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## **Project topic**

12. The Museum of Fine Arts exhibits exhibits in various rooms. It also has a warehouse and exchanges exhibits with other museums. During the season, the museum is visited by 2,000 people per day.

## **Project description**

A database project used to facilitate the management of the exhibition of works at the Museum of Art, the sending of works from the Museum of Art on loan to another museum, as well as the sale of works of art in the auction house run by the Museum.

## **Detailed description of the project**

1) The client is a museum director who wants to improve the operation of the facility.

2) The database will enable the management of the exhibition, exchange and sale of works of art in the museum and the auction house run by it. This will facilitate exchanges between museums, facilitate the management of art auctions, which is to help ensure the safety of all exhibits, and support the logistical process. Additionally, the database will store data on the number of tickets sold for specific exhibitions in order to check interest in specific art topics and later adjust its offer.

3) Users:

- warehouse staff in the scope of lending works outside the museum premises
- auction house vendors regarding available works for sale
- exhibition managers in the field of managing works on the themes of their exhibitions
- director of the museum in all capacities, mainly for the purpose of creating reports and supervising current work of subordinates

#### 4) Usage scenarios:

- warehouse workers - when they receive a request to start an exchange, they will be able to easily locate works at a given exhibition and provide information about their current status (whether they are currently available or until when they are on exhibition/exchange) as well as update the data if an exchange has taken place.

- auction house sellers - preparing offers for clients/responding to customer inquiries will be able to search for works at currently ongoing auctions, the status of each painting at the auction, i.e. its current price and time until the end of the auction, and determine where a given work can currently be seen

- exhibition managers - when planning new exhibitions: they will be able to search for paintings about theme/author/style related to the theme of the planned exhibition and check what is happening with the paintings they are looking for and check the possible time of their return to the Art Museum in order to plan the date and possible content of the exhibitions. Knowing the possibilities, they can create a new exhibition and assign works to it

- the museum director will have access to view all database resources in order to check whether everything is in proper order in his facility and will conduct the necessary reports

#### 5) Query examples:

a) Name all of Van Gogh's works in the museum

b) Give all the titles of the sculptures in the museum, but only those created before the year 2000

c) List the works from the 1920s currently up for auction.

d) The police are asking for a list of people who bid on the stolen work in order to find it. potential robbers.

e) The director of the museum prepares an annual report. He asks for a summary of the number of items sold tickets for individual exhibitions in the last year.

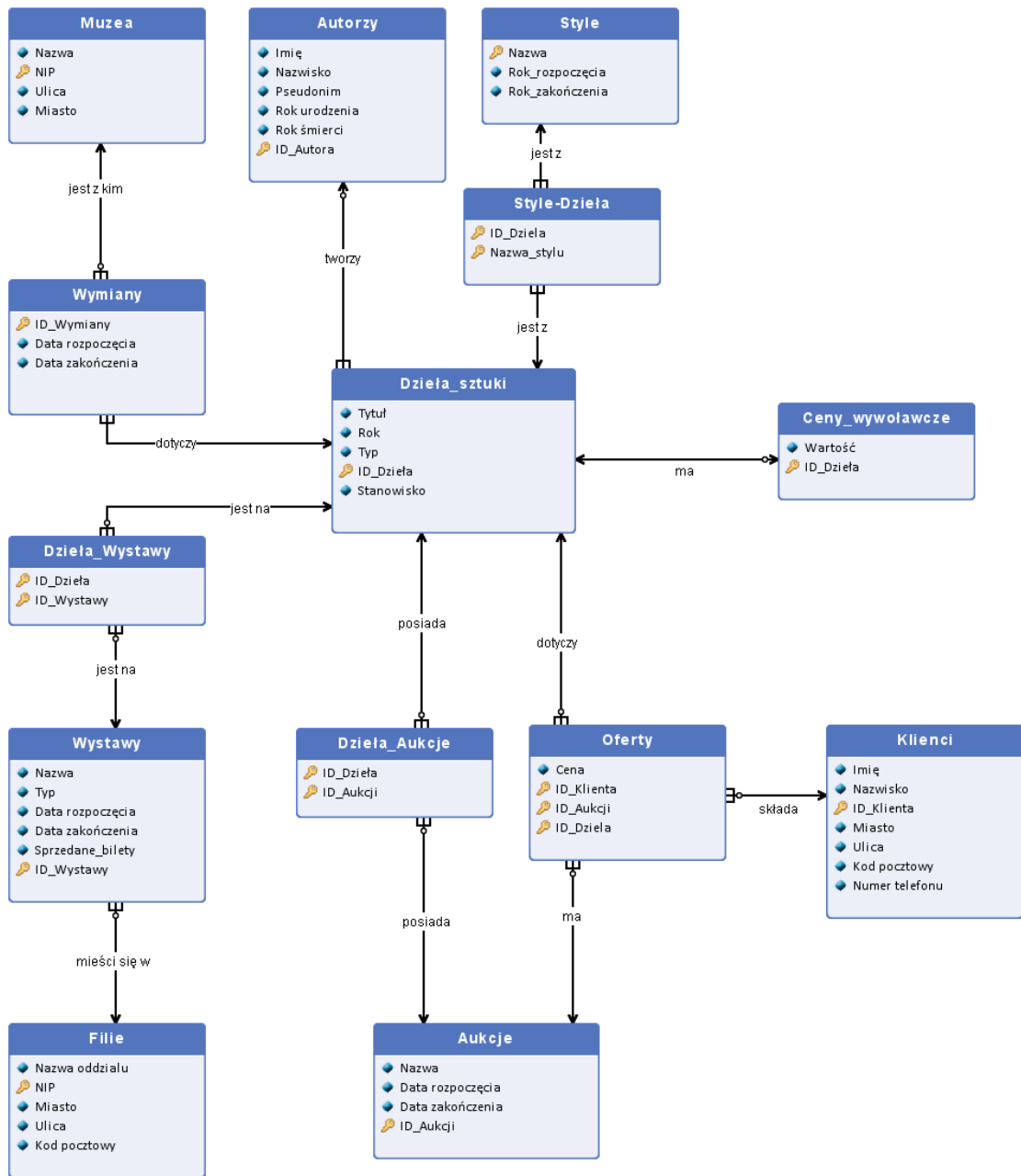
#### 6) Exclusions:

