

CSIT115 Data Management and Security

Conceptual Modeling

Dr Janusz R. Getta

School of Computing and Information Technology -
University of Wollongong

Conceptual Modeling

Outline

Methodology

Example 1

Example 2

Example 3

Example 4

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

2/39

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

In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

3/39

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

In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

4/39

Conceptual Modeling

Outline

Methodology

Example 1

Example 2

Example 3

Example 4

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

5/39

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 their employee numbers and projects are identified by titles

In HTML view press 'p' to see the lecture notes

[TOP](#)

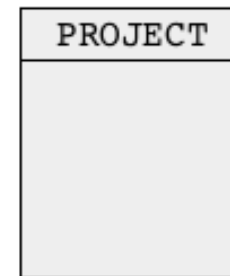
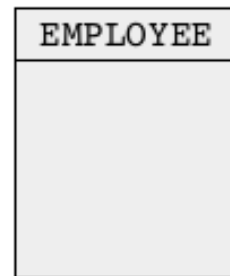
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

6/39

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 their employee numbers and projects are identified by the titles



In HTML view press 'p' to see the lecture notes

[TOP](#)

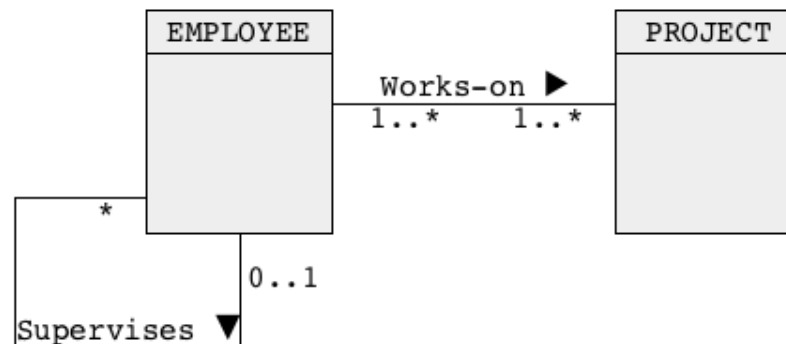
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

7/39

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 their employee numbers and projects are identified by the titles



In HTML view press 'p' to see the lecture notes

[TOP](#)

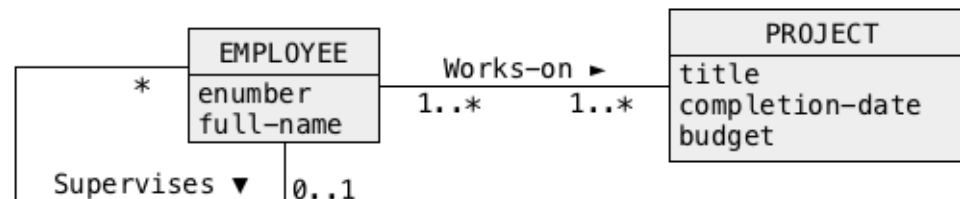
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

8/39

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 their employee numbers and projects are identified by the titles



In HTML view press 'p' to see the lecture notes

[TOP](#)

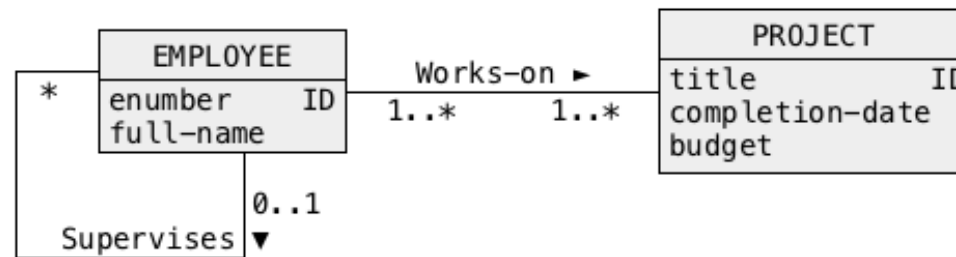
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

9/39

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 their **employee numbers** and projects are identified by the **titles**



In HTML view press 'p' to see the lecture notes

[TOP](#)

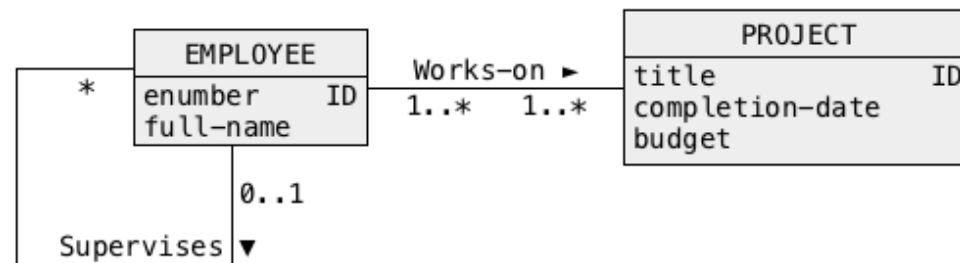
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

