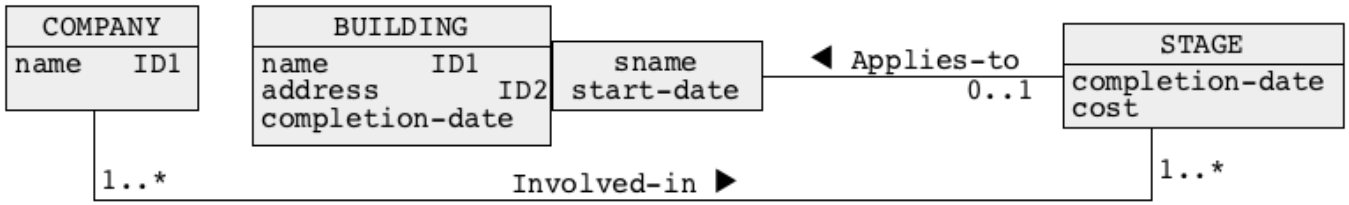


Example 3

Step 5: Creating qualifications

A group of construction companies is involved in construction of industrial buildings. A building is located at a different address, it has a unique name, and completion date. A number of construction stages apply to each building. A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs. A construction company is usually involved in many construction stages of the same building. Many construction companies are involved in one construction stage

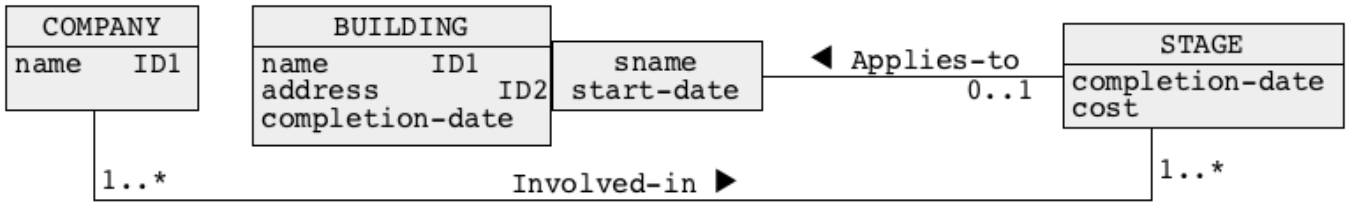
What we also know about the reality is that a construction stage of a building starts once at a given moment in time



Example 3

Step 6: Creating generalizations

A group of construction companies is involved in construction of industrial buildings. A building is located at a different address, it has a unique name, and completion date. A number of construction stages apply to each building. A construction stage is described by its name, the names of construction companies involved together with the start date, completion date, and the total costs. A construction company is usually involved in many construction stages of the same building. Many construction companies are involved in one construction stage



Conceptual Modeling

Outline

Example 4

An objective is to create a conceptual schema for a database domain described by the following poem for kids

"Caterpillar"

by Christina Rossetti

Brown and furry

Caterpillar in a hurry,

Take your walk

To the shady leaf, or stalk,

Or what not,

Which may be the chosen spot.

No toad spy you,

Hovering bird of prey pass by you;

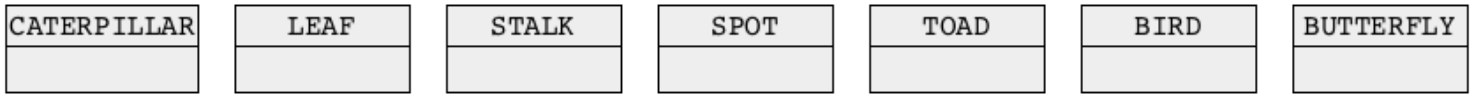
Spin and die,

To live again a butterfly.

Example 4

Step 1: Creating classes of objects

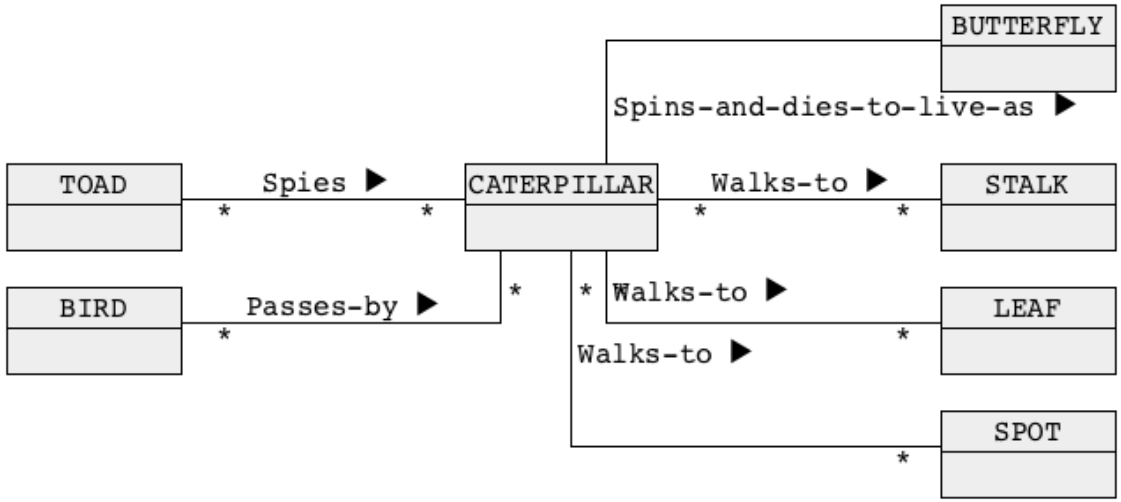
Brown and furry Caterpillar in a hurry Take your walk To the shady leaf, or stalk, Or what not, Which may be the chosen spot. No toad spy you, Hovering bird of prey pass by you; Spin and die, To live again a butterfly.



