### **Final Design Description**

### **Key Entities:**

**Buildings**: Represents all buildings on campus (academic, residential, administrative, etc.).

**Attributes:**

1. building\_id **(Primary Key)**
2. building\_name
3. building\_type**(e.g., academic, residential, administrative, mosque, library, TSC, gymnasium, auditorium)**
4. building\_location
5. total\_floors
6. number\_of\_lifts
7. number\_of\_staircases

**Note:** It serves as the central entity to which other entities are linked.

**Floors:** The floors entity stores information about individual floors within the buildings.

**Attributes:**

1. building\_id **(Foreign Key Ref. Building entities)**
2. floor\_number **(Primary Key)**
3. number\_of\_classrooms
4. number\_of\_teachers\_rooms
5. number\_of\_office\_rooms
6. number\_of\_washrooms
7. number\_of\_lab\_rooms
8. number\_of\_storage\_rooms
9. total\_room

**Note:** The building\_id establishes a relationship between floors and buildings, indicating that each floor belongs to a specific building.

**Rooms**: Represents individual rooms within a building.

Attributes:

1. room\_number **(Primary Key)**
2. building\_id **(Foreign key ref. Building entities)**
3. floor\_number **(Foreign key ref. Floors entities)**
4. room\_type**(e.g. lab room, classroom, teachers room, office room ,storage room, reading room,bed room, dining, prayer room, washroom)**
5. room\_size
6. seat\_type**(e.g , chair, bench)**

**Note:** The building\_id establishes a relationship between rooms and buildings, indicating that each floor belongs to a specific building. Also floor\_number establishes a relationship between floors and rooms.

**Normalization:**

To normalize the database structure for the given entities (Buildings, Floors, and Rooms) following the steps of 1NF, 2NF, 3NF, and BCNF, here is the detailed breakdown:

### **1NF (First Normal Form):**

* Ensure that each column contains atomic values, meaning no repeating groups or arrays of values are allowed.
* All entries in a column must be of the same type.

The provided structure already seems to be in 1NF, with individual attributes clearly defined for Buildings, Floors, and Rooms. Each attribute contains atomic values (e.g., number\_of\_floors, building\_id, etc.), and each entity represents a unique table.

### **2NF (Second Normal Form):**

* Achieve 1NF and ensure no partial dependencies, i.e., no non-prime attribute depends on part of a composite key.

For Floors and Rooms, we have composite keys (building\_id + floor\_number for Floors and building\_id + floor\_number + room\_number for Rooms). We need to ensure that no non-key attribute depends only on part of the composite key.

#### **Tables After 2NF**

#### **1.Building Table (No Change Needed):**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Building\_id | Building\_name | Building\_type | Building\_location | Total\_floors | Number\_of\_lifts | Number\_of\_staircases |
| PK |  |  |  |  |  |  |

1. **Floors Table (Already in 2NF)**  
   Since building\_id is a foreign key and part of the composite key with floor\_number, all attributes in this table depend on the full composite key. No further normalization is required.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Building\_id | floor\_number | Number\_of\_classrooms | Number\_of\_teachers\_rooms | Number\_of\_office\_rooms | Number\_of\_washrooms | Number\_of\_lab\_rooms | Number\_of\_storage\_rooms | Total\_rooms |
| FK(Building) | PK |  |  |  |  |  |  |  |

**Rooms Table**  
The same applies to Rooms, where building\_id and floor\_number establish relationships. All attributes depend on the composite key, so the table remains unchanged.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Room\_number | Building\_id | floor\_number | Room\_type | Room\_size | Seat\_type |
| PK | FK(Building) | FK(Floor) |  |  |  |

### **3NF (Third Normal Form):**

* Achieve 2NF and ensure no transitive dependencies, i.e., non-key attributes should not depend on other non-key attributes.

In the provided structure, there are no transitive dependencies because each attribute depends on the entire primary key in all tables. Therefore, no additional changes are needed.

### **BCNF (Boyce-Codd Normal Form):**

* Every determinant in the table should be a candidate key.
* The tables are already in BCNF because all the determinants (e.g., building\_id, floor\_number, room\_number) are either candidate keys or foreign keys related to primary keys.

**Next Target**

**Auditorium: Represent auditorium information.**

**Attributes:**

* **room\_number** **(Primary Key)**
* **building\_id** **(Foreign Key referencing the Building entity)**
* **building\_name** **(Foreign Key referencing Building name)**
* **floor\_number**
* **room\_type (e.g., Green Room,Electricity Room,Store Room)**
* **audience\_capacity**: Number of people the auditorium can seat
* **audio\_equipment\_available**: Boolean or list of available audio equipment
* **projector\_available**: Boolean, indicating if a projector is available
* **stage\_size**: Dimensions of the stage **(if applicable)**

|  |
| --- |
| **Buildings** |
| building\_id  1. building\_name 2. building\_type 3. building\_location 4. total\_floors 5. number\_of\_lifts 6. number\_of\_staircases |

**E-R Model**

1..M

Has

1…1

1..1

|  |
| --- |
| **Floor** |
| 1. building\_id 2. floor\_number 3. number\_of\_classrooms 4. number\_of\_teachers\_rooms 5. number\_of\_washrooms 6. number\_of\_lab\_rooms 7. number\_of\_storage\_rooms 8. total\_room |

|  |
| --- |
| **Room** |
| 1. room\_number 2. building\_id 3. floor\_number 4. room\_type 5. room\_size 6. seat\_type |

1..M 1..1

Has