CMSC 127

Unified Modeling Language (UML)

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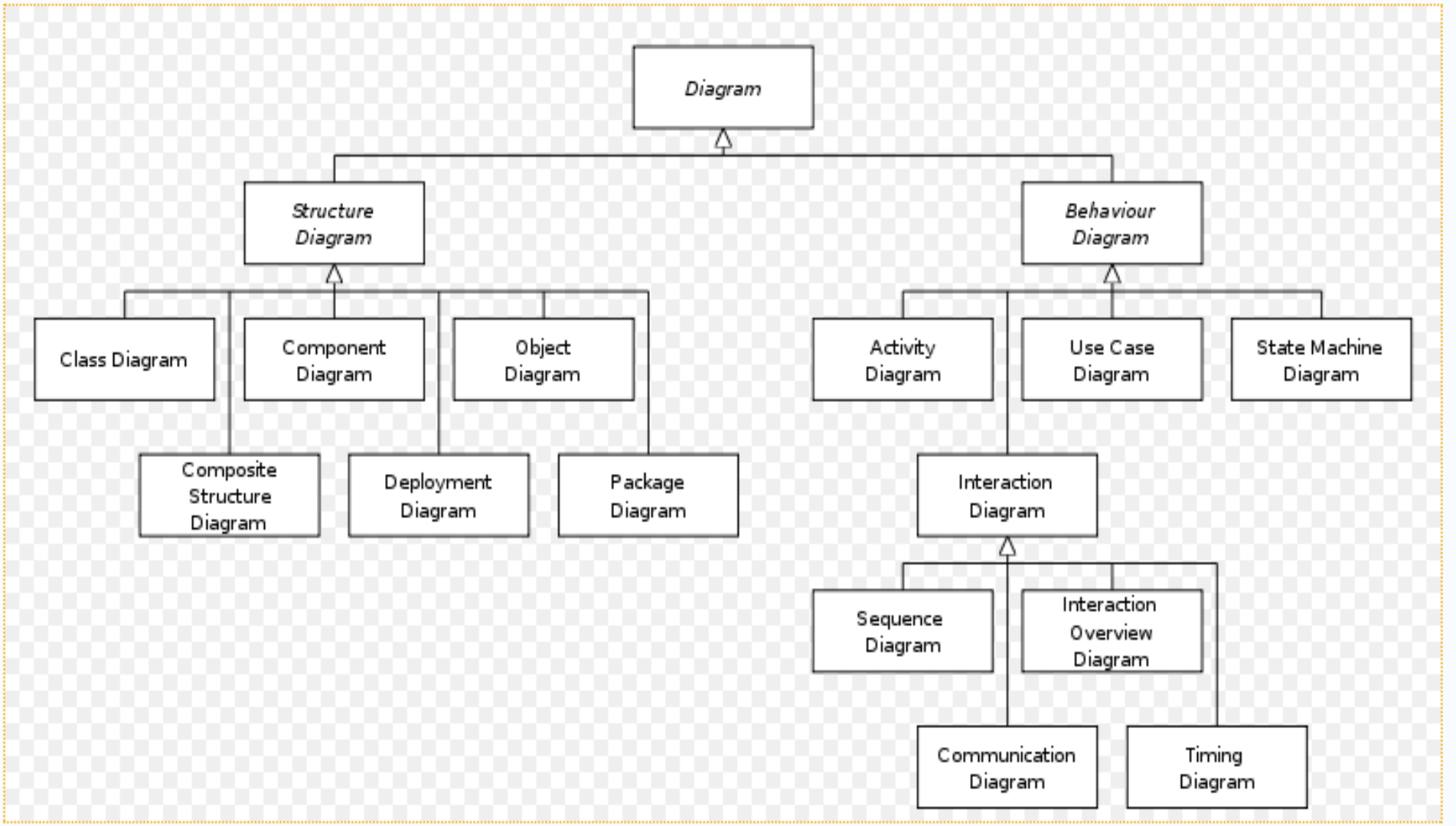
UML

- is a standardized general-purpose modeling language in the field of software engineering
- comes in different versions
- has different types of diagrams based on structure or behavior

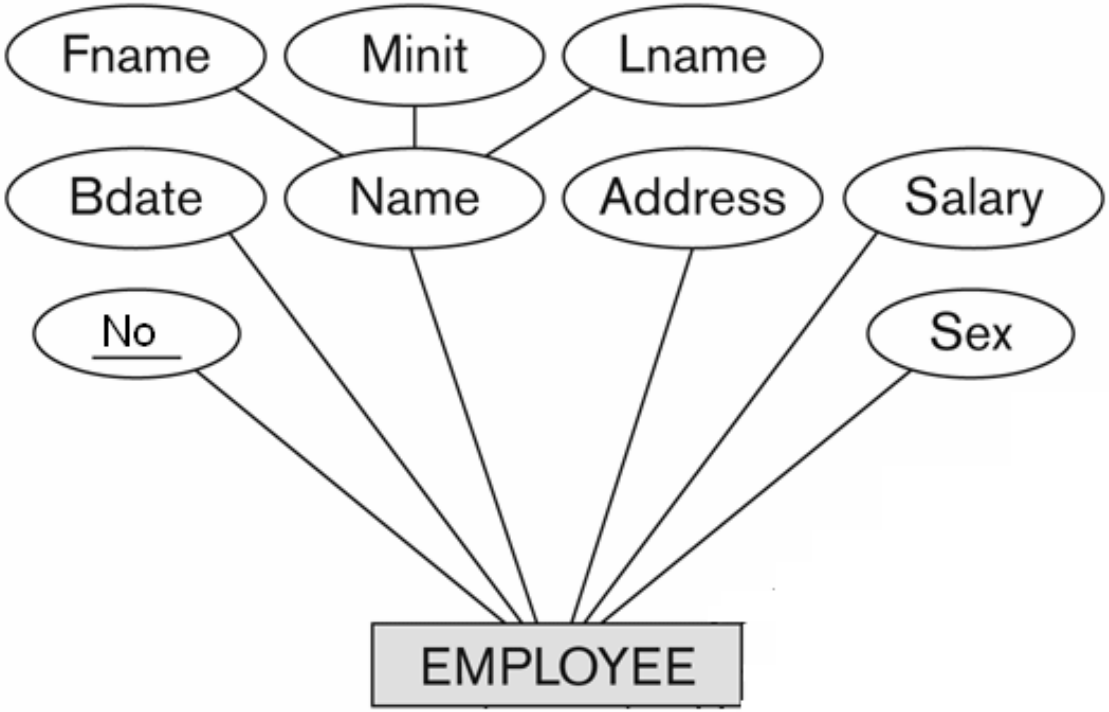
Types of UML Diagrams



UML Class Diagram

- Class (entity type) representation:
- Large box with three sections:
  - Top section gives class name
  - Second section includes attributes
  - Third section includes class operations

Class (Entity Type)