10/39

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 their **employee numbers** and projects are identified by the **titles**



In HTML view press 'p' to see the lecture notes

[TOP](#)

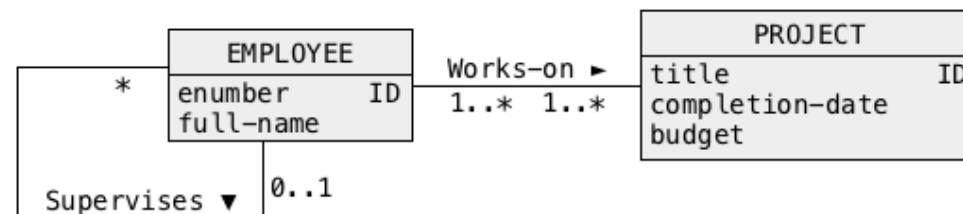
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

11/39

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 their **employee numbers** and projects are identified by the **titles**



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

12/39

Conceptual Modeling

Outline

Methodology

Example 1

Example 2

Example 3

Example 4

In HTML view press 'p' to see the lecture notes

TOP

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

13/39

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 editing the research papers
- A research paper is written by one or more authors

In HTML view press 'p' to see the lecture notes

[TOP](#)

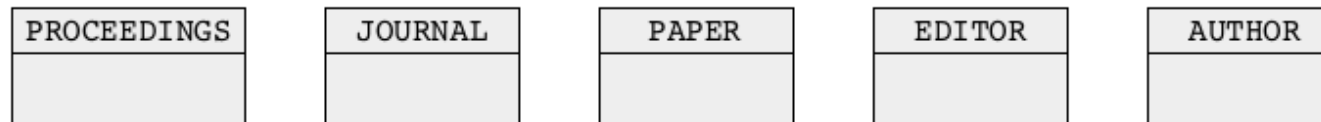
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

14/39

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 editing the **research papers**. A **research paper** is written by one or more **authors**



In HTML view press 'p' to see the lecture notes

[TOP](#)

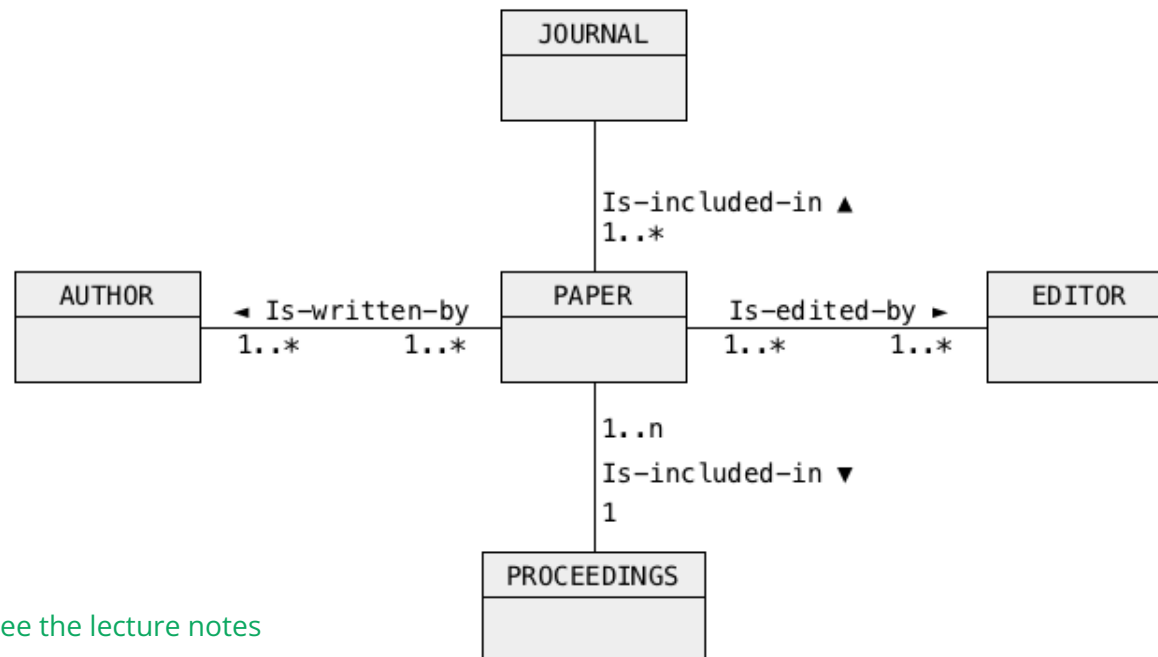
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

