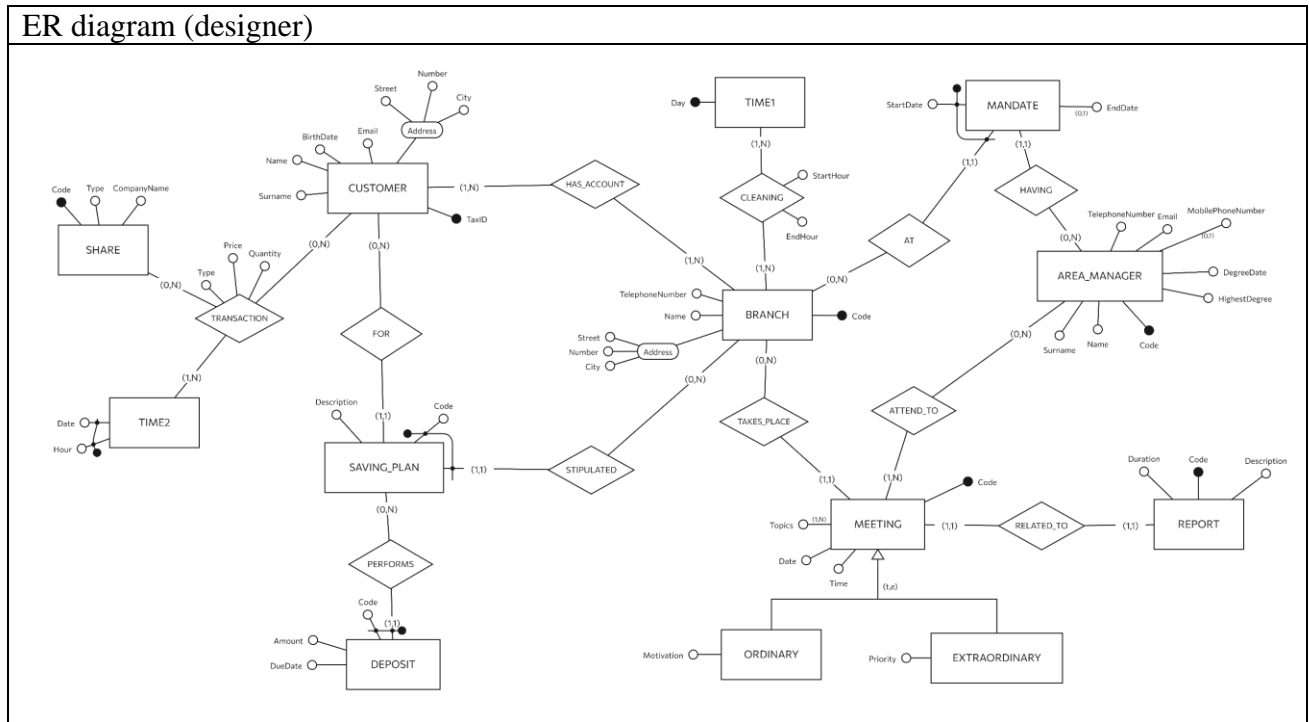


## Homework no. 1: Relational database design

A bank wishes to design a database to manage some activities of its Italian branches.

- The bank has a variety of branches throughout the Italian area. Each branch is identified by a code, and it is characterized by the name, the address and the telephone number. The address is composed by street, number and city. The bank's customers are characterized by Social Security Number (SSN), full name (name and surname), date of birth, address and email. For each customer the database stores the list of branches in which he/she has at least a bank account. Each customer cannot have different bank accounts in the same branch, but he/she may have different bank accounts in different branches.
- The bank has area managers. Each area manager is identified by an alphanumeric code, and he/she is characterized by name, email, phone number and mobile phone number (if available). For each area manager the title of the highest obtained degree and the date when he/she received that title are also known.
- Each branch organizes some meetings periodically. Each meeting is identified by a code and it is characterized by the branch at which it takes place, the meeting date and time, and list of addressed topics. For each meeting, it is known the list of area managers which attended it. The meetings are classified as ordinary and extraordinary meetings. For ordinary meetings the motivation for which the meeting was called is stored, whereas for extraordinary ones, the level of priority is known. A report is written at the end of each meeting. Each report is identified by a code, and it is characterized by the meeting for which it was written, a brief description and the meeting duration.
- Each branch manages different savings plan. Each savings plan is identified by a code that is unique within all savings plan referring to the same branch and it is characterized by the subscribing customer and a brief description. Each savings plan is associated with a set of deposits. Each deposit is identified by a code unique within the corresponding savings plan and it is characterized by the due date of payment and the corresponding amount.
- Customers can buy or sell shares. Each share is identified by a univocal alphanumeric code, and it is characterized by the type and name of the company that issued it. For each transaction the hour, the date, the type (buy or sell), the unitary price and the quantity are known. Each customer can perform more transactions, for each share or for different shares, within the same day, and each share can be sold or bought by every customer.
- For each branch the database stores the list of its area manager over time with the corresponding period of time (start and end date). Please note that a branch can not have more than one area manager at a time, while each area manager can manage more branches in the same time period.
- The cleaning of the branch premises is carried out in specific days of the week. For each branch the database stores the days of the week on which the cleaning activity takes place and the corresponding time slot (i.e., start hour and end hour).