EMPLOYEE

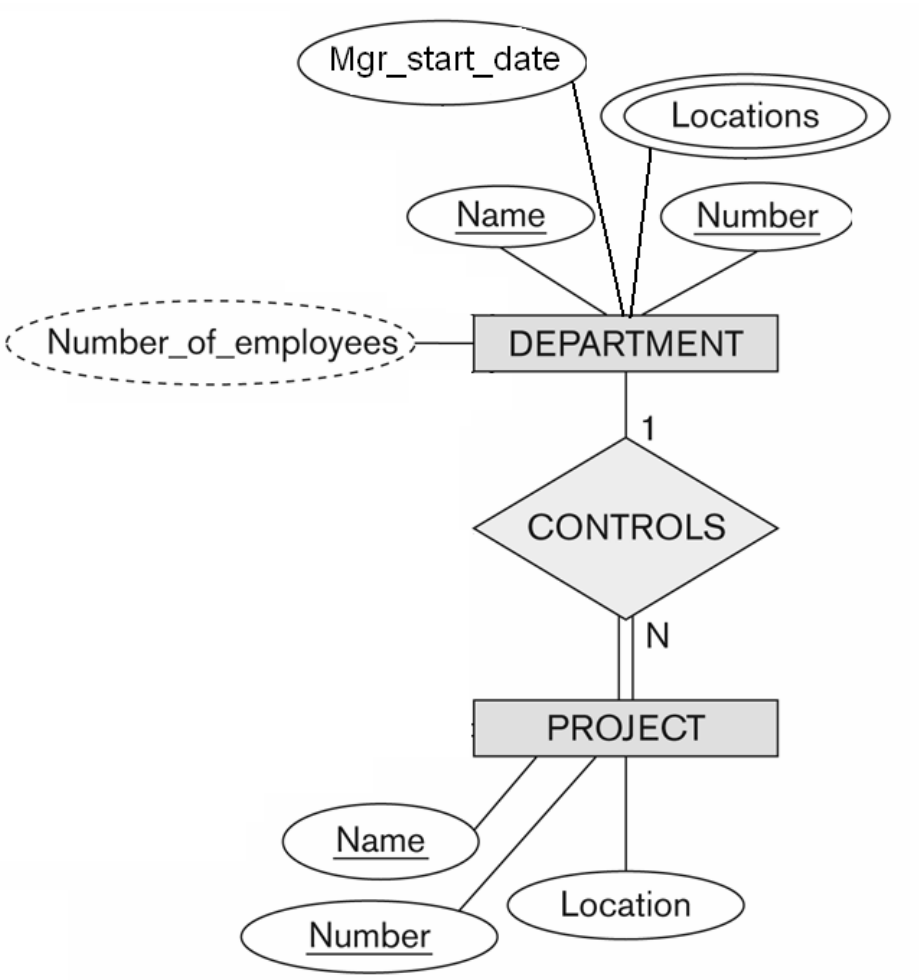
No
Name: Name_dom
  Fname
  Minit
  Lname
Bdate: Date
Sex: {M,F}
Address
Salary

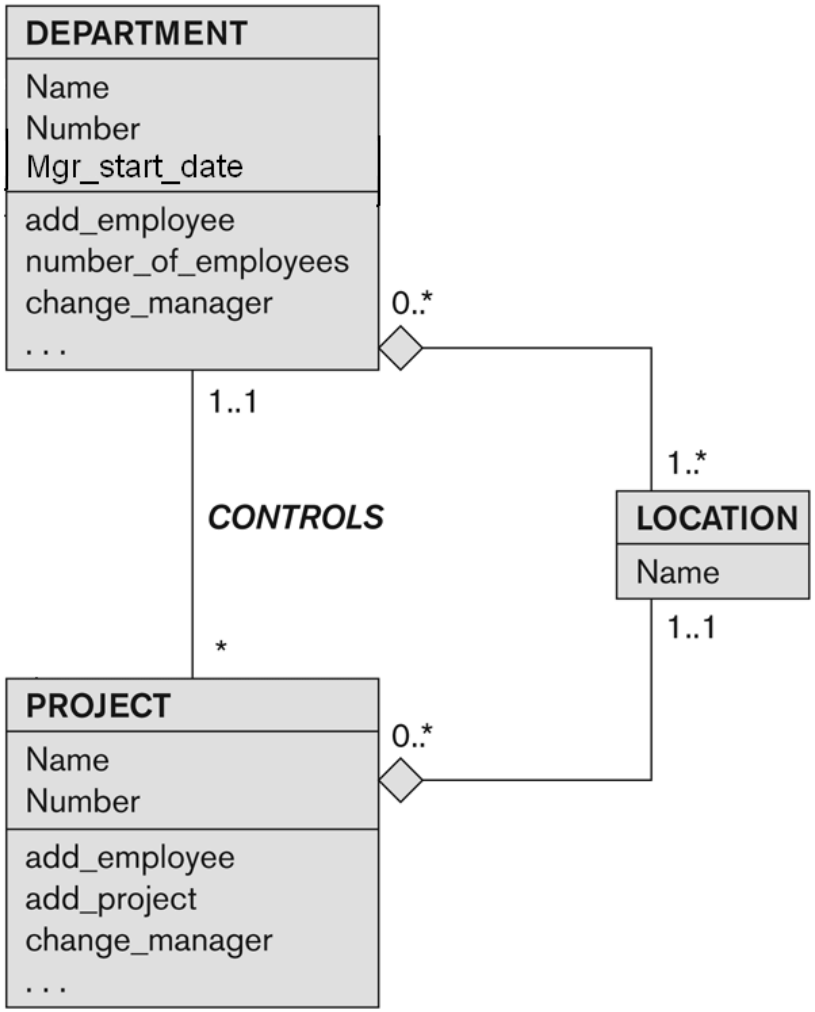
age
change_department
change_projects
. . .

Attributes

- Components of the composite attributes are listed separately
- Derived attribute is placed in the third section
- Multivalued attribute is modeled as a separate class

Attributes

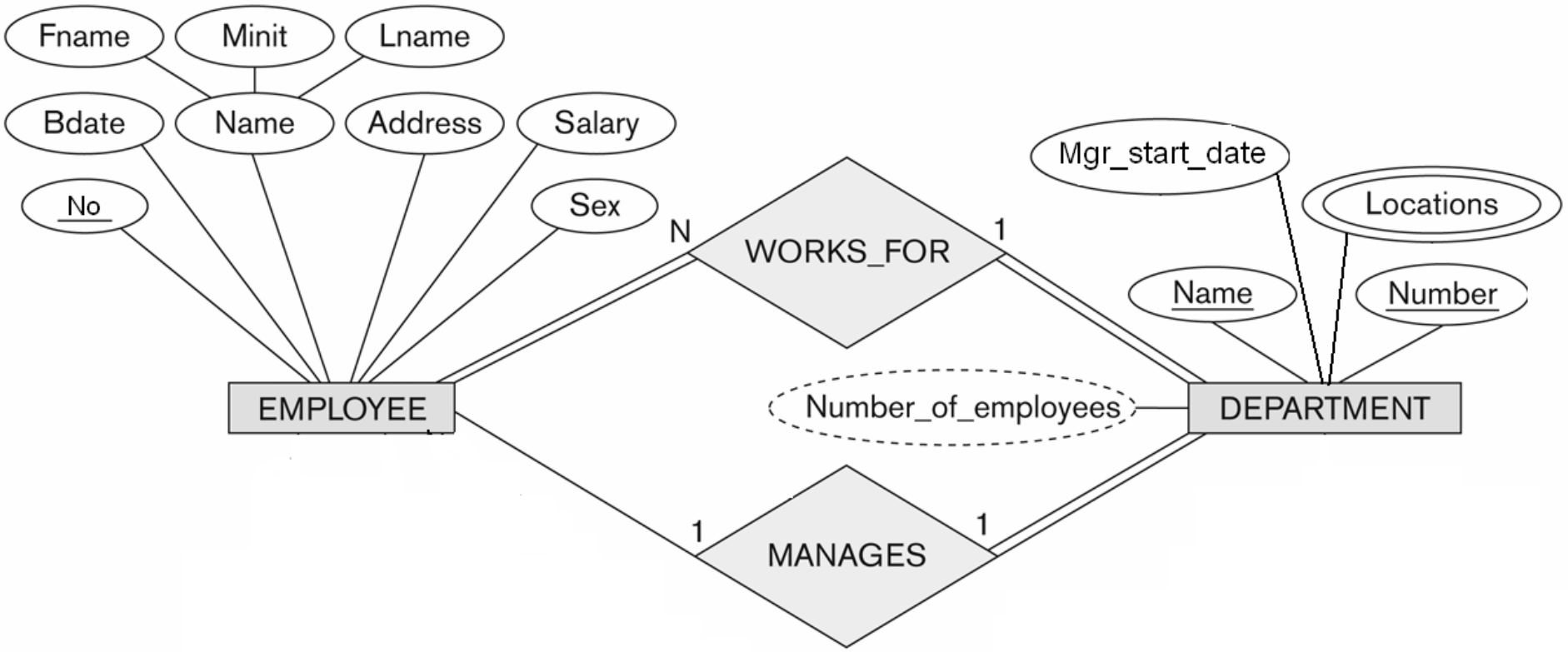

Mgr_start_date
Locations
Name
Number
Number_of_employees
DEPARTMENT
1
CONTROLS
N
PROJECT
Name
Number
Location