15/39

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 **editing** the **research papers**. A **research paper** is **written** by one or more **authors**



In HTML view press 'p' to see the lecture notes

[TOP](#)

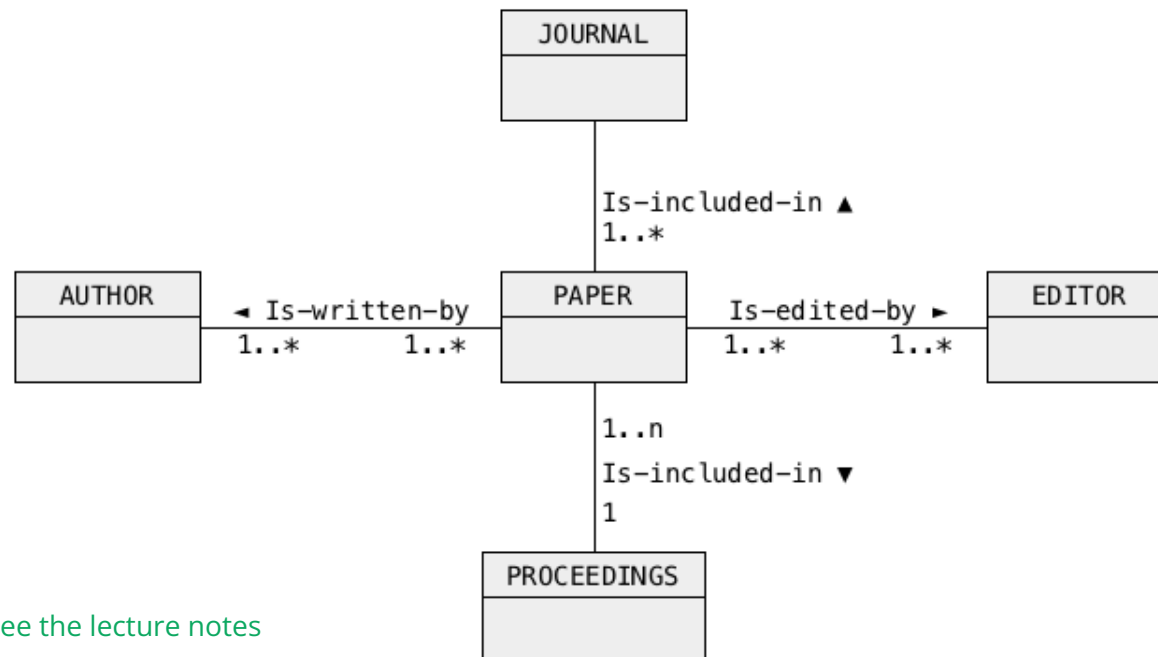
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

16/39

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 **editing** the **research papers**. A **research paper** is **written** by one or more **authors**



In HTML view press 'p' to see the lecture notes

[TOP](#)

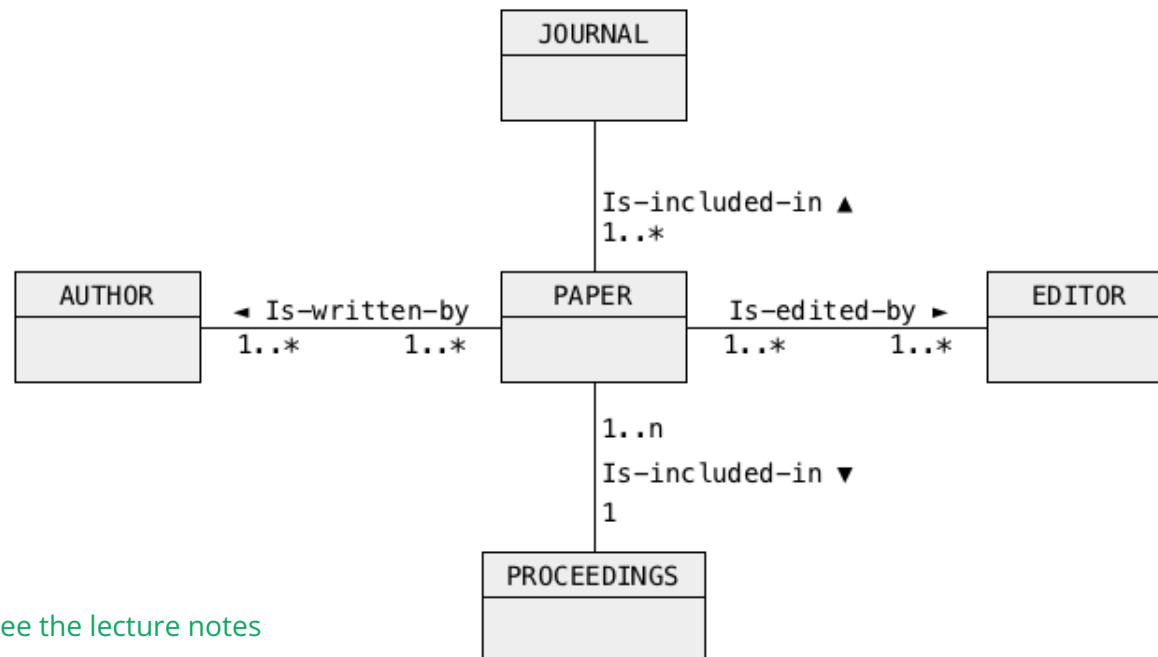
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