1. Describe the conceptual schema of a database for the above application by means of an ER diagram.
2. Derive a normalized relational logical schema for the same database.
3. Define referential integrity constraints for 3 relations of your choice among those dened in the conceptual schema.

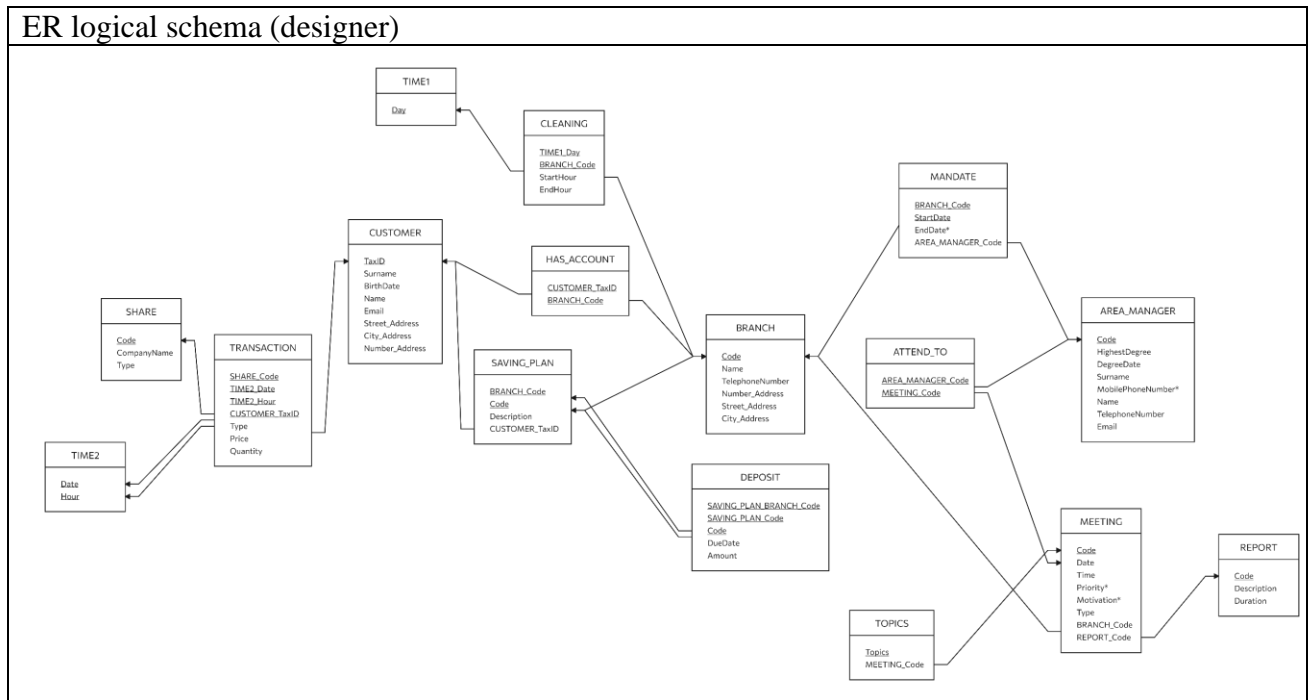


Logical schema (list of tables)
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<p>SHARE(<u>Code</u>, CompanyName, Type)</p> <p>TIME2(<u>Date</u>, Hour)</p> <p>CUSTOMER(<u>TaxID</u>, Name, Surname, BirthDate, Email, Street_Address, City_Address, Number_Address)</p> <p>BRANCH(<u>Code</u>, Name, TelephoneNumber, Number_Address, Street_Address, City_Address)</p> <p>TIME1(<u>Day</u>)</p> <p>MANDATE(<u>BRANCH_Code</u>, <u>StartDate</u>, EndDate*, AREA_MANAGER_Code)</p> <p>AREA_MANAGER(<u>Code</u>, HighestDegree, DegreeDate, Name, Surname, MobilePhoneNumber*, TelephoneNumber, Email)</p> <p>MEETING(<u>Code</u>, Priority*, Motivation*, Type, REPORT_Code, BRANCH_Code)</p> <p>TOPICS(<u>Topics</u>, MEETING_Code)</p> <p>REPORT(<u>Code</u>, Description, Duration)</p> <p>SAVING_PLAN(<u>BRANCH_Code</u>, <u>Code</u>, Description, CUSTOMER_TaxID)</p> <p>DEPOSIT(<u>SAVING_PLAN_BRANCH_Code</u>, <u>SAVING_PLAN_Code</u>, <u>Code</u>, DueDate, Amount)</p> <p>ATTEND_TO(<u>AREA_MANAGER_Code</u>, <u>MEETING_Code</u>)</p> <p>CLEANING(<u>BRANCH_Code</u>, <u>TIME1_Day</u>, StartHour, EndHour)</p> <p>HAS_ACCOUNT(<u>CUSTOMER_TaxID</u>, <u>BRANCH_Code</u>)</p> <p>TRANSACTION(<u>SHARE_Code</u>, <u>TIME2_Date</u>, <u>TIME2_Hour</u>, <u>CUSTOMER_TaxID</u>, Type, Price, Quantity)</p>
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Integrity constraints
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<p>MEETING (BRANCH_Code) REFERENCES BRANCH(Code)</p> <p>MEETING (REPORT_Code) REFERENCES REPORT(Code)</p> <p>SAVING_PLAN (BRANCH_Code) REFERENCES BRANCH(Code)</p> <p>SAVING_PLAN (CUSTOMER_TaxID) REFERENCES CUSTOMER(TaxID)</p> <p>TRANSACTION (SHARE_Code) REFERENCES SHARE(Code),</p> <p>TRANSACTION (TIME2_Date) REFERENCES TIME2(Date),</p> <p>TRANSACTION (TIME2_Hour) REFERENCES TIME2(Hour),</p> <p>TRANSACTION (CUSTOMER_TaxID) REFERENCES CUSTOMER(TaxID)</p>
