

## Assignment: The entity-relationship data model

### Analysis

In the analysis, we use the following text annotations:

- an entity** The highlighted piece of text resembled an entity-like object.
- an attribute** The highlighted piece of text resembled an attribute of some entity-like object.
- a relationship** The highlighted piece of text resembled a relationship between entity-like objects.
- a constraint** The highlighted piece of text resembled a constraint on data.
- not-relevant** The highlighted piece of text is not relevant (e.g., context, application details, ...)

A local community group is brainstorming with local artists to support the artistry and share artwork with the community in a novel way via an art library that enables the local community to learn about the artists, borrow their art, and support their art (as part of the library subscription fees will return to the artists). The main component of the art library will be the **art catalogue** that **maintains information** on the **art pieces** that can be borrowed from the library. In addition, the art catalogue information will be used to promote art pieces and artists via the library website. Central to the art catalogue are art pieces. Each **art piece** has a **unique main artist** and **title** (hence, two distinct artists can both make distinct art pieces named "tomorrow"). Besides the main artist, multiple other artists **can contribute** to the art piece. In that case, a strict **order of the individual contributions** needs to be maintained (e.g., main artist, second contributor, third contributor, and so on). Typically, **art pieces** also have **a time** and **place of creation** (for now, the library expects to only hold newly created pieces for which these details are always available). For display purposes, the art library will maintain **the physical dimensions** (e.g., size of a painting) of each art piece. For some types of art pieces, other details are maintained. Initially, the library will be working with talented painters, sculptors, and photographers. For both **paintings** and **photo prints**, the library will catalogue the **category** (e.g., still life, portrait, landscape, and so on) and the **coloring** (e.g., natural colors or a black-and-white color tone), and the **type of support material** (e.g., canvas or wood) on which the painting was made or photo was printed. For **paintings**, the library will in addition catalogue **the type of paint** used (e.g., oil-based or water-based). For **sculptures**, the library will catalogue its **weight**, whether it can be **displayed indoor or outdoor**, and the **main material used**. Finally, each **photo print** will be **related to details on the original photo** the print was based on (e.g., the art piece is a reprint on canvas made in 2022 by Freda, based on a photo made by the photographer Xanthe in 1983). In the catalogue, **photos** (the original negatives or the original digital photo file) are **non-physical art pieces**: they cannot be borrowed from the library and do not have physical dimensions, but do have **titles**, **an artist that created them**, **other contributors**, and **a time** and **place of creation**. For each artist, the library maintains a profile page that is used to highlight the artist and via which one can find all art pieces of that artist in the catalogue. Each **artist's** profile displays their **name**, their **current location** (e.g., Hamilton if that is the location of their main atelier), and their **age**. In addition, the artist can **add links** to **external resources** such as personal websites, Instagram pages, YouTube channels, and so on. Art pieces can be grouped together, e.g., they can be part of the same collection(s), or they can be part of a **group of art pieces** made within a **collaboration**. Each such a group

has a *title*, *type*, and *description*. Several groups can have the same title, types, and/or descriptions. Finally, the library will have **members** that can **borrow art pieces**. The library plans to a pre-existing system to manage memberships and payment details. This system will assign a **unique member id** to each member. That system will not manage the borrowed and reserved art pieces, however. Each **borrowed work** is associated with an art piece, the member that borrowed it, and the *time period during which the work is borrowed*. Each **reserved work** is associated with an art piece, the member that wants to borrow it, and the *time when the reservation was placed* (reserving art pieces works on a first-come-first-serve basis). Members can borrow the same art piece multiple times and members can indefinitely **renew** their borrow period unless other members have reserved the piece (each renew is registered as a separate borrow).

## Model Solution

The information in the description can be represented by the ER-Diagram that can be found in Figure 1. Now I will provide a comprehensive overview of the diagram, discussing what constraints I incorporated and excluded.

Firstly, I assumed that the whole dataset itself is the Art Library so I do not have an entity for it. However, I do have an entity for **Art Catalogue** which is connected by the relationship catalogue, to the **Art Piece**. The participation constraint between these entities is one-to-many(total) since one catalogue archives all the art pieces together.