17/39

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 **editing** the **research papers**. A **research paper** is **written** by one or more **authors**



In HTML view press 'p' to see the lecture notes

[TOP](#)

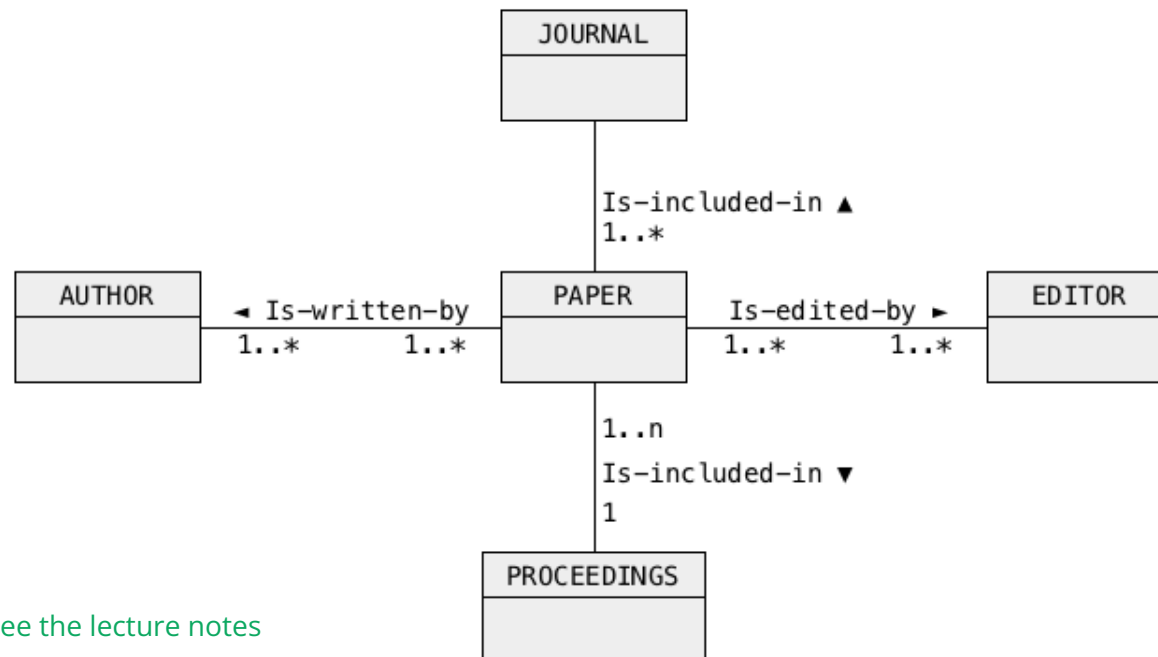
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

18/39

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 **editing** the **research papers**. A **research paper** is **written** by one or more **authors**



