
# Tutorial: Entity-relationship Modelling

The Varsity International Network of Oenology wishes to computerise the management of the information about its members as well as to record the information they gather about various wines. Your company, Apasaja Private Limited, is commissioned by the Varsity International Network of Oenology to design and implement the relational schema of the database application. The organisation is big enough so that there could be several members with the same name. A card with a unique number is issued to identify each drinker. The contact address of each member is also recorded for the mailing of announcements and calls for meetings.

At most once a week, VINO organises a tasting session. At each session, the attending members taste several bottles. Each member records for each bottle his or her evaluation of the quality (very good, good, average, mediocre, bad, very bad) of each wine that she or he tastes. The evaluation may differ for the same wine from one drinker to another. Actual quality and therefore evaluation also varies from one to another bottle of a given wine. Every bottle that is opened during the tasting session is finished during that session.

Each wine is identified by its name ("Parade D'Amour"), appellation ("Bordeaux") and vintage (1990). Other information of interest about the wine is the degree of alcohol (11.5), where and by whom it has been bottled ("Mis en Bouteille par Amblard-Larolphie Negociant-Eleveur a Saint Andrede Cubzac (Gironde) - France"), the certification of its appellation if available ("Appellation Bordeaux Controlée"), and the country it comes from (produce of "France").

Generally, there are or have been several bottles of the same wine in the cellar. For each wine, the bottles in the wine cellar of VINO are numbered. For instance, the cellar has 20 bottles numbered 1 to 20 of a Semillon from 1996 named Rumbalara. For documentation purposes VINO may also want to record wines for which it does not own bottles. The bottles are either available in the cellar or they have been tasted and emptied.

We first want to design an entity-relationship schema that most correctly and most completely captures the constraints expressed in the above description of the VINO application.

1. Entity-relationship design.
   (a) Identify the entity sets. Justify your choice by quoting the sentences in the text that support it.

   > **Solution:** There are three entity sets: `member`, `bottle` and `wine`.

   (b) Identify the relationship sets and the entity sets that they associate. Justify your choice by quoting the sentences in the text that support it.

   > **Solution:** There are two relationship sets: `taste` and `contain`. The relationship set `taste` links the entity set `member` with the entity set `bottle`. The relationship set `contain` links the entity set `wine` with the entity set `bottle`.

   (c) For each entity set and relationship set identify its attributes. Justify your choice by quoting the sentences in the text that support it.

**Solution:** See the solution.

(d) For each entity set, identify its keys.

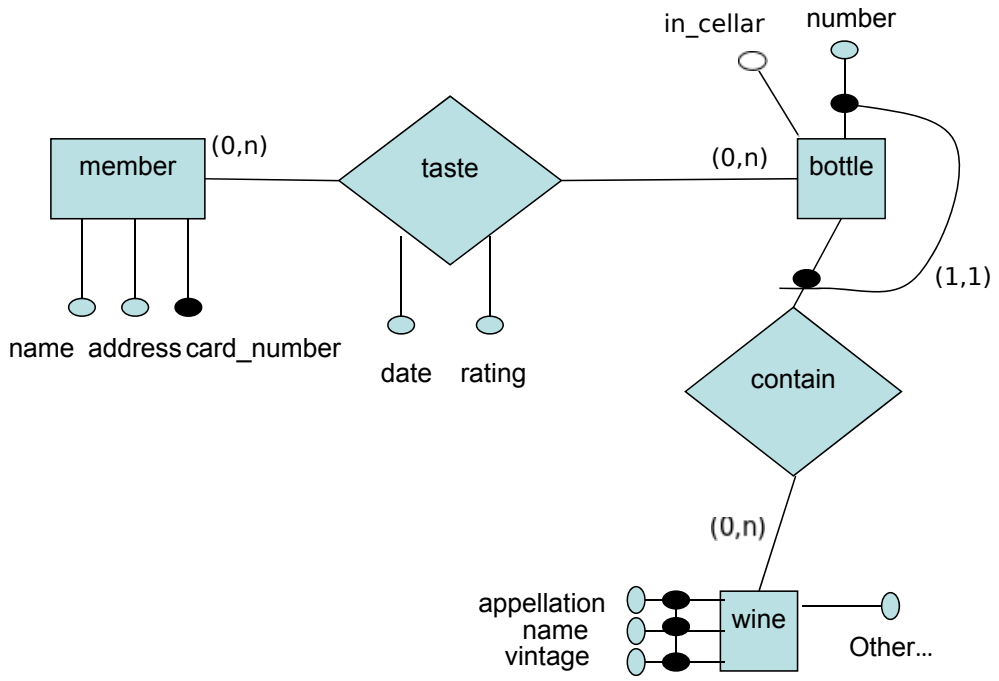
**Solution:** See the solution.