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ER diagram (designer) – text version

```

/* Entities */
entity CUSTOMER {
  TaxID (id),
  Address {
    Street,
    City,
    Number
  },
  Surname,
  BirthDate,
  Name,
  Email
}
entity BRANCH {
  Name,
  TelephoneNumber,
  Code (id),
  Address {
    Number,
    Street,
    City
  }
}
entity SAVING_PLAN {
  Code (external),
  Description

```

```
}
entity DEPOSIT {
  DueDate,
  Amount,
  Code (external)
}
entity TIME1 {
  Day (id)
}
entity MANDATE {
  StartDate (external),
  EndDate (optional)
}
entity REPORT {
  Description,
  Duration,
  Code (id)
}
entity MEETING {
  Code (id),
  Topics (multi),
  Date,
  Time
}
entity ORDINARY {
  Motivation
}
entity EXTRAORDINARY {
  Priority
}
entity AREA_MANAGER {
  HighestDegree,
  DegreeDate,
  Surname,
  MobilePhoneNumber (optional),
  Name,
  TelephoneNumber,
  Code (id),
  Email
}
entity TIME2 {
  Date (id),
  Hour (id)
}
entity SHARE {
  Code (id),
  CompanyName,
  Type
}
```

```
}

/* Relationships */
relationship RELATED_TO (
  REPORT: one..one,
  MEETING: one..one
)
relationship ATTEND_TO (
  AREA_MANAGER: zero..many,
  MEETING: one..many
)
relationship HAVING (
  MANDATE: one..one,
  AREA_MANAGER: zero..many
)
relationship AT (
  MANDATE: one..one external,
  BRANCH: zero..many
)
relationship TAKES_PLACE (
  BRANCH: zero..many,
  MEETING: one..one
)
relationship CLEANING (
  TIME1: one..many,
  BRANCH: one..many
){
  StartHour,
  EndHour
}
relationship STIPULATED (
  SAVING_PLAN: one..one external,
  BRANCH: zero..many
)
relationship PERFORMS (
  SAVING_PLAN: zero..many,
  DEPOSIT: one..one external
)
relationship HAS_ACCOUNT (
  CUSTOMER: one..many,
  BRANCH: one..many
)
relationship FOR (
  CUSTOMER: zero..many,
  SAVING_PLAN: one..one
)
relationship TRANSACTION (
  SHARE: zero..many,
```

```
CUSTOMER: zero..many,  
TIME2: one..many  
{  
  Type,  
  Price,  
  Quantity  
}  
  
/* Generalizations */  
MEETING <= {  
  EXTRAORDINARY,  
  ORDINARY  
}(total, exclusive)
```