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

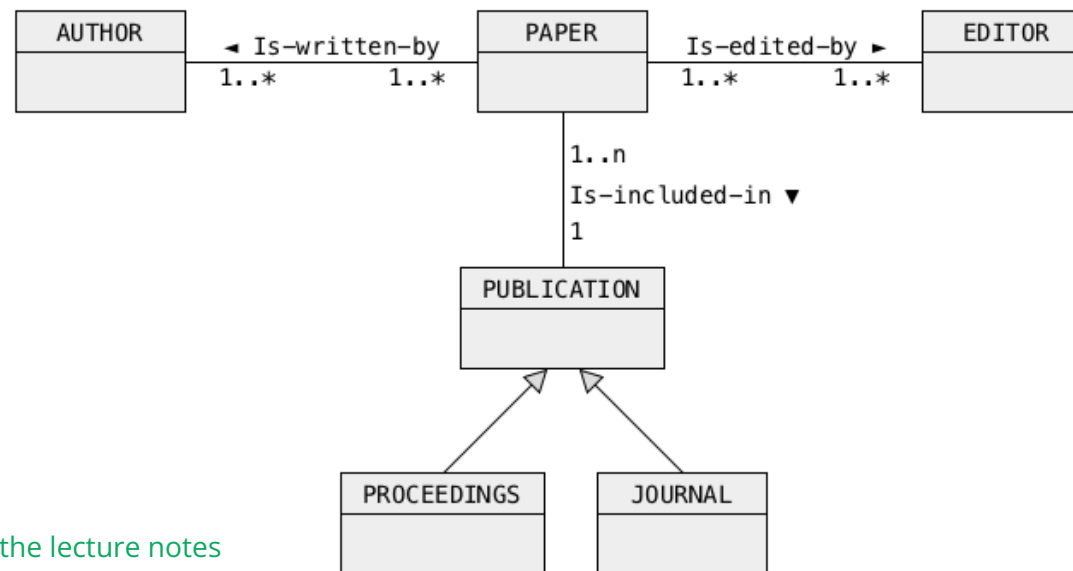
19/39

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 **editing** the **research papers**. A **research paper** is **written** by one or more **authors**

Journal, proceedings **IS-A** publication



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

20/39

Conceptual Modeling

Outline

Methodology

Example 1

Example 2

Example 3

Example 4

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 the 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 the 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

In HTML view press 'p' to see the lecture notes

[TOP](#)

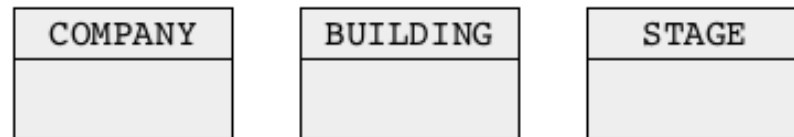
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

22/39

Example 3

Step 1: Creating classes of objects

A group of construction **companies** is involved in the 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 the 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**



In HTML view press 'p' to see the lecture notes

[TOP](#)

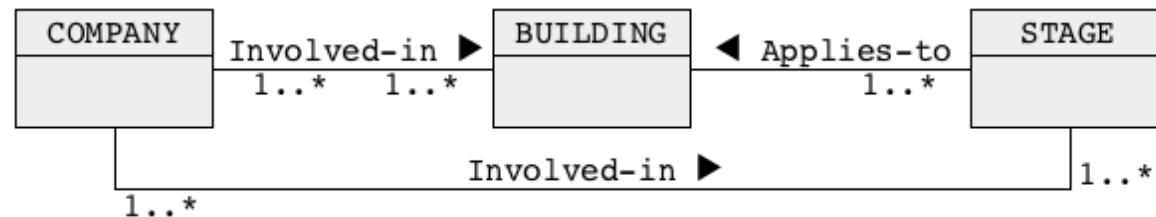
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

23/39

Example 3

Step 2: Creating associations and association classes

A group of construction **companies** is **involved in the 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 the 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**



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

24/39

Example 3

Step 2 (improved): Creating associations and association classes

A group of construction **companies** is **involved in the 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 the 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**

In HTML view press 'p' to see the lecture notes

[TOP](#)

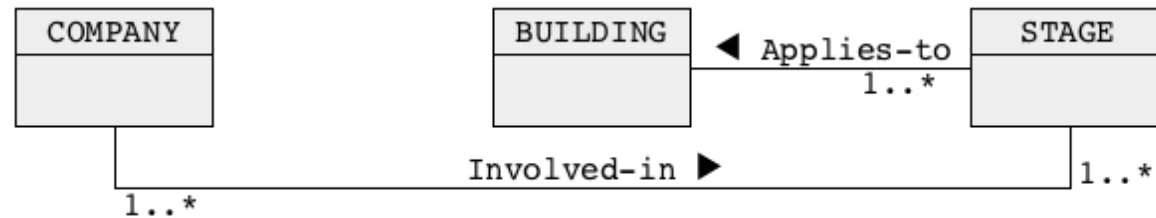
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

25/39

Example 3

Step 2 (improved): Creating associations and association classes

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



In HTML view press 'p' to see the lecture notes

[TOP](#)

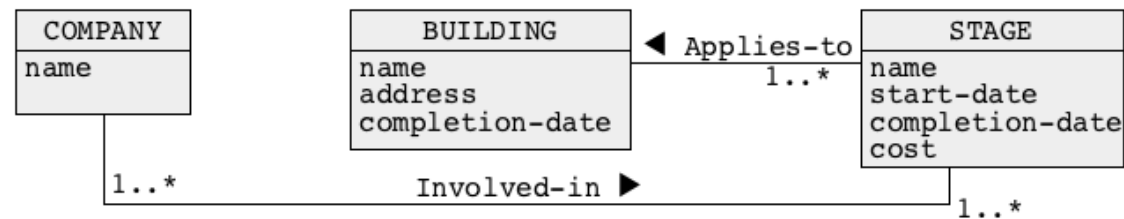
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