(e) For each entity set and each relationship set in which it participates, indicate the minimum and maximum participation constraints.

**Solution:** The relationship `taste` is an optional many-to-many relationship: both pairs of cardinality constraints are `(0, n)`.

The relationship `taste` is a one-to-many relationship from `wine` to `bottle`. It is mandatory for the `bottle` entities and optional for the optional for the `wine` entities. The participation constraints for the entity set `wine` is `(0, n)`. The participation constraints for the entity set `bottle` is `(1, 1)`. It could not be otherwise since the entity set `bottle` is a weak entity (is weakly identified under the relationship set `contain` and the dominant entity set `wine`).

(f) Draw the corresponding entity-relationship diagram with the key and participation constraints. Indicate in English the constraints that cannot be captured, if any.




**Solution:**
There are no additional constraints.

2. Logical design and SQL DDL code.

(a) Translate your entity-relationship diagram into a relational schema. Give the SQL DDL statements to create the schema. Declare the necessary integrity constraints. Indicate in English the constraints that cannot be captured, if any.

**Solution:**

```
CREATE TABLE members (
name            VARCHAR(20) NOT NULL,
card_number     NUMERIC PRIMARY KEY,
```

```
address          VARCHAR(50) NOT NULL
);

CREATE TABLE wines (
name             VARCHAR(20),
appellation      VARCHAR(20),
vintage          DATE,
alcohol_degree   NUMERIC NOT NULL,
bottled          VARCHAR(100) NOT NULL,
certification    VARCHAR(50),
country          VARCHAR(20) NOT NULL,
PRIMARY KEY (name, vintage, appellation)
);

CREATE TABLE bottles (
wine_name        VARCHAR(20),
vintage          DATE,
appellation      VARCHAR(20),
number           INTEGER,
PRIMARY KEY (number, wine_name, vintage, appellation),
FOREIGN KEY (wine_name, vintage, appellation)
    REFERENCES wines(name, vintage, appellation));

CREATE TABLE taste (
member           NUMERIC(20),
wine_name        VARCHAR(20),
vintage          DATE,
appellation      VARCHAR(20),
rating           VARCHAR(9) NOT NULL,
bottle_no        INTEGER,
date             DATE NOT NULL,
PRIMARY KEY (member, bottle_no, wine_name, vintage, appellation),
FOREIGN KEY (member)
    REFERENCES members(card_number),
FOREIGN KEY (bottle_no, wine_name, vintage, appellation)
    REFERENCES bottles(number, wine_name, vintage, appellation));
```

# References


[1] P. Atzeni, S. Ceri, S. Paraboschi, and R. Torlone. *Database Systems - Concepts, Languages and Architectures.* `http://dbbook.dia.uniroma3.it`. Visited on 29 December 2021.

[2] S. Bressan and B. Catania. *Introduction to Database Systems.* McGraw-Hill Education, 2006.

[3] H. Garcia-Molina, J.D. Ullman, and J. Widom. *Database Systems: The Complete Book.* Pearson international edition. Pearson Prentice Hall, 2009.

[4] R. Ramakrishnan and J. Gehrke. *Database Management Systems.* McGraw-Hill, 2002.