COMP3013 Tutorial01

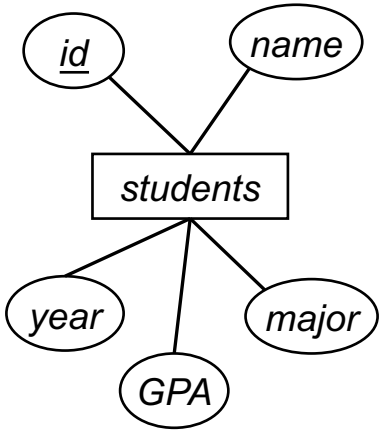
2024 Fall

Outline

- Design Process
  - Conceptual-design -> ER diagram
  - ER diagram Optimization -> redundancies minimized
  - Logical-design -> logical view
  - Physical-design -> implementation
- Entity Sets
  - Entity: A “thing” or “object” in the real world; how to describe? -> attributes
- Attributes
  - Attributes for different purposes can be different
  - Attribute value, domain
  - Key: the set of special attribute(s), can uniquely identify the entities
  - Basic ER Features
- Relationship Sets
- Basic SQL

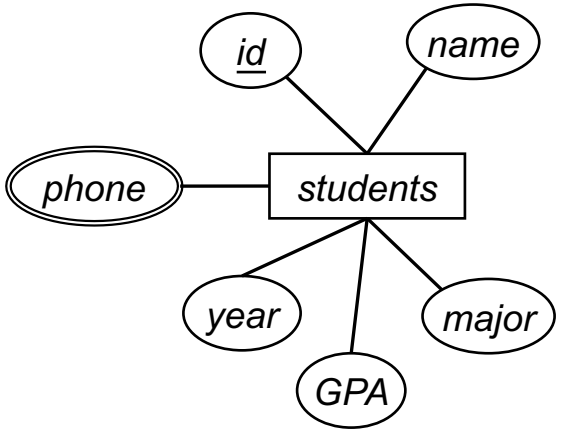
Basic ER Features

- In ER diagrams,
  - ***rectangles*** represent entity sets;
  - ***ellipses*** represent attributes;
  - ***keys*** are underlined; and
  - ***lines*** link attributes to entity sets.
- For example, the student entity set is modeled as follows.



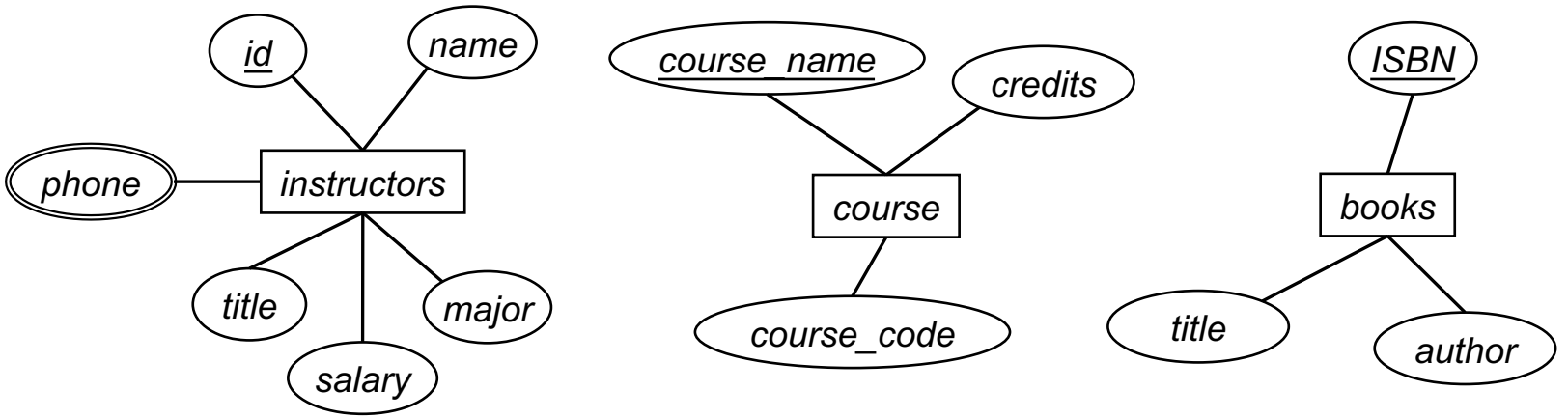
Multi-valued Attribute

- Suppose that we also want to model students' phone number.
- It is possible that one student may have multiple phone numbers.
- Thus, the phone number of a student is a ***multi-valued*** attribute, denoted by ***double ellipses***.