26/39

Example 3

Step 3: Creating attributes and link attributes

A group of construction **companies** is involved in the 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 the 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**



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

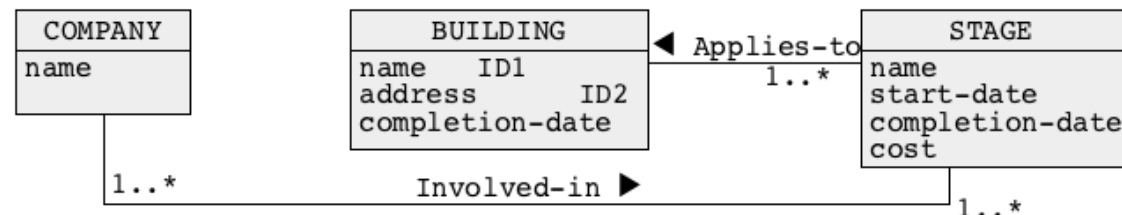
27/39

Example 3

Step 4: Creating identifiers

A group of construction **companies** is involved in the 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 the 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**



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

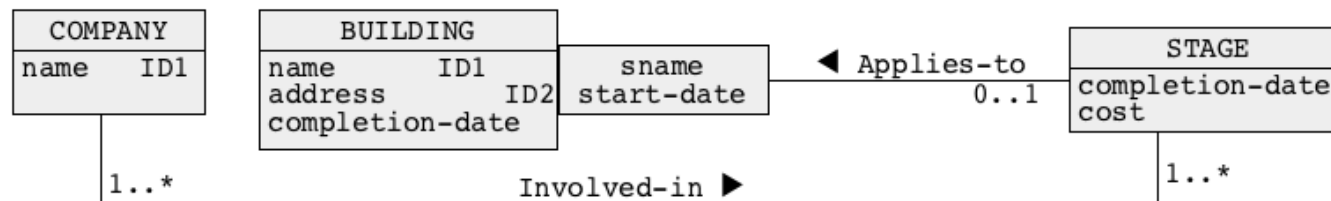
28/39

Example 3

Step 5: Creating qualifications

A group of construction **companies** is involved in the 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 the 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**



In HTML view press 'p' to see the lecture notes

[TOP](#)

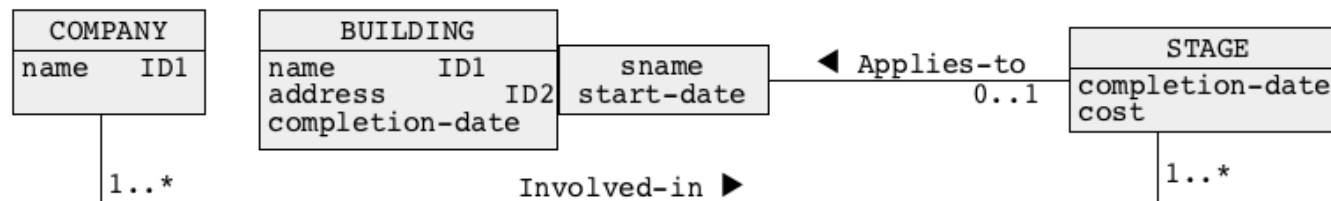
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

29/39

Example 3

Step 6: Creating generalizations

A group of construction **companies** is involved in the 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 the 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**



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

30/39

Conceptual Modeling

Outline

Methodology

Example 1

Example 2

Example 3

Example 4

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**.

CATERPILLAR	LEAF	STALK	SPOT	TOAD	BIRD	BUTTERFLY

In HTML view press 'p' to see the lecture notes

[TOP](#)

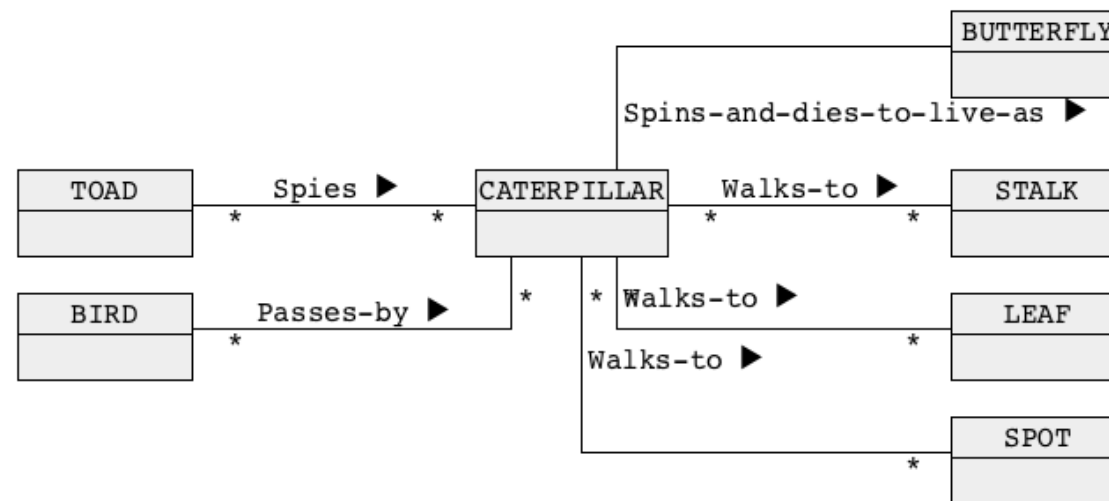
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

