**Database Systems assignment 2**

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**Solution 1-**

1NF or First Normal Form.

* The domain of an attribute in the 1NF must include only atomic (simple, indivisible) values and that the value of any attribute in a tuple must be a single value from the domain of that attribute. 1NF disallows relations within relations, or relations as attribute values within the tuple. For finding a 1NF, we form new relation for each multivalued or nested relation

2NF or Second Normal Form

* For a relational schema R, if every nonprime attribute A in R is fully functionally dependent on the primary key of R, R is said to be in 2NF. The test for 2NF involves testing for functional dependencies whose left-hand side attributes are part of the primary key. For finding a 2NF, we decompose and set up a new relation for each partial key with its dependent attribute, while making sure the relations between the original primary key and any attributes dependent on it are maintained.

3NF or Third Normal Form

* A relation schema R is in 3NF if it satisfies 2NF and no nonprime attribute of R is transitively dependent on the primary key. For making a 3NF, we decompose and set up a relation that includes the non-key attributes that functionally determines other non-key attributes.

**Solution 2-**

We can observe the following functional dependencies –

* Project ID -> Project Name
* Guide ID -> {Guide Name, Place Name, Hourly Salary per Place} (and its subsets)
* Place Name -> Hourly Salary per Place
* Guide Name -> Place Name

**Solution 3-**

The given table is –

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Project ID** | **Project Name** | **Guide ID** | **Guide Name** | **Place ID** | **Place Name** | **Hourly Salary per Place (Rs.)** |
| 23 | Bangalore City Tour | 10,  11,  12 | Rajeev  Manoj  Anil | 25,  23,  20 | Lalbagh Garden,  Innovative Film City,  Bangalore Palace | 550,  400,  800 |
| 56 | Mysore City Tour | 1,  2 | Prem,  Kapil | 28,  23 | Vrindavan Garden,  Mysore Palace | 700,  800 |

The **first normal form** doesn’t allow multivalued attributes. In the table we can observe multivalued attributes as follows –

* Place ID
* Hourly salary per place (Rs)

We change the tables so that each attributes behave like single valued attributes-

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Project ID** | **Project Name** | **Guide ID** | **Guide Name** | **Place ID** | **Place Name** | **Hourly Salary per Place (Rs.)** |
| 23 | Bangalore City Tour | 10 | Rajeev | 25 | Lalbagh Garden | 550 |
| 23 | Bangalore City Tour | 11 | Manoj | 23 | Innovative Film City | 400 |
| 23 | Bangalore City Tour | 12 | Anil | 20 | Bangalore Palace | 800 |
| 56 | Mysore City Tour | 1 | Prem | 28 | Vrindavan Garden | 700 |
| 56 | Mysore City Tour | 2 | Kapil | 23 | Mysore Palace | 800 |

For choosing the candidate key, we have to choose the key such that the attributes which are not a part of the key are functionally dependent on our key. In this case our key will be

{Project ID, Guide ID}. All the non-prime attributes are functionally dependent on the key. Attribute Project Name and Guide Name is only partially dependent on our key. **To convert the table into 2NF** form, we need to remove that. Thus, we can separate the partial key Project ID and Project Name since Project Name is fully functional dependent on partial key, Project ID.

|  |  |
| --- | --- |
| **Project ID** | **Project Name** |
| 23 | Bangalore City Tour |
| 56 | Mysore City Tour |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Project ID** | **Guide ID** | **Guide Name** | **Place ID** | **Place Name** | **Hourly Salary per Place (Rs)** |
| 23 | 10 | Rajeev | 25 | Lalbagh Garden | 550 |
| 23 | 11 | Manoj | 23 | Innovative Film City | 400 |
| 23 | 12 | Anil | 20 | Bangalore Palace | 800 |
| 56 | 1 | Prem | 28 | Vrindavan Garden | 700 |
| 56 | 2 | Kapil | 23 | Mysore Palace | 800 |

From the table, we can find the following transitive relations,

{Project ID, Guide ID} -> {Guide Name, Place Name}

{Guide Name, Place Name} -> Hourly Salary per Place,

{Project ID, Guide ID} -> Hourly Salary per Place

We can separate {Guide Name, Place Name} -> Hourly Salary per Place into another table.

Thus **the 3NF form can be –**

|  |  |
| --- | --- |
| **Project ID** | **Project Name** |
| 23 | Bangalore City Tour |
| 56 | Mysore City Tour |

|  |  |  |
| --- | --- | --- |
| **Guide Name** | **Place Name** | **Hourly Salary per Place** |
| Rajeev | Lalbagh Garden | 550 |
| Manoj | Innovative Film City | 400 |
| Anil | Bangalore Palace | 800 |
| Prem | Vrindavan Garden | 700 |
| Kapil | Mysore Palace | 800 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Project ID** | **Guide ID** | **Guide Name** | **Place ID** |
| 23 | 10 | Rajeev | 25 |
| 23 | 11 | Manoj | 23 |
| 23 | 12 | Anil | 20 |
| 56 | 1 | Prem | 28 |
| 56 | 2 | Kapil | 23 |