Example

- For more examples, instructors, courses, and books are modeled in the same way.

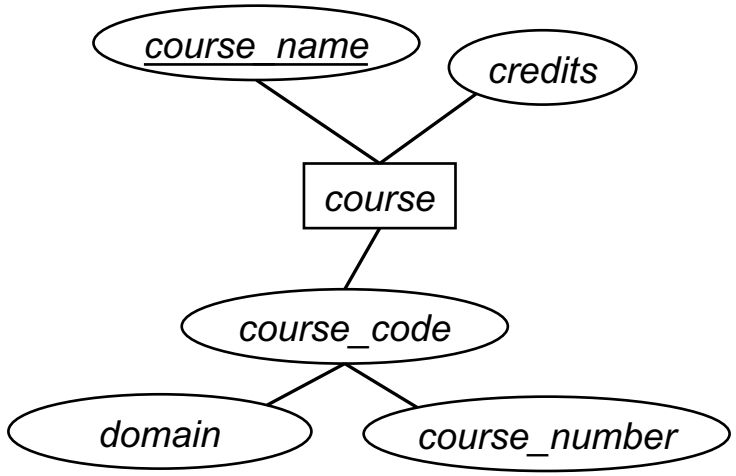


Composite Attribute

- One may ask “why the course code is not selected as a key?”
- The reason is that a course code is not ***atomic***.
- An attribute is atomic if each value of the attribute has only one unit of information.
- If an attribute is not atomic, it is a ***composite attribute***.
- For example, the course code for this database course is “$COMP3013$”.
  - “$COMP$”: the course is in the domain computer science.
  - “3013”: the course number.

Composite Attribute

- Thus, the attribute course code is decomposed into offering unit and course number.



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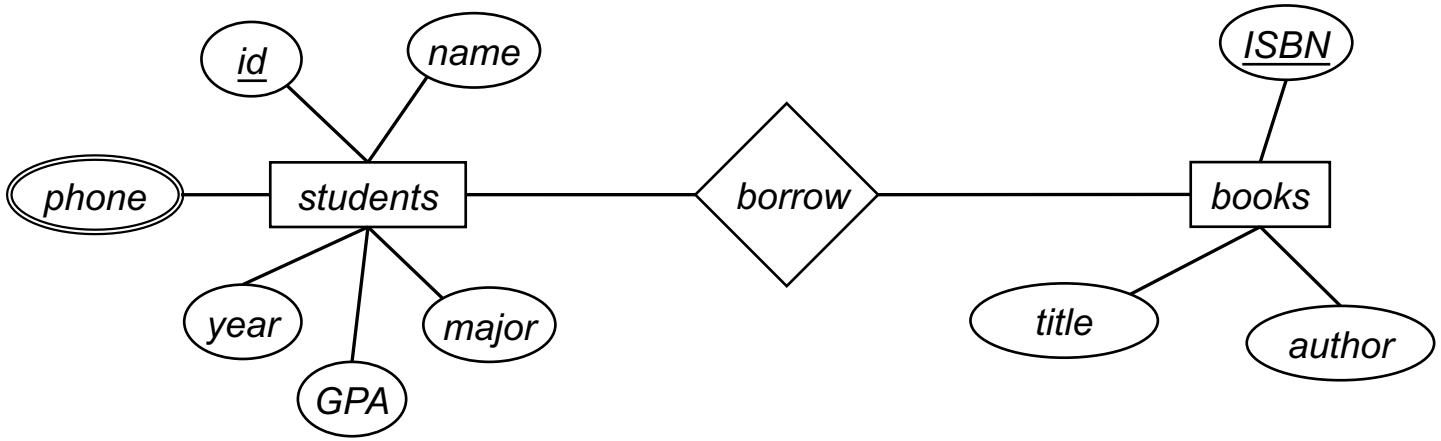
  - Relationship set: a set of relationships of the same type
- Basic SQL

Relationship Set

- In ER diagrams, a relationship set is denoted by a ***diamond***.
- The previous example “students borrow books” can be modeled as