Example 4

Step 2: Creating associations and association classes

Brown and furry Caterpillar in a hurry Take your walk To the shady leaf, or stalk, Or what not, Which may be the chosen spot. No toad spy you, Hovering bird of prey pass by you; Spin and die, To live again a butterfly.



Example 4

Step 3: Creating attributes and link attributes

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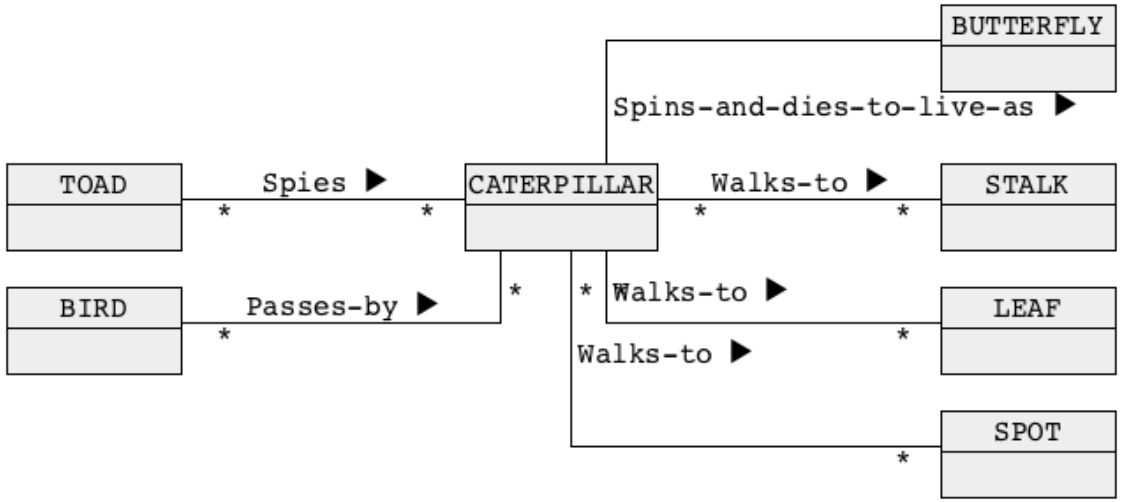
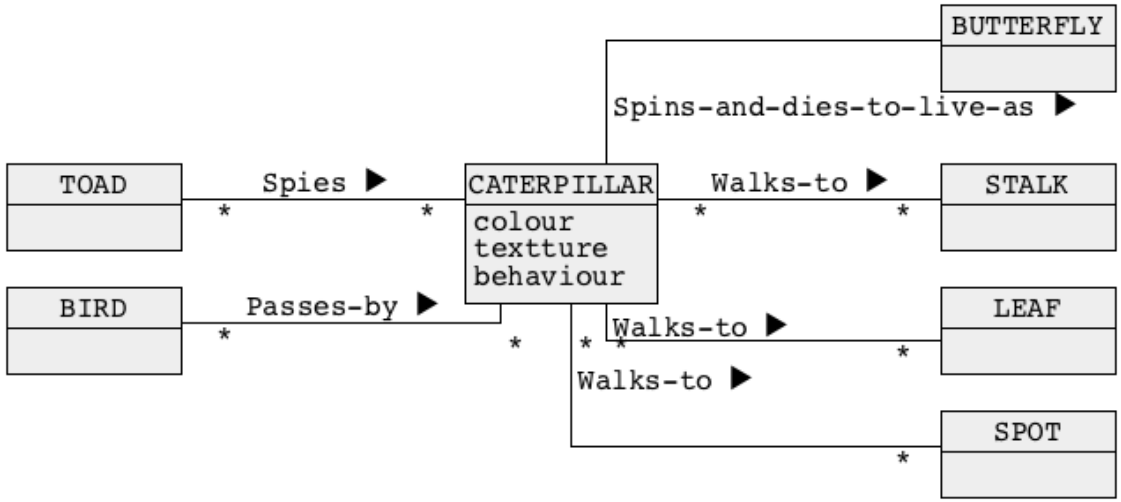


