



what are the functional dependencies of this university schema
section (course_id, sec_id, semester, year, building,...



Let's break down the functional dependencies (FDs) for each table in your university schema.

1. section (course_id, sec_id, semester, year, building, room_number, time_slot_id)

• **Primary Key FDs:**

- (course_id, sec_id, semester, year) -> building
- (course_id, sec_id, semester, year) -> room_number
- (course_id, sec_id, semester, year) -> time_slot_id

• **Foreign Key FDs:**

- (building, room_number) -> capacity (from classroom)
- time_slot_id -> day, start_hr, start_min, end_hr, end_min (from time_slot)

2. classroom (building, room_number, capacity)

• **Primary Key FDs:**

- (building, room_number) -> capacity

3. takes (ID, course_id, sec_id, semester, year, grade)

• **Primary Key FDs:**

- (ID, course_id, sec_id, semester, year) -> grade

• **Foreign Key FDs:**

- (course_id, sec_id, semester, year) -> building, room_number, time_slot_id (from section)
- ID -> name, dept_name, tot_cred (from student)

4. teaches (ID, course_id, sec_id, semester, year)

• **Primary Key FDs:**

- (ID, course_id, sec_id, semester, year) -> nothing more, as it is just the primary key.

• **Foreign Key FDs:**

- (course_id, sec_id, semester, year) -> building, room_number, time_slot_id (from section)
- ID -> name, dept_name, salary (from instructor)

5. course (course_id, title, dept_name, credits)

• **Primary Key FDs:**

- course_id -> title
- course_id -> dept_name
- course_id -> credits

• **Foreign Key FDs:**

- dept_name -> building, budget (from department)

6. prereq (course_id, prereq_id)

• **Primary Key FDs:**

- (course_id, prereq_id) -> nothing more, as it is just the primary key.

- **Foreign Key FDs:**
 - course_id -> title, dept_name, credits (from course)
 - prereq_id -> title, dept_name, credits (from course)

7. student (ID, name, dept_name, tot_cred)

- **Primary Key FDs:**
 - ID -> name
 - ID -> dept_name
 - ID -> tot_cred
- **Foreign Key FDs:**
 - dept_name -> building, budget (from department)

8. department (dept_name, building, budget)

- **Primary Key FDs:**
 - dept_name -> building
 - dept_name -> budget

9. instructor (ID, name, dept_name, salary)

- **Primary Key FDs:**
 - ID -> name
 - ID -> dept_name
 - ID -> salary
- **Foreign Key FDs:**
 - dept_name -> building, budget (from department)

10. advisor (s_id, i_id)

- **Primary Key FDs:**
 - s_id -> i_id
- **Foreign Key FDs:**
 - s_id -> name, dept_name, tot_cred (from student)
 - i_id -> name, dept_name, salary (from instructor)

11. time_slot (time_slot_id, day, start_hr, start_min, end_hr, end_min)

- **Primary Key FDs:**
 - time_slot_id -> day
 - time_slot_id -> start_hr
 - time_slot_id -> start_min
 - time_slot_id -> end_hr
 - time_slot_id -> end_min

Important Notes:

- These FDs are based on the primary and foreign key constraints, as well as the inherent relationships between the attributes.
- There might be other FDs that are not explicitly stated in the schema, but these are the most fundamental ones.
- In the time_slot table, although the primary key is (time_slot_id, day, start_hr, start_min), because time_slot_id is unique, it functionally determines all other attributes.

what is the canonical cover of course (course id, title, dept name, credits) FDs = { course_id -> title course_id -> dept_name course_id -> credits title -> dept_name title -> credits }



Let's find the canonical cover of the given set of functional dependencies (FDs):

FDs = { course_id -> title, course_id -> dept_name, course_id -> credits, title -> dept_name, title -> credits }

Steps to find the canonical cover:

1. **Right-hand side (RHS) reduction:**

- Separate FDs with multiple attributes on the RHS:
 - course_id -> title
 - course_id -> dept_name
 - course_id -> credits
 - title -> dept_name
 - title -> credits

2. **Eliminate redundant attributes in the left-hand side (LHS):**

- In this case, all LHS consist of a single attribute, so there are no redundant attributes to remove.

3. **Eliminate redundant FDs:**

- For each FD, check if it can be derived from the other FDs.
- **course_id -> title:**
 - We cannot derive this from other FDs.
- **course_id -> dept_name:**
 - We cannot derive this from other FDs.
- **course_id -> credits:**
 - We cannot derive this from other FDs.
- **title -> dept_name:**
 - We cannot derive this from other FDs.
- **title -> credits:**
 - We cannot derive this from other FDs.
- Now, we need to check if any of these FDs can be derived using the others.
- **Check title -> dept_name:**
 - We can't derive it using course_id -> title, course_id -> dept_name, course_id -> credits, title -> credits.
- **Check title -> credits:**
 - We can't derive it using course_id -> title, course_id -> dept_name, course_id -> credits, title -> dept_name.
- **Check course_id -> dept_name:**
 - We can't derive it using course_id -> title, course_id -> credits, title -> dept_name, title -> credits.

- **Check `course_id` -> `credits`:**
 - We can't derive it using `course_id` -> `title`, `course_id` -> `dept_name`, `title` -> `dept_name`, `title` -> `credits`.
- **Check `course_id` -> `title`:**
 - We can't derive it using `course_id` -> `dept_name`, `course_id` -> `credits`, `title` -> `dept_name`, `title` -> `credits`.
- However, let's examine the closure of `course_id` and `title`:
 - `course_id+` = {`course_id`, `title`, `dept_name`, `credits`}
 - `title+` = {`title`, `dept_name`, `credits`}
- Since `course_id+` contains all attributes, `course_id` is a key.
- Since `title+` contains `dept_name` and `credits`, `title` determines `dept_name` and `credits`.
- All the FDs are already simplified.

Therefore, the canonical cover is:

{ `course_id` -> `title`, `course_id` -> `dept_name`, `course_id` -> `credits`, `title` -> `dept_name`, `title` -> `credits` }

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