The database will not include employee payroll and financial matters (salaries, holidays, etc.), because the database is intended to manage works and not employees.

The Museum Warehouse will be treated as an entity from the Exhibitions set with a very distant end date and the number of tickets sold equal to 0 - these are the only logical differences, so there is no need to separate entity sets to manage warehouse positions.

The Art Museum will not accept works from other museums; it will only loan its collections for a specified period.

# ERD Chart



## Entity Set Description

Works_of_art			
Count: up to 20000 (permanent)			
<p>A collection of works of art kept in a museum. It is difficult to establish a criterion for distinguishing the entity of a work of art, because the work may have the same title, year of creation and type, or even position (e.g. position no. 1, but in different branches). A natural criterion would be to see the work live and stating its visual difference from others and at that moment assigning an artificial number ID. Such situations often occur in the world, e.g. <i>Water lilies</i> Coin or <i>Orange Tree</i> Gierymski.</p> <p>The entity of a work of art enters the collection when the work arrives at the museum and remains there forever. to keep records of all actions performed on the work.</p>			
Name	Key main	Type/Field	Description
Title	NO	A string of up to 50 characters of alphabets European	Title of the work
Year	NO	4-digit number	Year of creation of the work
Type	NO	A string of up to 30 alphabet characters European	The type of art branch represented, e.g. sculpture/installation/painting
ID_of_Artwork	Yes	Natural number	Artificial and unique number of the work
Position	NO	A string of up to 10 characters, consistent with the set of names used in Museum	Name of the position you currently hold there is a work of art

Authors			
Number of: up to 5000 (permanent)			
<p>A collection of authors of works of art held in a museum. Each author entity can be clearly distinguished by his/her Name, Surname, Nickname (of course if selected) along with the years of birth and death, because the personal data can often be repeated. Due to the complexity of the key natural, an artificial key was used.</p> <p>An author entity is added to a collection when the first work of art by that author is added to the collection. works and remains forever in order to keep a complete history of actions performed on the works.</p>			
Name	Master key	Type/Field	Description
Name	NO	A string of up to 30 alphabet characters European	The name of the author of the work, maybe not exist
Last name	NO	A string of up to 30 alphabet characters European	The name of the author of the work, maybe not exist

Pseudonym	NO	A string of up to 30 alphabet characters European	The pseudonym of the author of the work, perhaps not exist
Year of birth	NO	Date in dd-mm-yyyy format	Year of birth of the author of the work
Year of death	NO	Date in dd-mm-yyyy format	The year of death of the author of the work
Author_ID	Yes	Natural number	Artificial and unique ID number Author

Style			
<p>Quantity: up to 500(permanent)</p> <p>A collection of styles and eras existing in art and culture. Each style entity can be clearly distinguished by its name, because art and culture have named each novelty that has appeared in history differently and have not has two styles with the same name.</p> <p>A style entity is added to the collection when the first work of art from that style is added and remains forever in order to maintain a complete history of actions performed on the works.</p>			
Name	Key main	Type/Field	Description
Name	Yes	A string of up to 30 alphabet characters European	The full name of the style or era in art
Year_started	NO	Date in dd-mm-yyyy format	The year a given style started in culture
End_year	NO	Date in dd-mm-yyyy format	The year a given style ended in culture

Auctions			
<p>Number of: up to 1000 (permanent)</p> <p>A collection of auctions of the auction house run by the Museum, past, future and ongoing. Each auction entity can be clearly distinguished by its chronological number in the auction history (auctions are numbered continuously from 1), which was the primary key. The auction entity goes to the set in the moment when the auction house employees (in agreement with the director) decide to organize it and all the details are known and it remains forever in order to preserve history conducted auctions.</p>			
Name	Master key	Type/Field	Description
Name	NO	A string of up to 30 alphabet characters European	Full name of the auction
Start date	NO	Date in dd-mm-yyyy format	Auction start date