DEPARTMENT
Name
Number
Mgr_start_date
add_employee
number_of_employees
change_manager
. . .
0..*
1..1
1..*
CONTROLS
LOCATION
Name
1..1
*
PROJECT
Name
Number
add_employee
add_project
change_manager
. . .
0..*

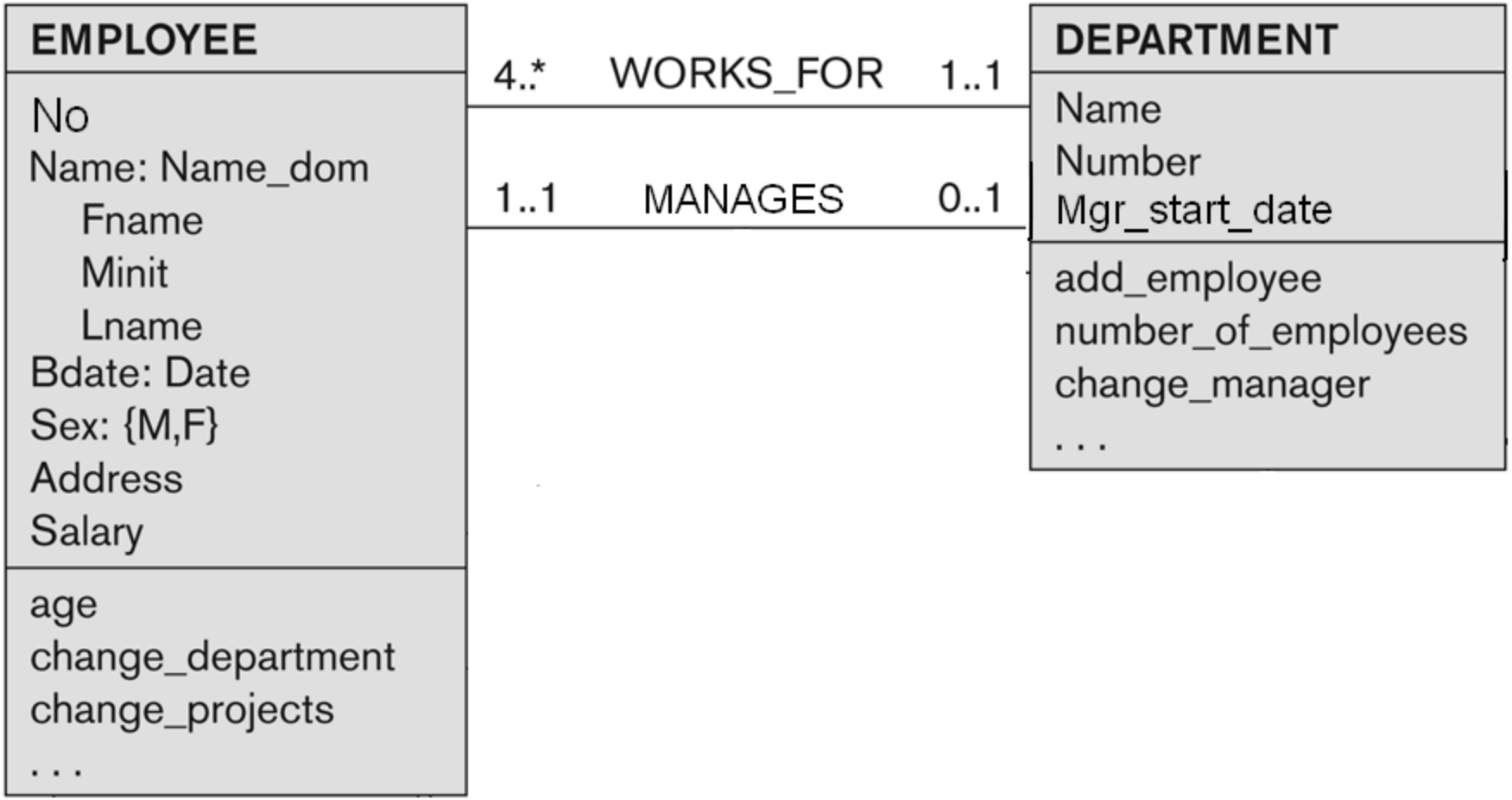
Relationship Type

- Called ***association*** in UML
- Relationship instances are called ***links***
- Represented as line
- Relationship attribute is called as ***link attribute***
  - Placed in a box that is connected to the association's line by a dashed line

