**DATABASE SCHEMA BEFORE NORMALISATION:**

**Asset Management System(** Customer\_id, Account\_Number, First\_name, Last\_name, Phone\_No, door\_no, street, city, state, dob, Age, Occupation, No\_of\_schemes, Account\_Number, IFSC\_code, Account\_holder, Account\_balance, Instrument\_ID, Invested\_date, Maturity\_date, Face\_value, Stock\_value, Maturity\_amount, Ownership, Maturity\_amount, Rates\_of\_interest, Maturity\_amount, Employee\_id, First\_name, Last\_name, Role, Salary, Scheme\_name, no\_of\_workers, no\_of\_clients, No\_of\_employees, No\_of\_customers, No\_of\_schemes, Profits\_per\_year, Year, Stocks\_and\_equities, Real\_estate, Debt\_funds, Bonds, Invested\_amount **).**

**NORMALIZATION PROCEDURE:**

**1st Normalization:-**

**The multivalued and non-atomic attributes are:**

1. Phone\_No
2. dob
3. Account\_Number
4. IFSC\_code
5. Invested\_date
6. Maturity\_date

**The repeating attributes in the schema are:**

1. Maturity\_amount
2. First\_name
3. Last\_name
4. Account\_Number
5. No\_of\_schemes

**After removing all the multivalued, non-atomic and duplicated attributes, the schema looks like:**

**1NF TABLES:**

**(1)Asset Management System(** Customer\_id, Instrument\_ID, Employee\_id, Year, First\_name, Last\_name, door\_no, street, city, state, Age, Occupation, No\_of\_schemes, Account\_holder, Account\_balance, Face\_value, Stock\_value, Ownership, Rates\_of\_interest, Maturity\_amount, Role, Salary, Scheme\_name, no\_of\_workers, no\_of\_clients, No\_of\_employees, No\_of\_customers, Profits\_per\_year, Stocks\_and\_equities, Real\_estate, Debt\_funds, Bonds, Invested\_amount **).**

**Functional dependencies,**

1. Customer\_id **->** First\_name, Last\_name, door\_no, street, city, state, Age, Occupation, No\_of\_schemes, Account\_holder, Account\_balance, Invested\_amount
2. Account\_holder -> Account\_balance
3. Instrument\_ID -> Face\_value, Stock\_value, Ownership, Rates\_of\_interest, Maturity\_amount, Invested\_amount
4. Employee\_id -> Role, Salary, Scheme\_name, no\_of\_workers, no\_of\_clients
5. Scheme\_name -> no\_of\_workers, no\_of\_clients
6. Year -> Profits\_per\_year, Stocks\_and\_equities, Real\_estate, Debt\_funds, Bonds
7. Year -> No\_of\_employees, No\_of\_customers, Stocks\_and\_equities, Real\_estate, Debt\_funds, Bonds
8. Invested\_amount -> Face\_value, Maturity\_amount
9. Invested\_amount, Maturity\_amount -> Stock\_value
10. Rates\_of\_interest -> Maturity\_amount
11. Profits\_per\_year -> No\_of\_employees, No\_of\_customers

**(2) Customer\_info(**Customer\_id, dob, Phone\_No, No\_of\_schemes**)**

Here,

Phone\_No acts as a primary key.

Functional Dependencies,

* Customer\_id -> Phone\_No
* Customer\_id -> dob
* Customer\_id -> No\_of\_schemes

**(3) Investment\_details(** Instrument\_ID, Scheme\_name, Customer\_id, Invested\_date, Maturity\_date **)**

Here,

Instrument\_ID acts as a primary key.

Functional dependencies,

* Instrument\_ID -> Invested\_date, Scheme\_name, Customer\_id
* Invested\_date, Instrument\_ID -> Maturity\_date

**2nd NORMALIZATION:**

The tables are in 1NF.

There are no partial dependencies because every table consists of only one primary key. Therefore, all non-key attributes in the table will only depend upon that single primary key.

So the tables are already in 2nd normalized form.

**3RD NORMALIZATION:**

The tables are in 2NF.