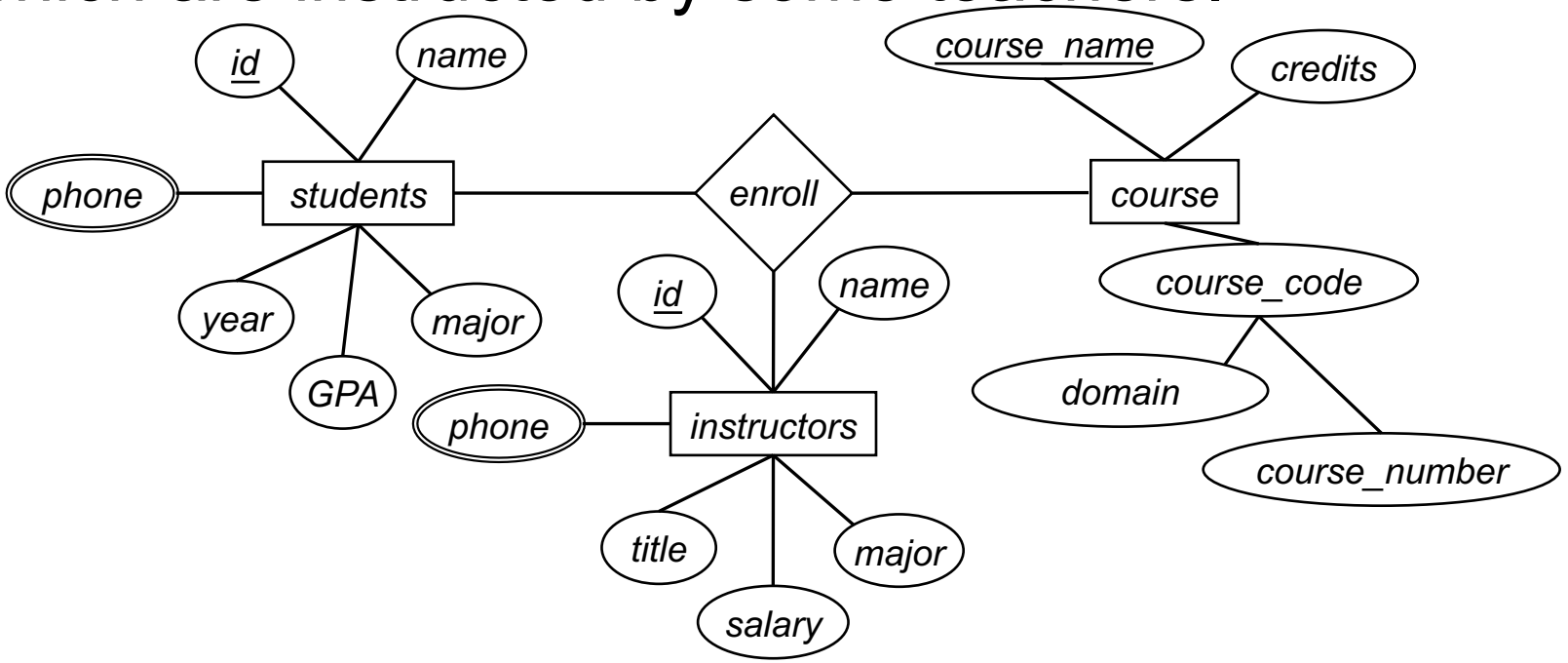


Multi-ary Relationship

- If a relationship associates n entities, this relationship is ***n*-ary**.
- n is the ***degree*** of the relationship
- If $n = 2$, the relationship is ***binary***.
- If $n = 3$, the relationship is ***ternary***.
- Theoretically, n can be any positive integer. But in this course, n is at most 3.

Multi-ary Relationship

- For the following example, a ternary relationship is reasonable.
- This example models that some students are enrolled in some courses which are instructed by some teachers.



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  - roles
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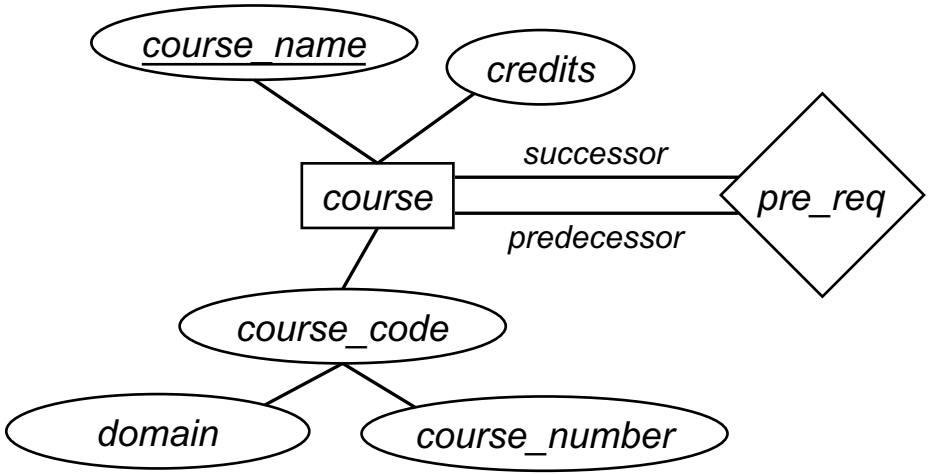
Roles