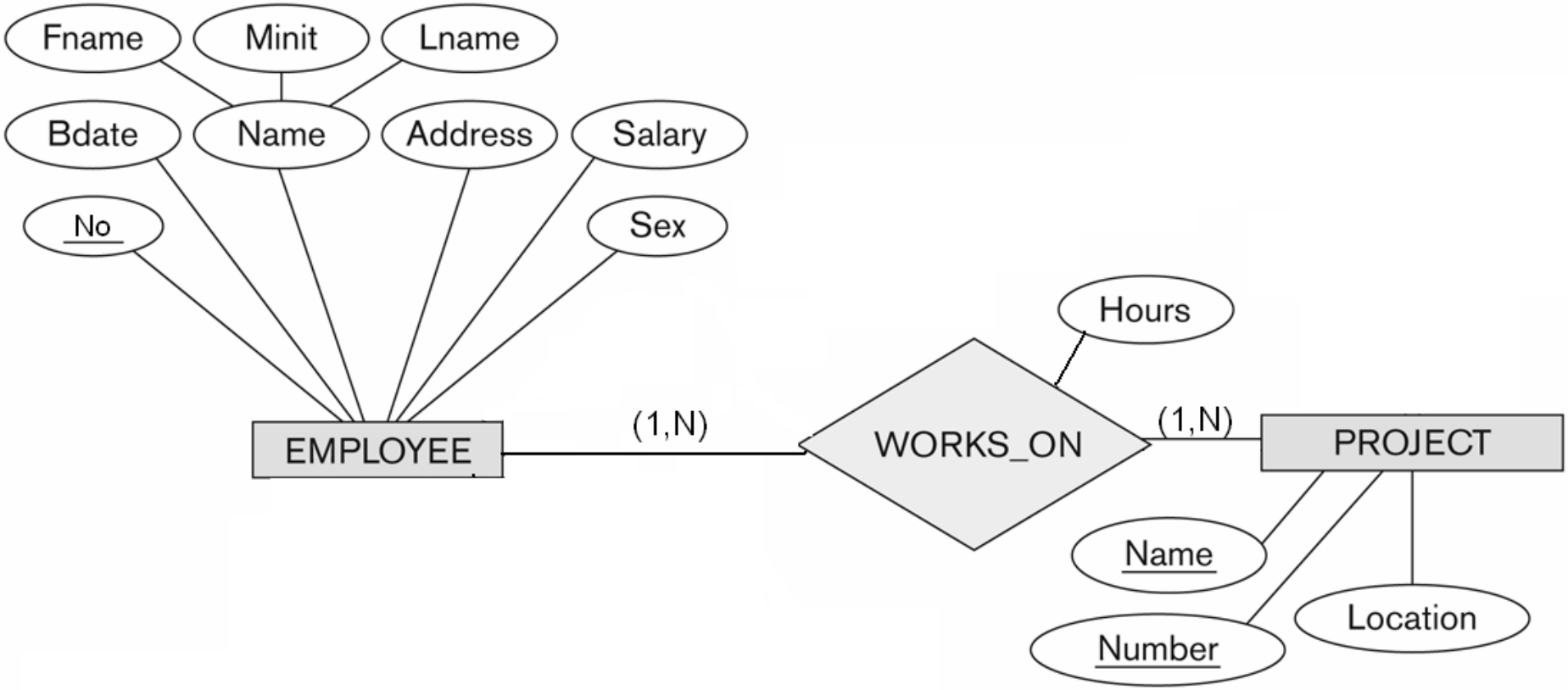
Relationship Type



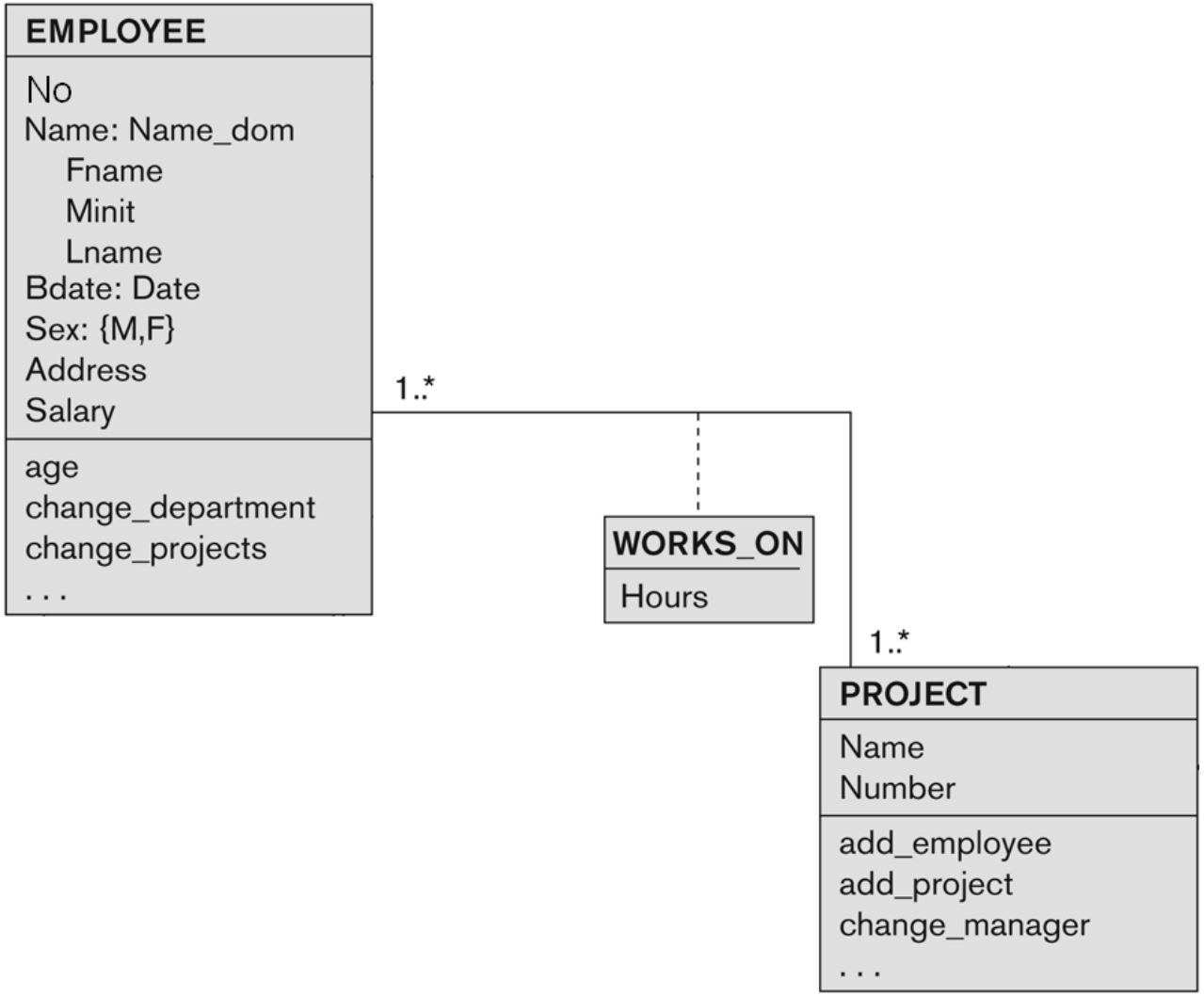
Association



With Relationship Attribute



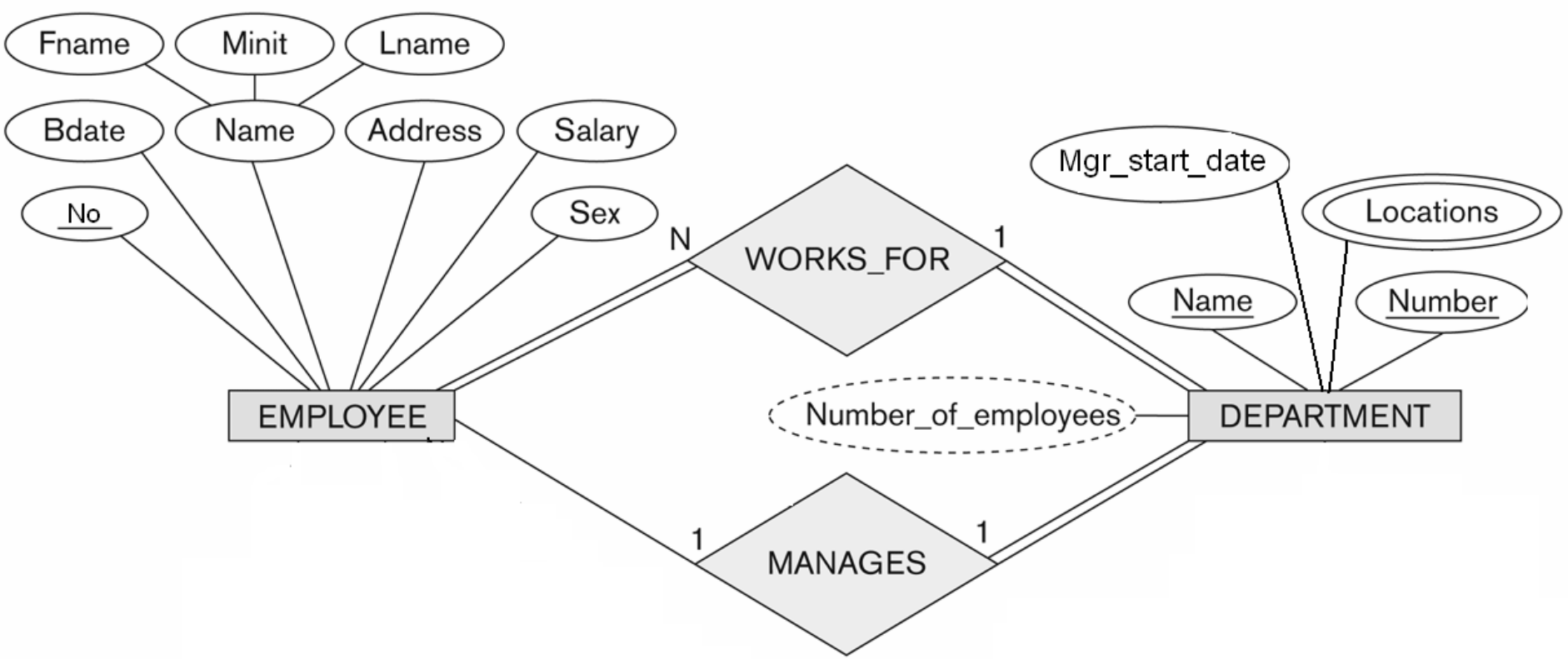
With Link Attribute



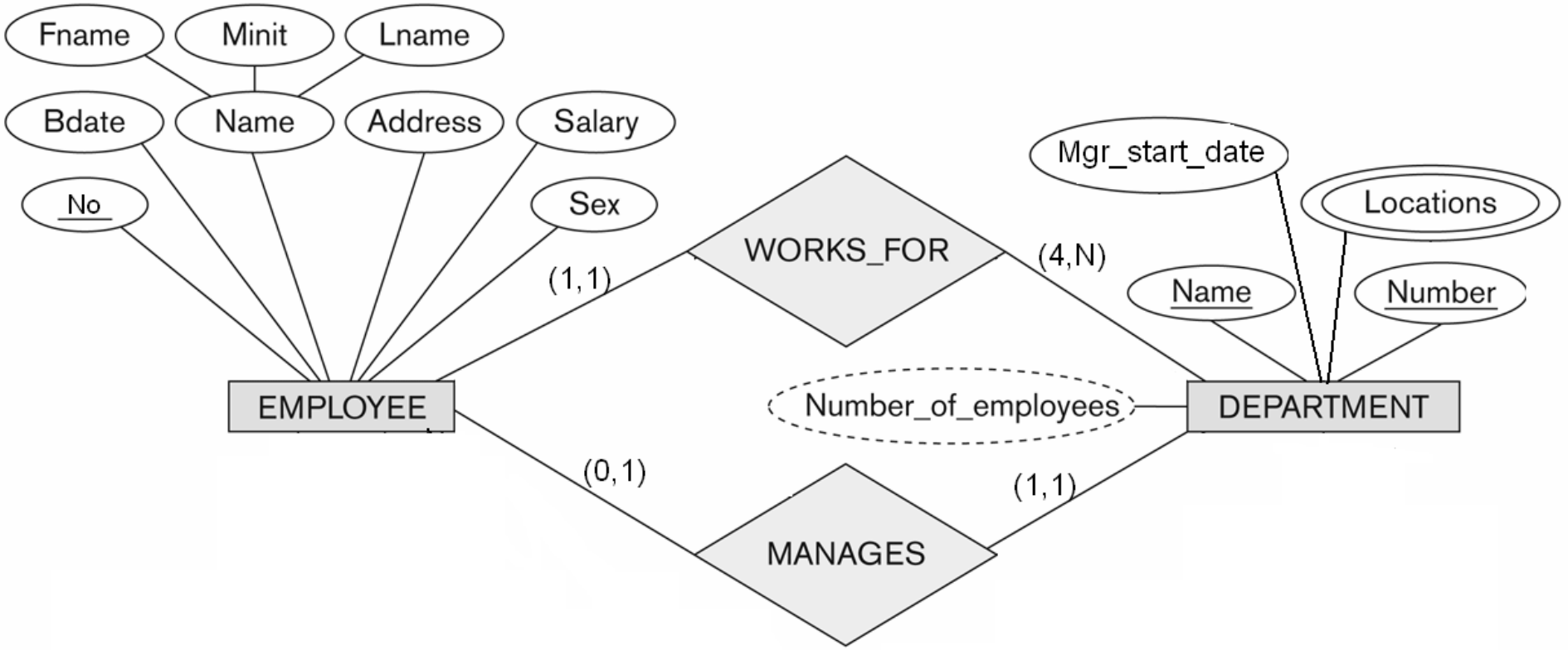
Constraints

- Called as ***multiplicities*** in UML
- Specified in ***min..max*** form
- Asterisk(*) indicates no maximum limit on participation
- A single * indicates 0..*
- A single 1 indicates 1..1
- Placed on the ***opposite ends*** of the relationship