33/39

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**.



In HTML view press 'p' to see the lecture notes

[TOP](#)

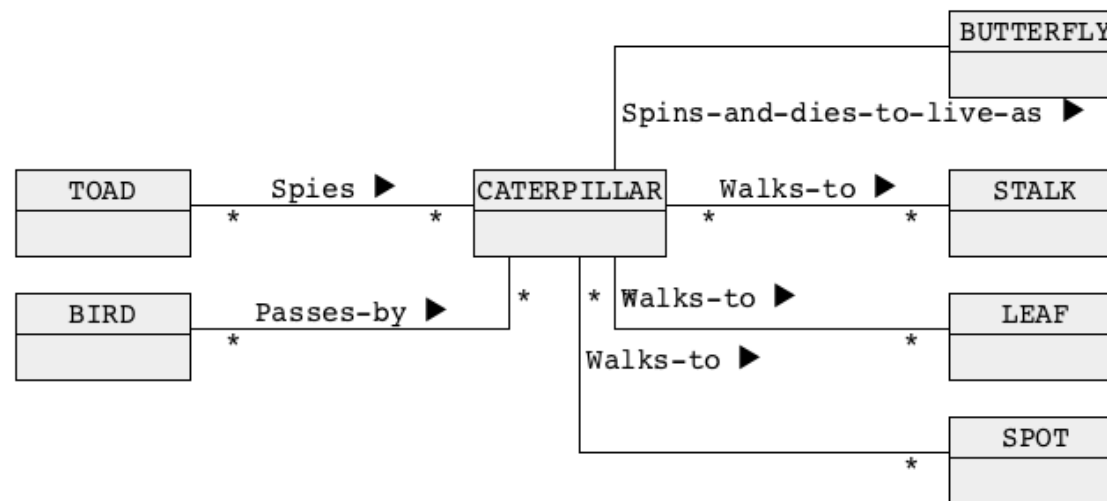
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

34/39

Example 4

Step 3: Creating attributes and link attributes

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.



In HTML view press 'p' to see the lecture notes

[TOP](#)

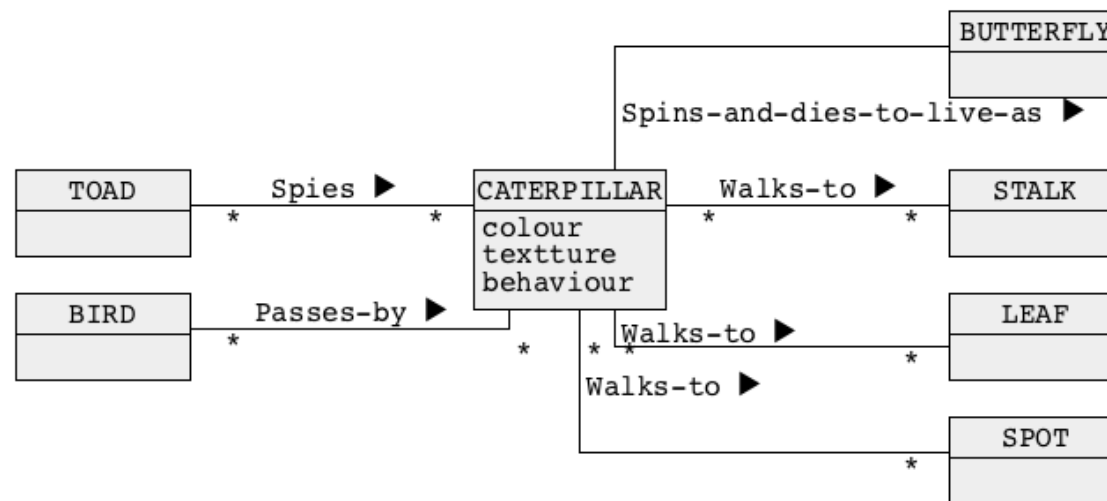
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

35/39

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.