**Transitive dependencies,**

1. Customer\_id -> Account\_holder -> Account\_balance
2. Employee\_id -> Scheme\_name -> no\_of\_workers, no\_of\_clients
3. Year -> Profits\_per\_year -> No\_of\_employees, No\_of\_customers
4. Customer\_id **->** Instrument\_ID -> Face\_value, Stock\_value, Ownership, Rates\_of\_interest, Maturity\_amount
5. Instrument\_ID -> Invested\_amount -> Face\_value, Maturity\_amount
6. Instrument\_ID -> Invested\_amount, Maturity\_amount -> Stock\_value
7. Instrument\_ID -> Rates\_of\_interest -> Maturity\_amount

**After removing the transitive dependencies, the obtained tables are:**

1. **Personal\_details(** Customer\_id, First\_name, Last\_name, door\_no, street, city, state, Age, Occupation, Account\_Number**)**

Functional Dependencies,

* Customer\_id -> First\_name, Last\_name, door\_no, street, city, state, Age, Occupation, Account\_Number

1. **Bank\_details(**Account\_Number, IFSC\_code, Account\_holder, Account\_balance)

Functional Dependencies,

* Account\_Number -> IFSC\_code
* Account\_Number -> Account\_holder, Account\_balance

1. **Customer\_info(**Customer\_id, dob, Phone\_No, No\_of\_schemes**)**

Functional Dependencies,

* Customer\_id -> Phone\_No
* Customer\_id -> dob
* Customer\_id -> No\_of\_schemes

1. **Investment\_details(** Instrument\_ID, Customer\_id, Invested\_date, Maturity\_date **,** Invested\_amount, Scheme\_name**)**

Functional dependencies,

* Instrument\_ID -> Invested\_date, Scheme\_name, Customer\_id
* Invested\_date, Instrument\_ID -> Maturity\_date

1. **Bonds(** Instrument\_ID**,** Invested\_date, Face\_value**)**

Functional dependencies,

* Instrument\_ID -> Invested\_date, Face\_value

1. **Stocks\_and\_equities**( Instrument\_ID, Invested\_date, Stock\_value, Maturity\_amount)

Functional dependencies,

* Instrument\_ID -> Invested\_date, Stock\_value, Maturity\_amount

1. **Real\_estate(** Instrument\_ID, Invested\_date, Ownership, Maturity\_amount**)**

Functional dependencies,

* Instrument\_ID -> Invested\_date, Ownership, Maturity\_amount

1. **Debt\_funds(** Instrument\_ID, Invested\_date, Rates\_of\_interest, Maturity\_amount**)**

Functional dependencies,

* Instrument\_ID -> Invested\_date, Rates\_of\_interest, Maturity\_amount

1. **Company\_profits(** Year, Profits\_per\_year, Bonds, Stocks\_and\_equities, Real\_estate, Debt\_funds **)**

Functional dependencies,

* Year -> Profits\_per\_year, Bonds, Stocks\_and\_equities, Real\_estate, Debt\_funds

1. **Employees(** Employee\_id, Role, Salary, no\_of\_workers, no\_of\_clients **)**

Functional dependencies,

* Employee\_id -> Role, Salary, no\_of\_workers, no\_of\_clients

1. **Company(** No\_of\_employees, No\_of\_customers, Scheme\_name, Year **)**

Functional dependencies,

* Scheme\_name, Year -> No\_of\_employees, No\_of\_customers

**BCNF TABLES:-**

* The tables are already in 3NF
* Every table has only trivial functional dependencies.
* In every FDs, the LHS is a super key and the RHS are determined by the corresponding super keys.

**Therefore, the tables are already in BCNF.**

The final list of tables after normalization are:-

1. **Personal\_details(** Customer\_id, First\_name, Last\_name, door\_no, street, city, state, Age, Occupation, Account\_Number**)**
2. **Bank\_details(**Account\_Number, IFSC\_code, Account\_holder, Account\_balance)
3. **Customer\_info(**Customer\_id, dob, Phone\_No, No\_of\_schemes**)**
4. **Investment\_details(** Instrument\_ID, Customer\_id, Invested\_date, Maturity\_date **,** Invested\_amount, Scheme\_name**)**
5. **Bonds(** Instrument\_ID**,** Invested\_date, Face\_value**)**
6. **Stocks\_and\_equities**( Instrument\_ID, Invested\_date, Stock\_value, Maturity\_amount)
7. **Real\_estate(** Instrument\_ID, Invested\_date, Ownership, Maturity\_amount**)**
8. **Debt\_funds(** Instrument\_ID, Invested\_date, Rates\_of\_interest, Maturity\_amount**)**
9. **Company\_profits(** Year, Profits\_per\_year, Bonds, Stocks\_and\_equities, Real\_estate, Debt\_funds **)**
10. **Employees(** Employee\_id, Role, Salary, no\_of\_workers, no\_of\_clients **)**
11. **Company(** No\_of\_employees, No\_of\_customers, Scheme\_name, Year **)**