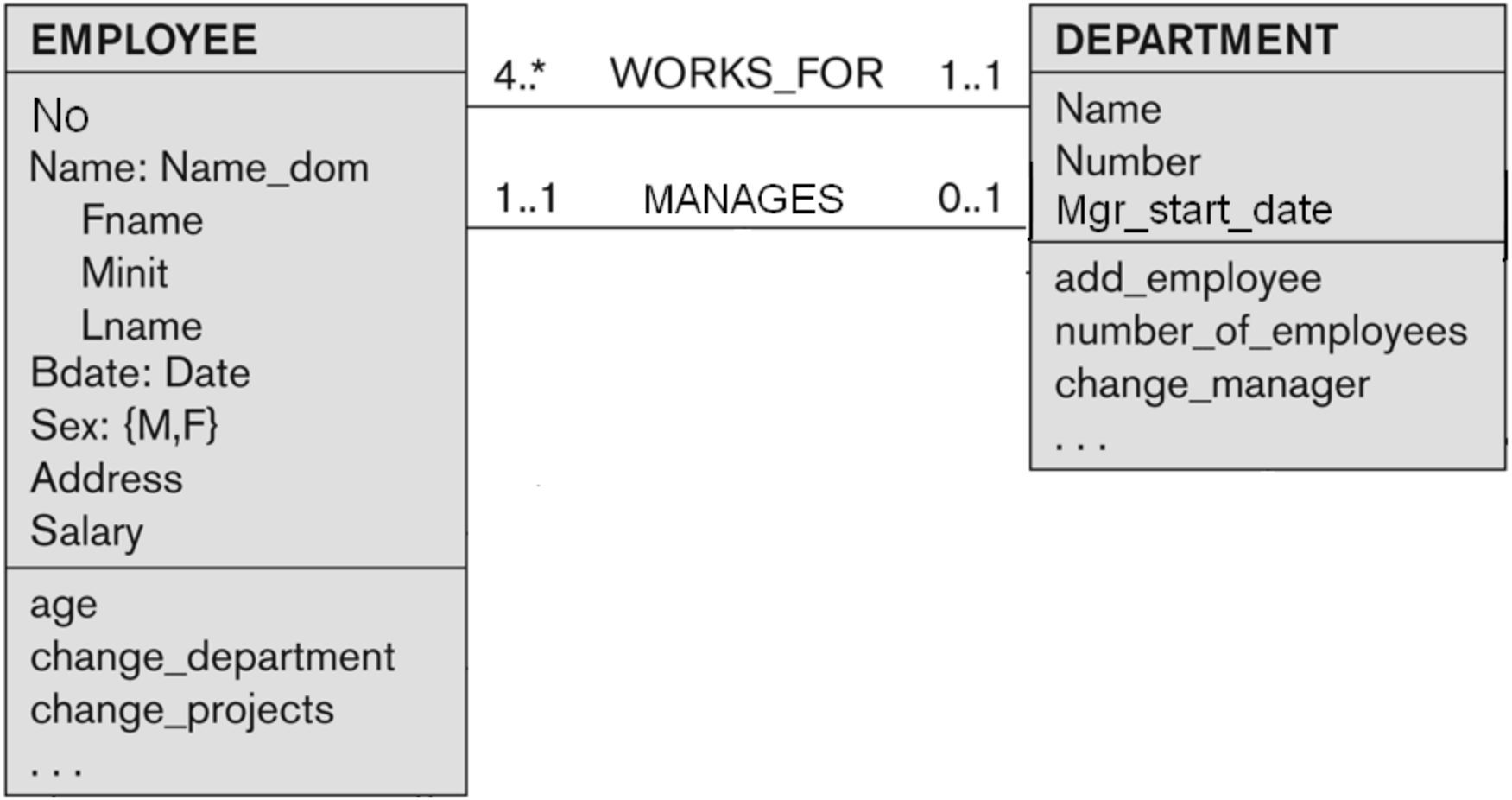
Constraints



Using (min, max) notation



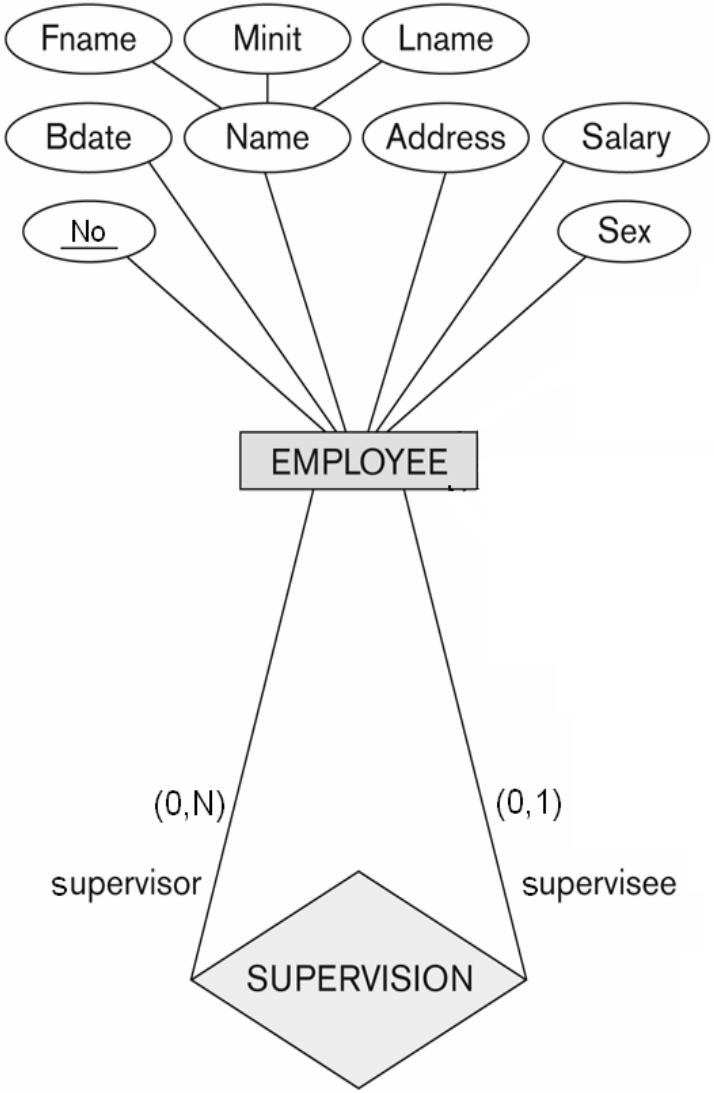
Using UML multiplicities

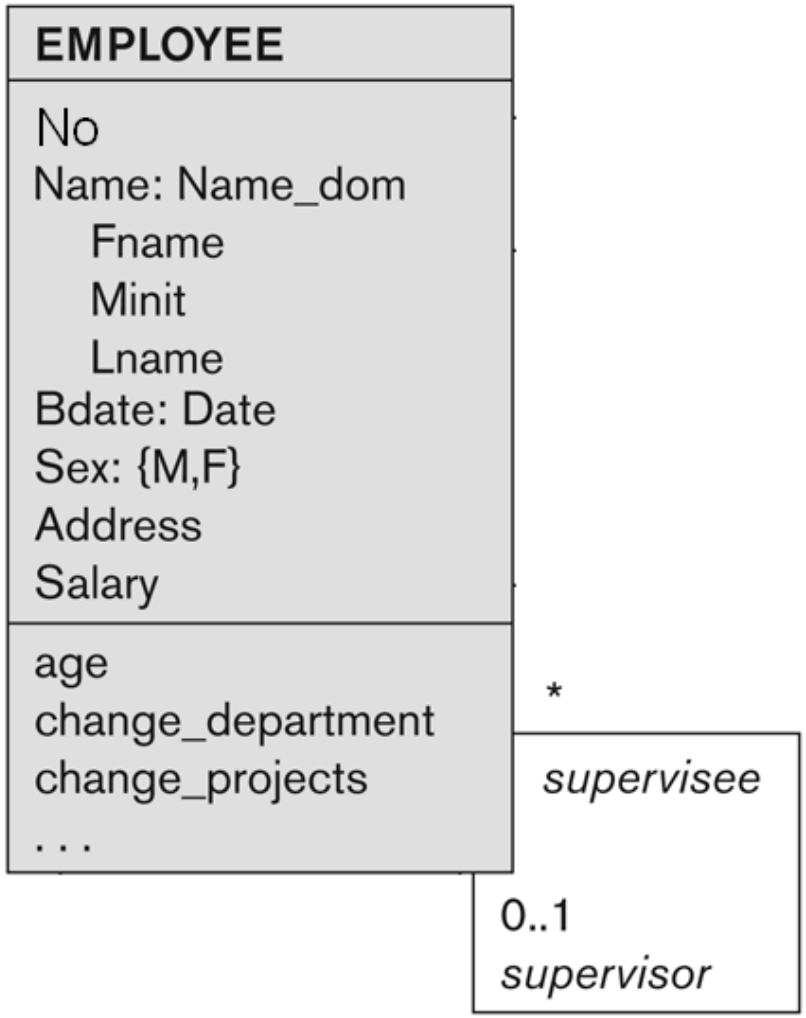


Recursive Relationship Type

- Called ***reflexive association*** in UML
- Role names are also displayed