Example 4

Step 4: Creating identifiers

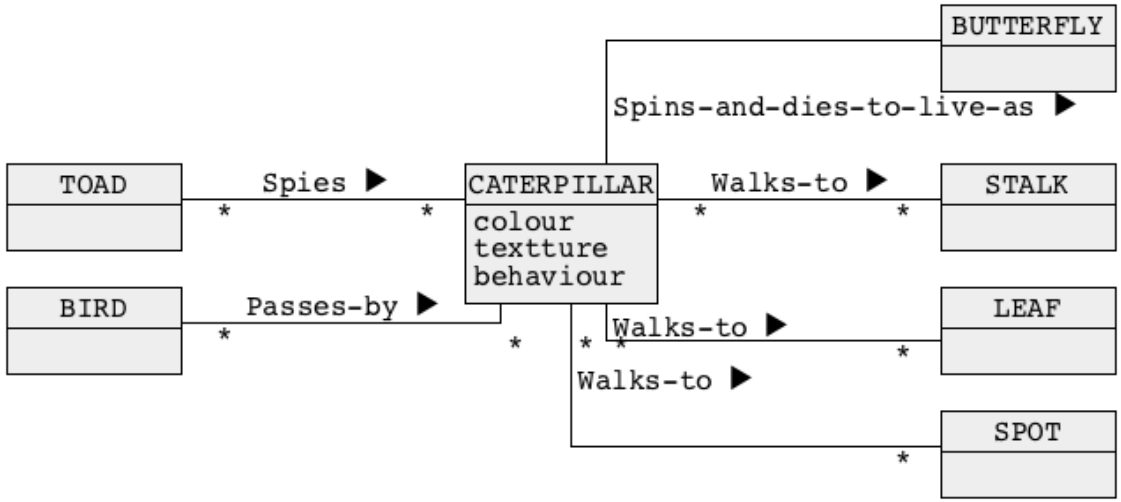
Brown and furry Caterpillar in a hurry Take your walk To the shady leaf, or stalk, Or what not, Which may be the chosen spot. No toad spy you, Hovering bird of prey pass by you; Spin and die, To live again a butterfly.



Example 4

Step 5: Creating qualifications

Brown and furry Caterpillar in a hurry Take your walk To the shady leaf, or stalk, Or what not, Which may be the chosen spot. No toad spy you, Hovering bird of prey pass by you; Spin and die, To live again a butterfly.



Example 4

Step 6: Creating generalizations

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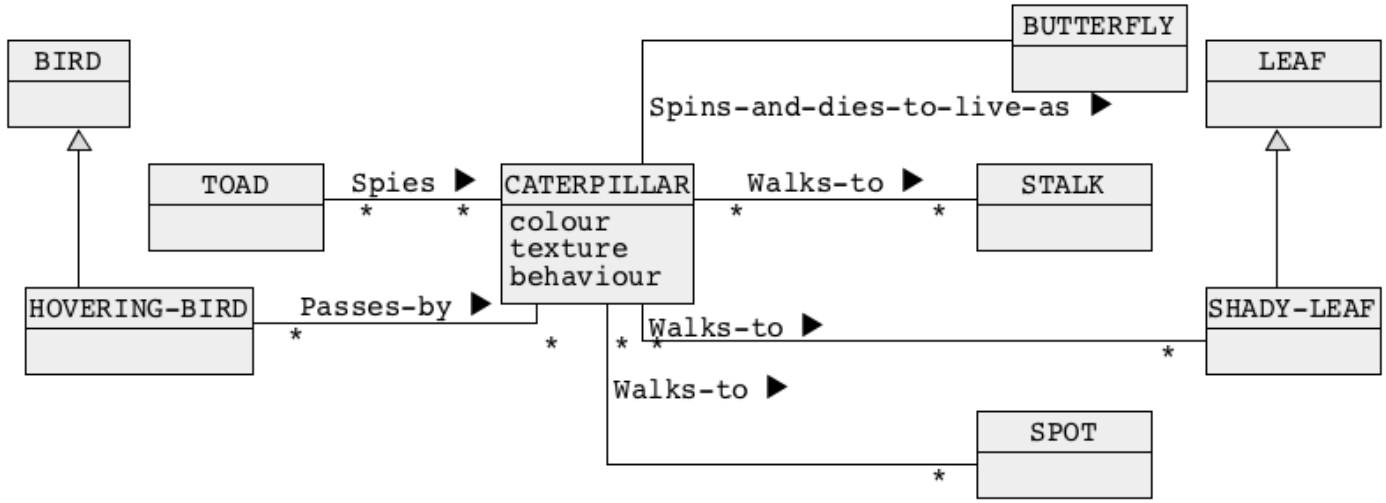

References

T. Connoly, C. Begg, Database Systems, A Practical Approach to Design, Implementation, and Management, Chapter 16 Methodology - Conceptual Database Design, Pearson Education Ltd, 2015

How to ... ? Cookbook, How to use UMLetlet for conceptual modeling ? Recipe 2.1 How to create very simple conceptual schemas with UMLetlet ?

How to ... ? Cookbook, How to use UMLetlet for conceptual modeling ? Recipes 2.2, 2.3, and 2.4 How to do design a conceptual schema with UMLetlet (Design 1, 2, and 3) ?