SUPPLIER

|  |  |  |
| --- | --- | --- |
| **Bank\_Acount\_Number** | Company\_Name | Contant\_number |

BOOKSTORE

|  |  |  |  |
| --- | --- | --- | --- |
| City | **Address** | Account | Date\_opened |

BOOK

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Title | **ISBN** | FName | Middle\_INIT | LName | Price | Amount\_In\_Stock | TTransaction\_Number |

TRANSACTION

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Time | **Transaction\_Number** | EIRD\_Number | Ccustomer\_ID |

EMPLOYEE

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| FNAME | Middle\_INIT | LName | **IRD\_Number** | Contact\_Number | Weekly\_Hours | Hourly\_Rate | BAddress | Wage |

CUSTOMER

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Stree\_Number | Street\_Name | Suburb | City | Postcode | **Customer\_ID** | FName | LName | Phone\_Number |

QUALIFICATIONS

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **EIRD\_Number** | **Name** | Date\_Received | Expiry\_Date | EIRD\_Number | ~~Type~~ |

SUPPLIES

|  |  |
| --- | --- |
| **SBank\_Acount\_Number** | **BISBN** |

QUALIFICATIONS\_TYPE

|  |  |  |
| --- | --- | --- |
| **EIRD\_Number** | **QName** | **QType** |

SUPPLIER

|  |  |  |
| --- | --- | --- |
| **Bank\_Account\_Number** | Company\_Name | Contact\_number |

This relation is already a BCNF.

1NF: All attributes values are atomic

2NF:

FD1: Bank\_Account\_Number -> Company\_Name, Contact\_Number

FD2: Contact\_Number -> Bank\_Account\_Number, Company\_Name

The PK contains a single attribute which is Bank\_Account\_Number, there is nothing to be done.

3NF: Company\_name and Contact\_number is non-transitively dependent on the primary key Bank\_Account\_Number

BCNF: It is in BCNF

BOOKSTORE

|  |  |  |  |
| --- | --- | --- | --- |
| City | **Address** | Account | Date\_opened |

This relation is already a BCNF

1NF: All attribute values are atomic

2NF: The PK contains only one attribute. There is no partial dependency.

3NF: There is no transitive dependency in this relation.

BCNF: This is in BCNF.

BOOK

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Title | **ISBN** | FName | Middle\_INIT | LName | Price | Amount\_In\_Stock | TTransaction\_Number |

**Step 1 : 1NF:**

All attribute values are atomic, so it is already in 1NF.

Should TTransaction\_number be treated as a non-atomic value in this relation? (For the purpose of identifying each book individually. As each TTransaction\_Number identifies a set of books but not single books).

**Step 2: 2NF:**

FD1: ISBN -> Title, FName,Middle\_INIT,LName,Price,Amount\_in\_Stock

FD2: {Title,FName,Middle\_INIT,LName} -> ISBN,Price,Amount\_in\_Stock

NOTE: Where does Transaction Number depend on?

TRANSACTION

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Time | **Transaction\_Number** | EIRD\_Number | Ccustomer\_ID |

Step 1: 1NF:

All attributes are atomic values.

Step 2: 2NF:

FD1: Transaction\_Number -> Time,Date,EIRD\_Number,Ccustomer\_ID

FD2: {Date,Time,EIRD} -> Transaction\_Number, Ccustomer\_ID

FD3: {Ccustomer\_ID, Date,Time} -> Transaction\_Number, EIRD\_Number

Step 3: 3NF:

The relation is in 3NF because all attributes are prime attributes.

Step 4: BCNF

The relation is in BCNF, as all attributes are prime attributes.

EMPLOYEE

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| FNAME | Middle\_INIT | LName | **IRD\_Number** | Contact\_Number | Weekly\_Hours | Hourly\_Rate | BAddress | Wage |

Step 1: 1NF:

All attributes are atomic, thus the relation is in 1NF.

Step 2: 2NF:

FD1: IRD\_Number -> FNAME, Middle\_INIT, LName, Contact\_Number, Weekly\_Hours, Hourly\_Rate,BAddress,Wage

FD2: {Weekly\_Hours,Hourly\_Rate} -> Wage

Step 3: 3NF:

FD2 in EMPLOYEE relation violates 3NF because Wage is not a prime attribute and {Weekly\_Hours , Hourly\_Rate} is not a superkey of R.

Post-Normalization:

EMPLOYEE

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| FNAME | Middle\_INIT | LName | **IRD\_Number** | Contact\_Number | Weekly\_Hours | Hourly\_Rate | BAddress |

EMPLOYEE\_WAGE

|  |  |  |
| --- | --- | --- |
| **Weekly\_Hours** | **Hourly\_Rate** | wage |

Step 4: BCNF

Both relations satisfy the conditions of BCNF.

CUSTOMER

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Street\_Number | Street\_Name | Suburb | City | Postcode | **Customer\_ID** | FName | LName | Phone\_Number |

FD1: Customer\_ID -> Street\_Number,Street\_Name, Suburb, City, Postcode, FName, LName, Phone\_Number

FD2: Postcode-> {City, Suburb}

Step 1: 1NF:

All attributes are atomic in this relation.

Step 2: 2NF:

FD1 has a single attribute, and FD2 cannot be reduced further.

Step 3: 3NF:

FD2 in CUSTOMER violates 3NF because Postcode is not a superkey; and the set {City, Suburbs} is not a primary attribute.

Post normalization:

CUSTOMER

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Street\_Number | Street\_Name | Postcode | **Customer\_ID** | FName | LName | Phone\_Number |

POSTCODE

|  |  |  |
| --- | --- | --- |
| **Postcode** | Suburb | City |

Step 4: BCNF

Both relations satisfy the conditions of BCNF.

QUALIFICATIONS

|  |  |  |  |
| --- | --- | --- | --- |
| **EIRD\_Number** | **Name** | Date\_Received | Expiry\_Date |

FD1: {EIRD\_Number, Name} -> Date\_Received, Expiry\_Date

Step 1: 1NF:

All attributes are atomic values.

Step 2: 2NF:

The relation is already in 2NF because the Primary Key cannot be reduced further.

Step 3: 3NF:

The relation is in 3NF because there are no other functional dependencies.

Step 4: BCNF

The relation satisfies all conditions of BCNF because the left hand side of the FD1 is a superkey.

QUALIFICATIONS\_TYPE

//ASK HAIBO

|  |  |  |
| --- | --- | --- |
| **EIRD\_Number** | **QName** | **QType** |

FD1: {EIRD\_Number,QName} -> QType

Step 1: 1NF:

Step 2: 2NF:

Step 3: 3NF:

Step 4: BCNF

SUPPLIES

|  |  |
| --- | --- |
| **SBank\_Acount\_Number** | **BISBN** |

BCNF:

This relation is already in BCNF because the combination of its attributes form the primary key.