Reflexive Association

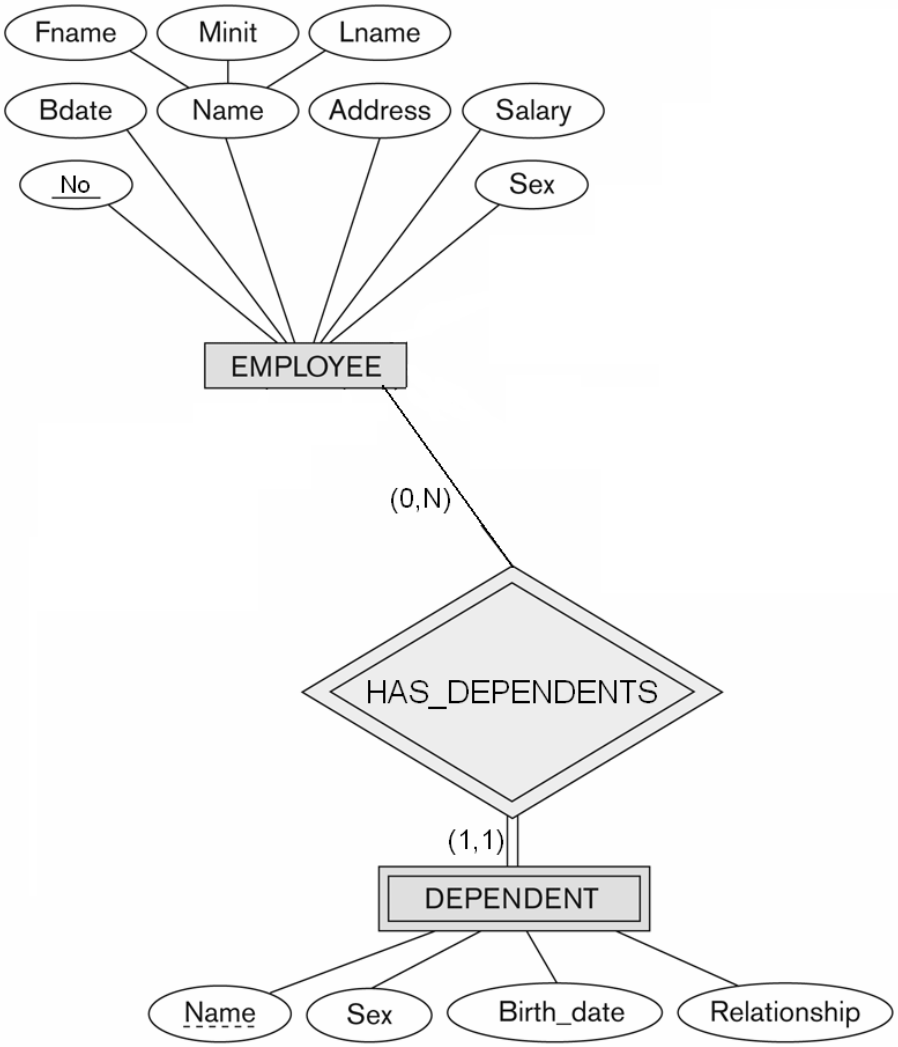


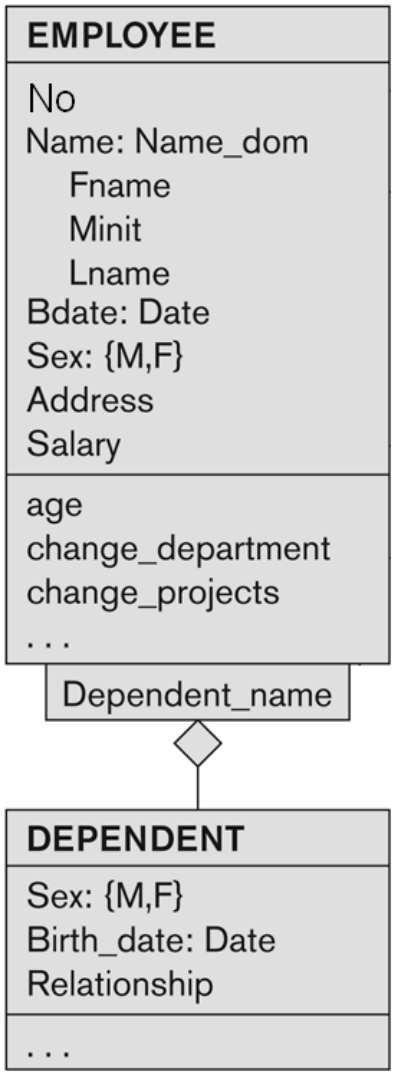


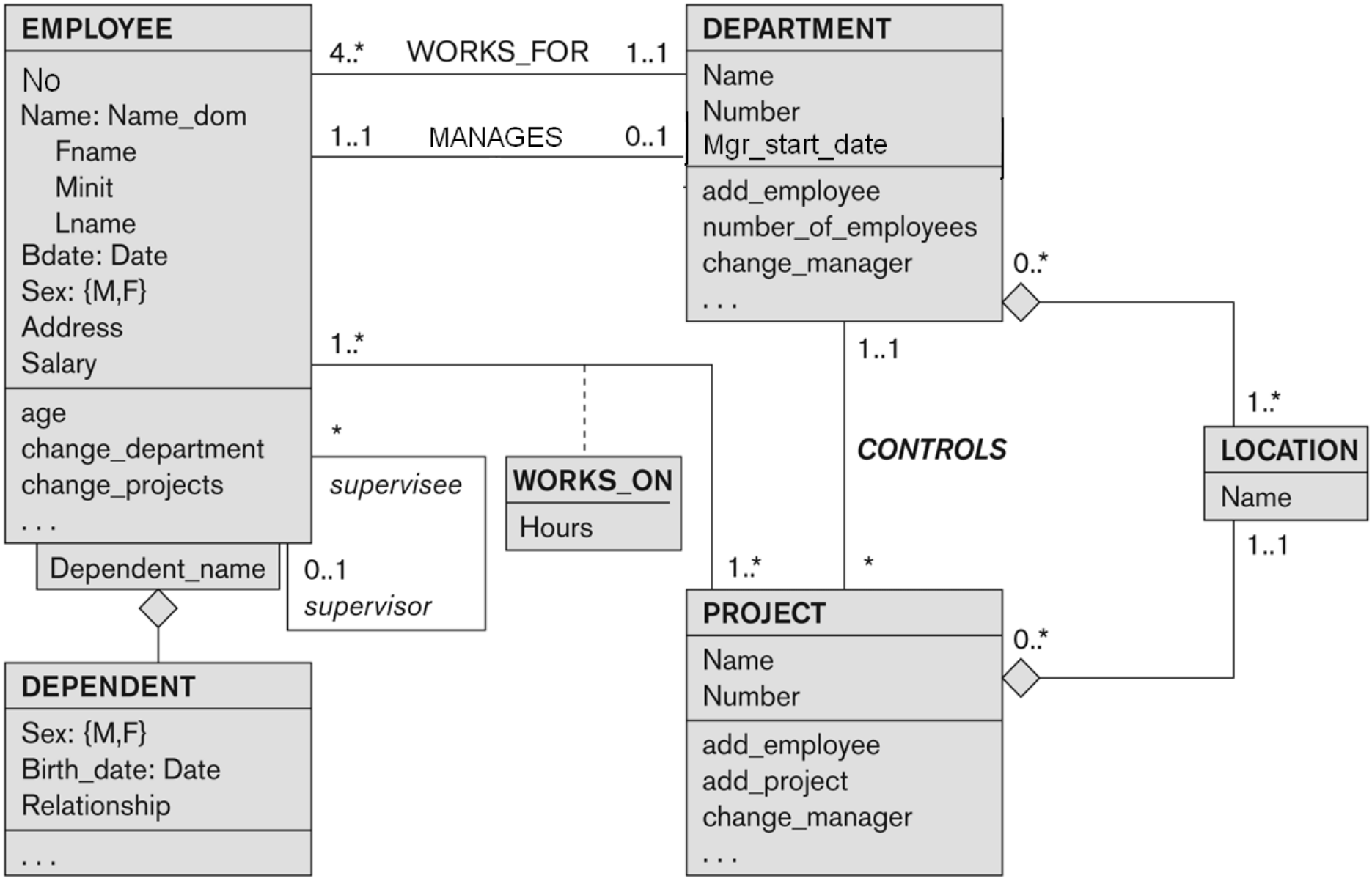
Weak Entity Type

- Partial key is placed in a box attached to the owner class
- Partial key is called as ***discriminator*** in UML