In HTML view press 'p' to see the lecture notes

[TOP](#)

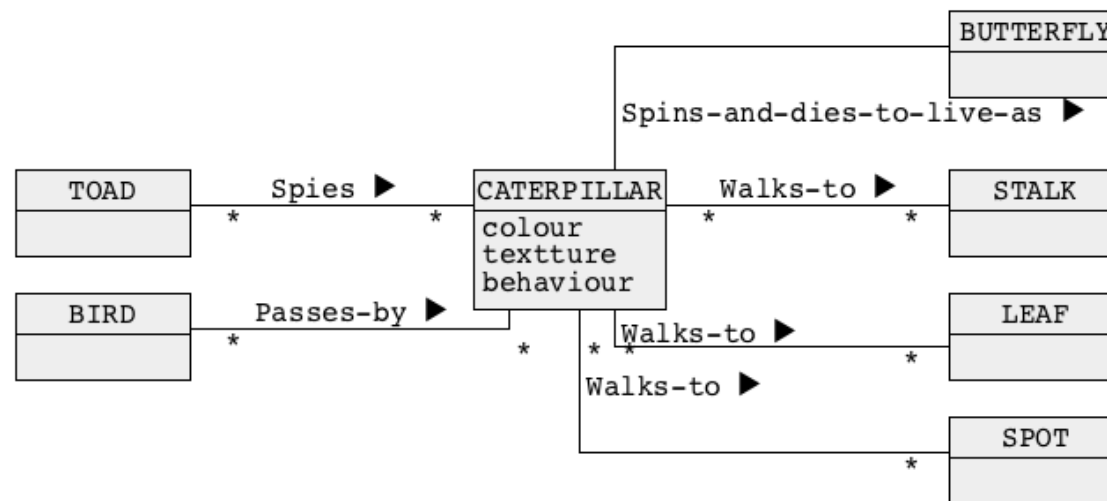
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

36/39

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.



In HTML view press 'p' to see the lecture notes

[TOP](#)

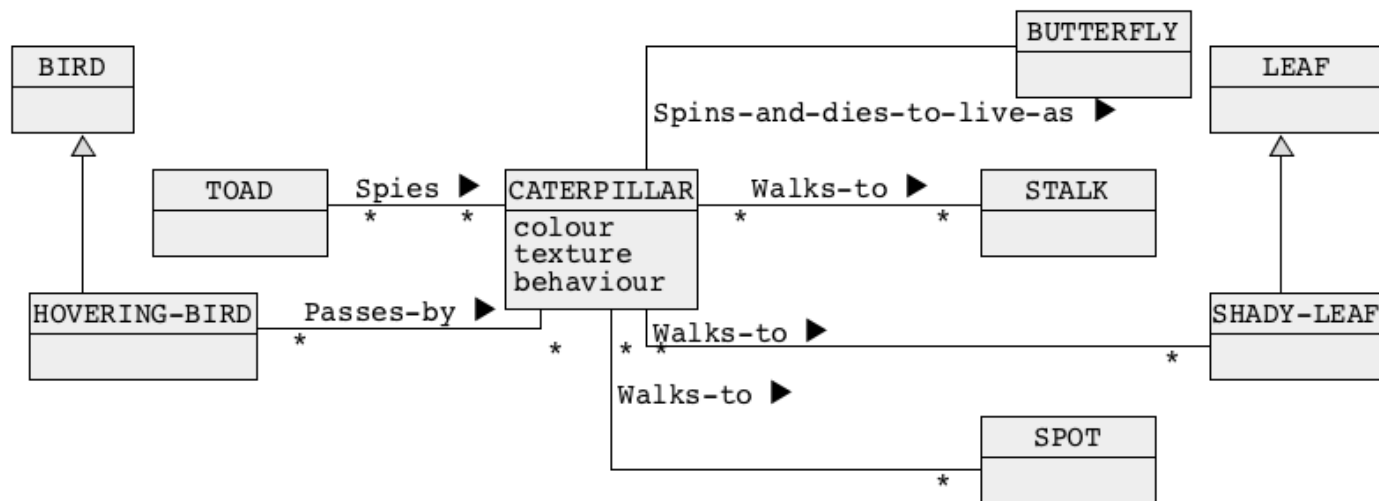
Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

37/39

Example 4

Step 6: Creating generalizations

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.



In HTML view press 'p' to see the lecture notes

[TOP](#)

Created by Janusz R. Getta, CSIT115 Data Management and Security, Autumn 2023

38/39

References

C. Coronel, S. Morris, A. Basta, M. Zgola, Data Management and Security, Chapters 3 and 4, Cengage Compose eBook, 2018, [eBook: Data Management and Security, 1st Edition](#)

T. Connolly, 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 \(Design 1, 2, and 3\) ?](#)