- Sometimes multiple entities of the same type can participate a same relationship.
- Suppose we want to express “some courses are the prerequisite of some other courses”.
- For example, before taking the database course, one must pass the C program course.
- To model this example, ER diagram allows an entity set to link with a relationship set multiple times.
- Roles are written in text, to express how the entities are participating the relationship.



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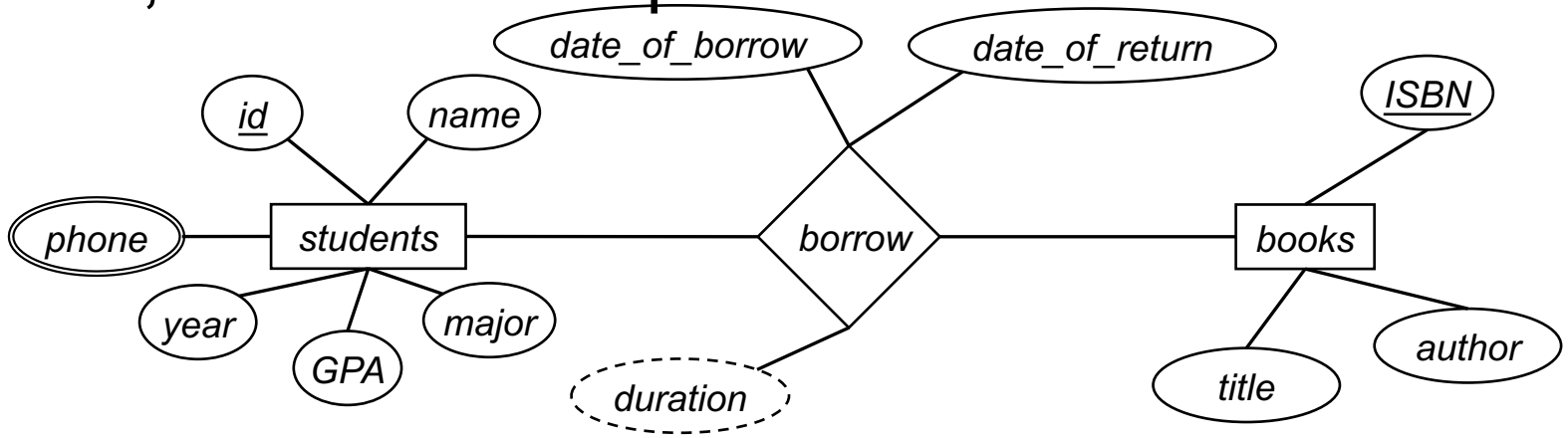
  - Relationship: association between entities
  - Relationship set: a set of relationships of the same type
  - Roles
  - Attributes for relationship sets: derived attributes
- Basic SQL

Attributes for Relationship Sets

- Sometimes people are also interested in some information about relationships.
- In the “students borrow books” example, we also want to know when the book is borrowed, when the book is returned, and how long the book is kept by the student.
- This information does not belong to students or books. It is about the association.
- Thus, in this case, the relationship set can also have some attributes.