Weak Entity Type

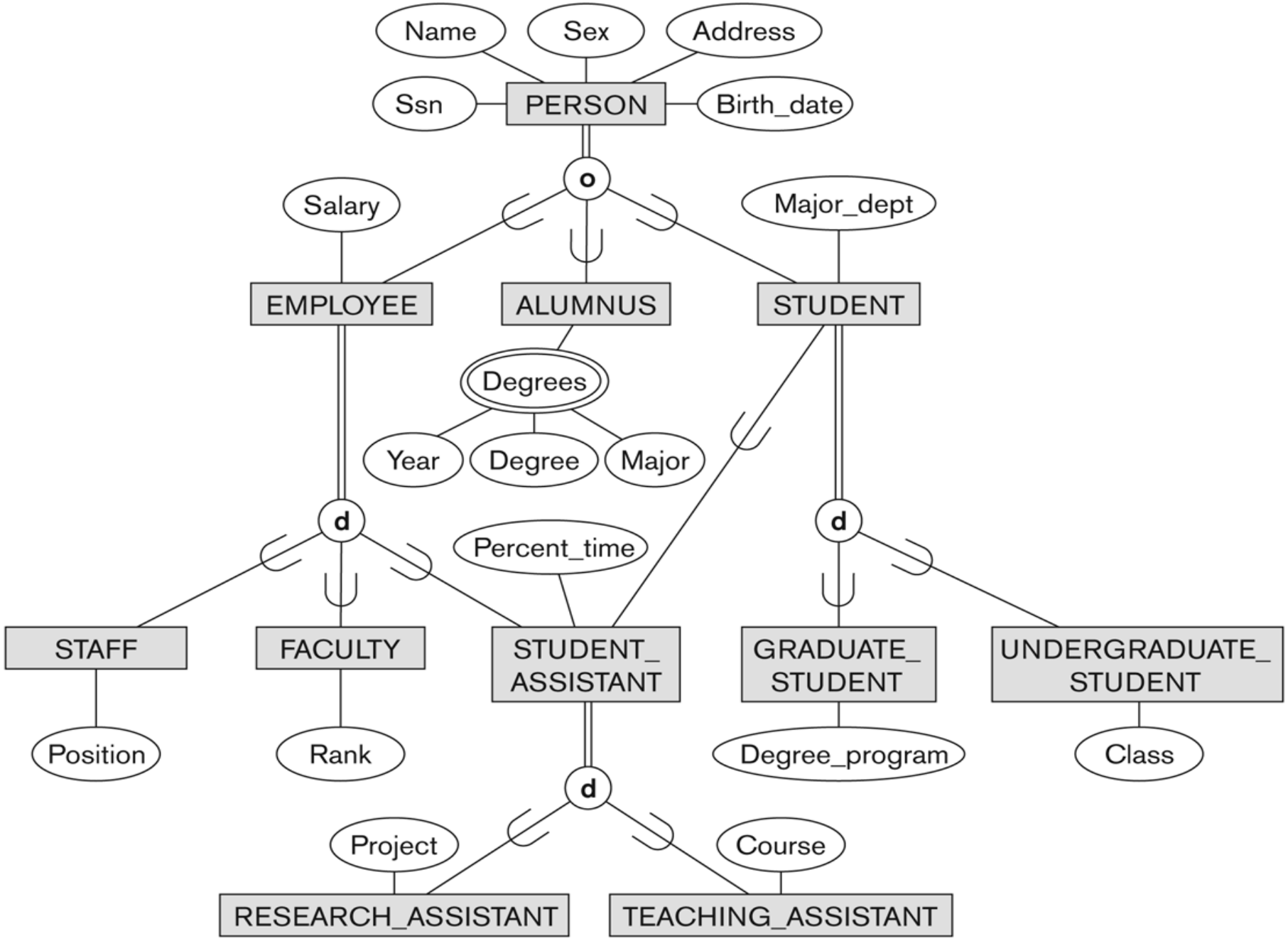


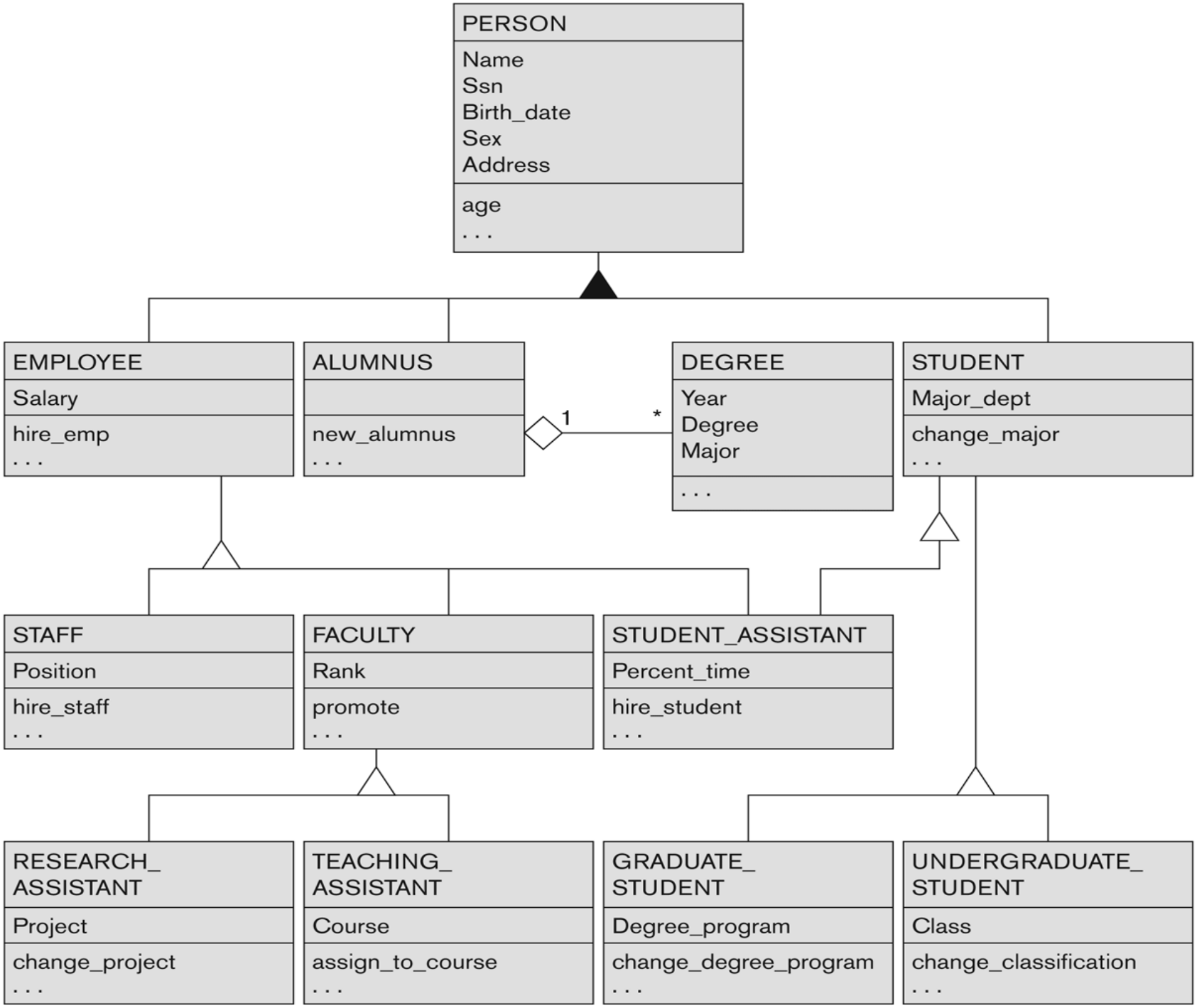



EMPLOYEE
No
Name: Name_dom
Fname
Minit
Lname
Bdate: Date
Sex: {M,F}
Address
Salary
age
change_department
change_projects
. . .
Dependent_name
DEPENDENT
Sex: {M,F}
Birth_date: Date
Relationship
. . .
4..*
WORKS_FOR
1..1
1..1
MANAGES
0..1
1..*
*
supervisee
0..1
supervisor
WORKS_ON
Hours
DEPARTMENT
Name
Number
Mgr_start_date
add_employee
number_of_employees
change_manager
. . .
0..*
1..1
CONTROLS
1..*
*
PROJECT
Name
Number
add_employee
add_project
change_manager
. . .
0..*
1..*
LOCATION
Name
1..1

Specialization/Generalization

- A ***blank*** triangle indicates disjoint specialization
- A ***filled*** triangle indicates overlapping specialization
- Single and multiple inheritance are permitted


Name
Sex
Address
Ssn
PERSON
Birth_date
o
Salary
Major_dept
EMPLOYEE
ALUMNUS
STUDENT
Degrees
Year
Degree
Major
d
Percent_time
d
STAFF
FACULTY
STUDENT_
ASSISTANT
GRADUATE_
STUDENT
UNDERGRADUATE_
STUDENT
Position
Rank
Degree_program
Class
d
Project
Course
RESEARCH_ASSISTANT
TEACHING_ASSISTANT


PERSON
Name
Ssn
Birth_date
Sex
Address
age
. . .
EMPLOYEE
Salary
hire_emp
. . .
ALUMNUS
new_alumnus
. . .
1
*
DEGREE
Year
Degree
Major
. . .
STUDENT
Major_dept
change_major
. . .
STAFF
Position
hire_staff
. . .
FACULTY
Rank
promote
. . .
STUDENT_ASSISTANT
Percent_time
hire_student
. . .
RESEARCH_ ASSISTANT
Project
change_project
. . .
TEACHING_ ASSISTANT
Course
assign_to_course
. . .
GRADUATE_ STUDENT
Degree_program
change_degree_program
. . .
UNDERGRADUATE_ STUDENT
Class
change_classification
. . .