Each art piece is represented by an entity **Art Piece** with attributes *title*(of type TEXT), *place of creation*(of type TEXT), *time*(of type INTEGER), *art-id*(of type INTEGER) and *aid*(of type INTEGER). The attribute *aid* is a numeric automatically-generated identifier and the primary key as there could be multiple artists with the same name contributing to the same art piece. Furthermore, the *art-id* attribute is also the primary key as it uniquely identifies each art piece.

Each artist has a profile which is represented by an entity **Artist** with attributes *name*(of type TEXT), *birthdate*(of type INTEGER), *location*(of type TEXT) and *aid*(of type INTEGER). The primary key of the **Artist** entity is *aid* as it uniquely represents each artist. Also rather than taking age as an attribute, I took birthdate as the age can be derived from it. Additionally, since there is a list of links it is connected to an entity **Links** with an attribute for an *external resource*(of type TEXT). **Links** is a weak entity of **Artist** as it would not exist without it and is connected through a 'has a' relationship. Furthermore, multiple artists can contribute to a single **Art Piece** so that's why there is a *contribution rank* attribute between the relationship of the **Artist** and the **Art Piece**. The participation constraint between the entities is one-to-many(partial) since each **Art Piece** must be made by at least one or more **Artist** and not every **Artist** has an **Art Piece** in this database.

All the art pieces can be separated into two different categories. One category is **Physical Art**, which can be displayed, borrowed and/or reserved from the library and has an attribute of *physical dimension*, which is needed to display the art. The other category is **Non-Physical Art**

which cannot be displayed, borrowed and/or reserved from the library, and can only be used for information. These categories are represented by the ISA hierarchy connected to the **Art Piece**. Each of these categories have different types of art pieces. **Physical Art** has painting, photo prints and sculptures. All of these types are represented by their own entity. So for painting, I have an entity **Painting** with attributes *category*(of type TEXT), *colouring* (of type TEXT), *support material*(of type TEXT) and *type of paint*(of type TEXT). For photo prints, I have an entity **Photo Prints** with attributes *category*(of type TEXT), *coloring*(of type TEXT) and *support material*(of type TEXT). Lastly, for sculptures I have an entity **Sculptures** with attributes *weight*(of type DOUBLE), *displayed* (of type TEXT) and *materials used*(of type TEXT). For **Non-Physical Art** there is only one type which is photos, this is also represented by an entity **Photos** with no attributes. Since each category has various types of art pieces, it can be represented by the ISA hierarchy connected to there the following category. Furthermore, **Photo Prints** is a weak entity since a photo print cannot exist without a **Photo** entity as it provides the details required to print. This is represented by the identifying relationship with one-to-many(total) since each photo can be photo printed.

**Art Pieces** can also be grouped together into a group. I represented this by an entity **Group** with the attributes *title*(of type TEXT), *type*(of type TEXT), *description*(of type TEXT) and *gid*(of type INTEGER). Since several groups can have the same title, types, and/or descriptions, I assigned **Group** a numeric automatically-generated identifiers *gid*. There is a participation constraint which specifies that each **Group** must be associated with at least one **Art Piece** for it to exist. So the relationship has a one-to-many (partial) constraint.

Lastly, the library has members that can borrow and reserve art pieces. The members of the library are represented by the entity **Members** with attribute *mid*(of type INTEGER) to uniquely identify each member. For renewing, I made a relationship between the **Members** and **Physical Art** entities. So when a person renews the art piece it goes back to the physical art catalogue and if there is no reservation made for the art piece then it can be borrowed again with the end period extending. The participation constraint between the entities is many-to-many (total) since every member can renew the art piece indefinitely unless there is a reservation. Every member can borrow or reserve any physical art pieces that are available in the catalogue. If it is already borrowed or reserved for the requested time, then the art piece is not available. Borrow and reserve can be represented by a relationship connecting to **Physical Art** and **Members** entities. For borrow relationship, I put *start time*(of type TEXT) and *end time*(of type TEXT) as attributes and for reserve relationship, I put *reservation time*(of type TEXT) as an attribute. The participation constraint between the entities is many-to-many (total) since every member can borrow and reserve every art piece even if it is the same piece multiple times.

## ER Model