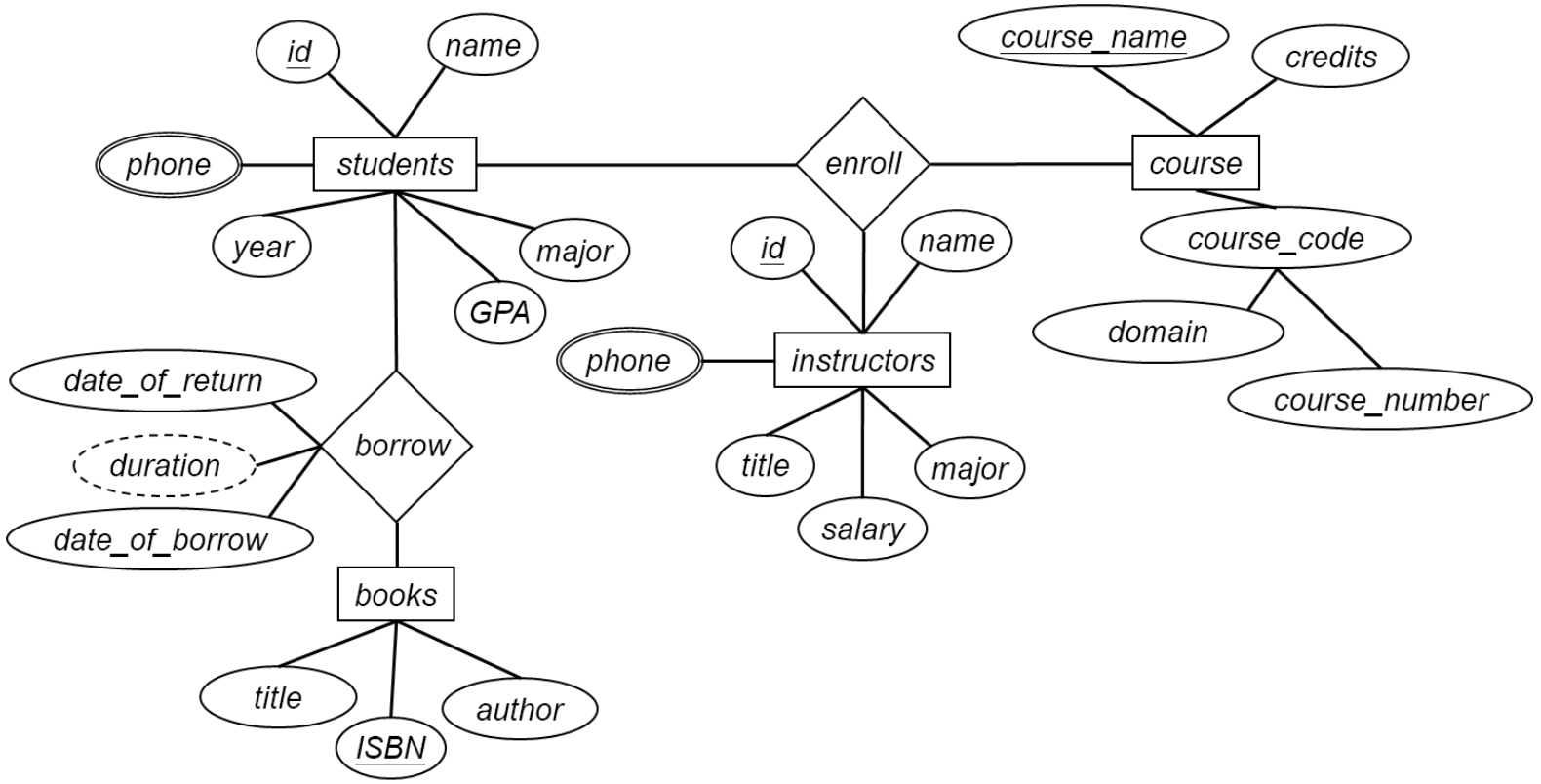


Derived Attributes

- In the previous example, the attribute duration is in a ***dashed ellipse*** because it is a ***derived attribute***.
- If one knows the date of borrow and the date of return, then the duration can be calculated from the two values.

Example

- Summarizing the examples.
- Sometimes designers have to reallocate the positions of some components of the ER diagram to make it beautiful.



How did you do for the class exercise? (Q&A)

