Here is some data that is to be kept in a database. Projects have multiple employees working on them. Pay rates are set by an employee’s job class. Normalize this data from unnormalized to 3NF. Explain what you are doing and why you are doing it at each step. Only do what is required from each transition from one form to the next. Once you have explained a transition, show the new relations and their attributes. This can be of the form TABLE(A1, A2,..An). Make sure you have indicated keys where necessary by underlining them.

This is sample data but does not represent all possibilities of data. Keep this in mind so you do not base your responses only on this dataset. For example, an employee could work on more than one project.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Proj\_Num | Proj\_Name | Emp\_Num | Emp\_Name | Job\_Class | CHG\_Hour | Hours |
| 15 | Evergreen | 103 | June E. Arbough | Elct. Engineer | $84.50 | 23.8 |
|  |  | 101 | John G. News | Database  Engineer | $105.00 | 19.4 |
|  |  | 105 | Alice K  Johnson \* | Database  Engineer | $105.00 | 35.7 |
|  |  | 106 | William Smithfield | Programmer | $35.75 | 12.6 |
|  |  | 102 | David H.  Senior | Systems Analyst | $96.75 | 23.8 |
| 18 | Amber Wave | 114 | Annelise Jones | Application Designer | $48.10 | 24.6 |
|  |  | 118 | James J Frommer | General  Support | $18.36 | 45.3 |
|  |  | 104 | Anne K. Ramoras | System Analyst | $96.75 | 32.4 |
|  |  | 112 | Darlen M.  Smithson | DSS Analyst | $45.95 | 44.0 |

Answer:

**1NF**

In the table I am considering proj\_Num as a primary key and it contains NULL values. For converting into 1NF relational tables must not contain NULL values. I am adding exact entries in proj\_Num column to eliminate NULL values.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Proj\_Num | Proj\_Name | Emp\_Num | Emp\_Name | Job\_Class | CHG\_Hour | Hours |
| 15 | Evergreen | 103 | June E. Arbough | Elct. Engineer | $84.50 | 23.8 |
| 15 | Evergreen | 101 | John G. News | Database  Engineer | $105.00 | 19.4 |
| 15 | Evergreen | 105 | Alice K  Johnson \* | Database  Engineer | $105.00 | 35.7 |
| 15 | Evergreen | 106 | William Smithfield | Programmer | $35.75 | 12.6 |
| 15 | Evergreen | 102 | David H.  Senior | Systems Analyst | $96.75 | 23.8 |
| 18 | Amber Wave | 114 | Annelise Jones | Application Designer | $48.10 | 24.6 |
| 18 | Amber Wave | 118 | James J Frommer | General  Support | $18.36 | 45.3 |
| 18 | Amber Wave | 104 | Anne K. Ramoras | System Analyst | $96.75 | 32.4 |
| 18 | Amber Wave | 112 | Darlen M.  Smithson | DSS Analyst | $45.95 | 44.0 |

In 1NF all NULL values are removed. All attributes are depending on the primary key.

**2NF**

It includes all 1NF conditions and it includes no partial dependencies i.e no attribute is dependent on only a portion of the primary key. So I created three tables

1.Project (Proj\_Num, Proj\_Name)

2.Employee (Emp\_Num, Emp\_Name, Job\_Class, CHG\_Hour)

3.Alloted Project(Proj\_Num, Emp\_Num, Hours)

2NF tables:

1 Project Table

|  |  |
| --- | --- |
| Proj\_Num | Proj\_Name |
| 15 | Evergreen |
| 15 | Evergreen |
| 15 | Evergreen |
| 15 | Evergreen |
| 15 | Evergreen |
| 18 | Amber Wave |
| 18 | Amber Wave |
| 18 | Amber Wave |
| 18 | Amber Wave |

2. Employee Table

|  |  |  |  |
| --- | --- | --- | --- |
| Emp\_Num | Emp\_Name | Job\_Class | CHG\_Hour |
| 103 | June E. Arbough | Elct. Engineer | $84.50 |
| 101 | John G. News | Database  Engineer | $105.00 |
| 105 | Alice K  Johnson \* | Database  Engineer | $105.00 |
| 106 | William Smithfield | Programmer | $35.75 |
| 102 | David H.  Senior | Systems Analyst | $96.75 |
| 114 | Annelise Jones | Application Designer | $48.10 |
| 118 | James J Frommer | General  Support | $18.36 |
| 104 | Anne K. Ramoras | System Analyst | $96.75 |
| 112 | Darlen M.  Smithson | DSS Analyst | $45.95 |

3.Alloted Project Table

|  |  |  |
| --- | --- | --- |
| Proj\_Num | Emp\_Num | Hours |
| 15 | 103 | 23.8 |
| 15 | 101 | 19.4 |
| 15 | 105 | 35.7 |
| 15 | 106 | 12.6 |
| 15 | 102 | 23.8 |
| 18 | 114 | 24.6 |
| 18 | 118 | 45.3 |
| 18 | 104 | 32.4 |
| 18 | 112 | 44.0 |

3NF

It includes all 2NF condition and also it contains no transitive dependencies. Therefor I Created a separate table with for each set of attributes in a transitive functional dependence relationship

1. Project (Proj\_Num, Proj\_Name)

2. Employee (Emp\_Num, Emp\_Name, Job\_Class)

3. Job (Job\_Class, CHG\_Hour)

4. Alloted Project(Proj\_Num, Emp\_Num, Hours)

1 Project Table

|  |  |
| --- | --- |
| Proj\_Num | Proj\_Name |
| 15 | Evergreen |
| 15 | Evergreen |
| 15 | Evergreen |
| 15 | Evergreen |
| 15 | Evergreen |
| 18 | Amber Wave |
| 18 | Amber Wave |
| 18 | Amber Wave |
| 18 | Amber Wave |

2. Employee Table

|  |  |  |
| --- | --- | --- |
| Emp\_Num | Emp\_Name | Job\_Class |
| 103 | June E. Arbough | Elct. Engineer |
| 101 | John G. News | Database  Engineer |
| 105 | Alice K  Johnson \* | Database  Engineer |
| 106 | William Smithfield | Programmer |
| 102 | David H.  Senior | Systems Analyst |
| 114 | Annelise Jones | Application Designer |
| 118 | James J Frommer | General  Support |
| 104 | Anne K. Ramoras | System Analyst |
| 112 | Darlen M.  Smithson | DSS Analyst |

3. Job Table

|  |  |
| --- | --- |
| Job\_Class | CHG\_Hour |
| Elct. Engineer | $84.50 |
| Database  Engineer | $105.00 |
| Database  Engineer | $105.00 |
| Programmer | $35.75 |
| Systems Analyst | $96.75 |
| Application Designer | $48.10 |
| General  Support | $18.36 |
| System Analyst | $96.75 |
| DSS Analyst | $45.95 |

3.Alloted Project Table

|  |  |  |
| --- | --- | --- |
| Proj\_Num | Emp\_Num | Hours |
| 15 | 103 | 23.8 |
| 15 | 101 | 19.4 |
| 15 | 105 | 35.7 |
| 15 | 106 | 12.6 |
| 15 | 102 | 23.8 |
| 18 | 114 | 24.6 |
| 18 | 118 | 45.3 |
| 18 | 104 | 32.4 |
| 18 | 112 | 44.0 |