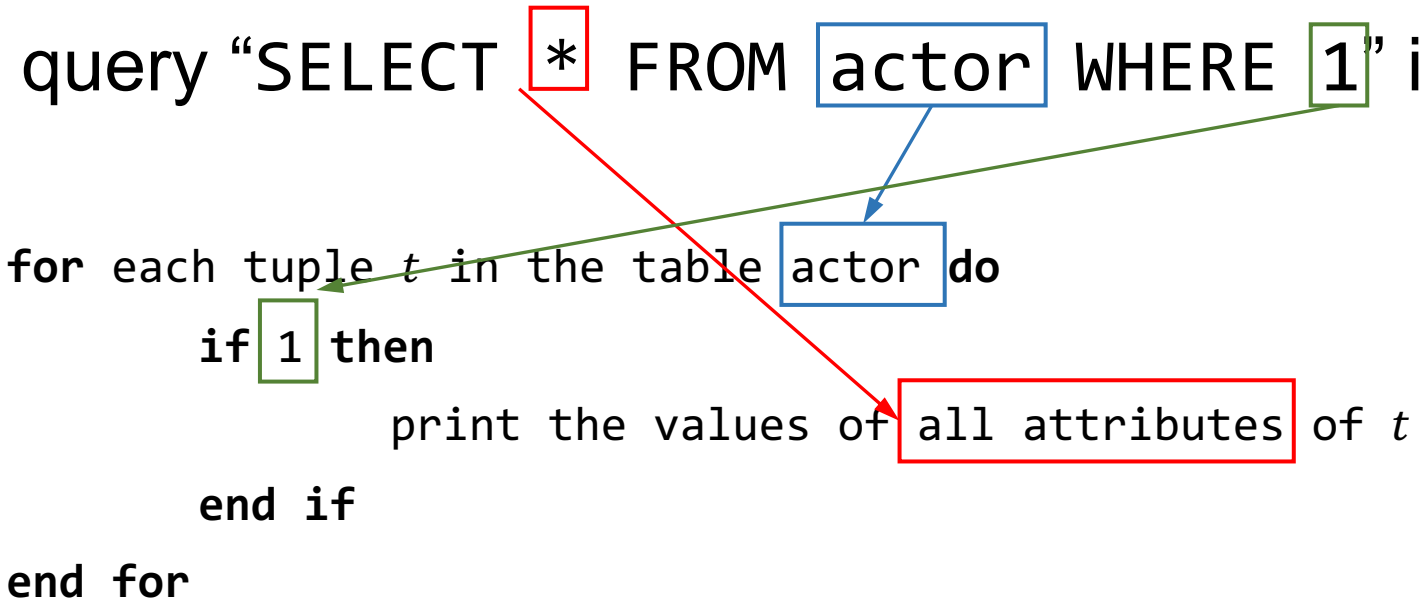
- Based on the ER diagram on the previous page, model the following features.
  - Programs, which have program codes, program names, and the division that each program belongs to.
  - Students have majors.
  - Instructors work for some programs.
  - Every program has a program director, who is also an instructor.
  - Courses are offered by programs.

Outline

- Basic ER Model……
- Basic SQL
  - Predicate
  - String constant
  - Case insensitive
  - Exercises Analysis

Basic Query

- The query "SELECT * FROM actor WHERE 1" is understood as



- Then, you can see the query simply print everything in the table "actor".

Basic Query

- Let's see another example.

```
SELECT title,release_year FROM film WHERE rental_rate<1
```

- Please try to tell the meaning of this query.
- And execute it in the system to check the outcome.

```
for each tuple t in the table film do
        if rental_rate<1 then
                print the values of attributes title and release of t
        end if
end for
```

Basic Query

- In general, a basic query is in the form

  SELECT $a_1, \cdots, a_n$ FROM r WHERE P

  where $a_1, \cdots, a_n$ are attributes; r is a table; and P is a predicate.
- The query is understood as

```
for each tuple t in r do
        if P(t) = 1 then
                print t[a_1], ..., t[a_n]
        end if
end for
```

- The case for multiple tables in the FROM clause will be discussed in the next lab.

Example

- To write a good query, you need to pay attention to three things.
  1. Which table is used?
  2. What is the predicate?
  3. What are the attributes in the result?
- For example, “Find the category ID for Sci-Fi movies”.
  1. Table: category
  2. Predicate: Sci-Fi movies
  3. Attribute: category ID
- Thus, the query is

```
SELECT category_id FROM category WHERE name="Sci-Fi"
```

- For this example, you need to know “Sci-Fi movies” is the attribute “name” of the category.

Exercises

- To write a good query, you need to pay attention to three things.
  1. Which table is used?
  2. What is the predicate?
  3. What are the attributes in the result?

1. Find the information of actors whose first name is Russell.
2. Find the information of actors whose first name is Russell and last name is Close.
3. Find the email of customers whose first name is Harry and active is 0.
4. Find the full name of the actor whose id is 99.
5. Find the title and special features of the films whose replacement cost is lower than 20 and rental rate is higher than 4.0.
6. Find the customer id of the customers who have made a payment on 2005-05-25 but the amount does not exceed 3.