End Date	NO	Date in dd-mm-yyyy format	Auction start date
Auction_ID	<b>Yes</b>	Natural number	Unique Auction ID

Exhibitions			
<p>Number of: up to 1000 (permanent)</p> <p>A collection of exhibitions held in various branches of the Museum.</p> <p>The natural criterion for distinguishing an exhibition would include its name, the date of its opening and the Tax Identification Number of the branch in which it would be located. The name and date alone are not enough - the Tax Identification Number would be necessary because they could there could be two exhibitions with the same name and start date, but never in the same branch - it would be illogical. However, it would be a complicated master key, therefore all exhibitions will be numbered chronologically from 1.</p> <p>An exhibition entity is included in the collection when its manager and the museum director approve it. conduct and remains forever in order to keep the history of all exhibitions.</p>			
Name	Key main	Type/Field	Description
Name	NO	A string of up to 50 characters of alphabets European	Full name of the exhibition
Type	NO	Temporary/Permanent (2 options to choose from)	Is it temporary or permanent?
Start date	NO	Date in dd-mm-yyyy format	Exhibition start date
End Date	NO	Date in dd-mm-yyyy format	Exhibition End Date
Tickets sold	NO	Natural number	Number of tickets sold during duration of the exhibition
ID_Exhibitions	<b>Yes</b>	Natural number	Unique exhibition ID number

Branches			
<p>Count: up to 100 (permanent)</p> <p>A collection of all branches of the Museum of Art. Each branch entity can be clearly distinguished by its Tax Identification Number. The entity is added to the collection along with the database structure (so that all existing branches are in it) or when a new branch is created. The branch entity remains in the set forever for the purpose of maintaining history of all activities in the museum.</p>			
Name	Key main	Type/Field	Description
Name	NO	A string of up to 50 characters of European alphabets	Full name of the branch

branch			Art Museum
Tax Identification Number	<b>Yes</b>	10-digit number, verified by the Ministry Finance (service available electronically or by phone)	Unique Tax Identification Number branch
City	NO	A string of up to 30 characters of European alphabets	The city where the branch is located
Street	NO	A string of up to 30 characters of European alphabets	The street where the branch is located
Code postal	NO	A string of 6 characters in the format xx-xxx	Postcode to above cities and streets

Starting_prices			
<p>Number of: up to 3000 (permanent)</p> <p>A set of starting prices for works put up for auction at the auction house. Each auction entity is uniquely distinguished by the ID number of the work to which it is assigned. The starting price entity is entered into the set when the starting price of the work is established at the auction and can be changed or removed when the work has not been sold at a given auction. It can also remain, as the current market price of the work for future sales of the work, even if it is not currently on an active auction. There is no need to keep a history of the works' asking prices, because the price is treated only as a starting point for bidding.</p>			
Name	Master key	Type/Field	Description
Value	NO	Natural number	The starting price of the work in zlotys
ID_of_Artwork	<b>Yes</b>	Natural number	The unique ID number of the work whose price refers to

Customers			
<p>Number of: up to 1000 (permanent)</p> <p>A collection of clients of an auction house run by the Art Museum. We can clearly distinguish each client entity by its phone number, but this is sensitive data, so I will use an artificial ID. The client entity is added to the collection when the client first reports to the auction house to buy or watch the auction and stays forever to maintain the auction history. The customer can request that their data be removed from the database - in such a case we do not remove the entity, we only change the customer's data by changing the attribute values to unambiguous values for us with deletion (e.g. NULL or "deleted").</p>			
Name	Key main	Type/Field	Description
Name	NO	A string of up to 30 characters of European alphabets	Home customer name auction
Last name	NO	A string of up to 30 characters of European alphabets	Home customer name auction
Customer_ID	Yes	Natural number	Unique customer ID number auction house
City	NO	A string of up to 30 characters of European alphabets	Customer's city of residence
Street	NO	A string of up to 30 characters of European alphabets	Client's street address
Zip code	NO	A string of 6 characters in the format xx-xxx	Postal code of residence customer
Number phone	NO	A 9-digit natural number preceded by an area code, i.e. a number of characters + XX xxx xxx xxx	Customer's phone number

Offers			
<p>Number of: up to 2000 (permanent)</p> <p>A collection of offers from clients who are bidding in an ongoing auction of the auction house run by the Museum. Each entity of the offer is clearly distinguished by the ID number of the client who is bidding, the ID number of the auction to which the offer applies, and the ID number of the work to which the offer applies, because in one There can be many works in an auction. The entity of the offer is entered into the collection when the client reports to the auction house employee the amount they want to bid and remains there forever for the purpose of selecting winner, resolution of disputes and possible legal issues.</p>			
Name	Master key	Type/Field	Description
Price	NO	Natural number	The price that the customer offers in a given auction
Customer_ID	Yes	Natural number	Unique bidding customer number



Auction_ID	<b>Yes</b>	Natural number	Unique auction number for which the offer is given refers to
ID_Works	<b>Yes</b>	Natural number	The unique number of the work of art it refers to customer offer

Exchanges			
<p>Number of: up to 5000 (permanent)</p> <p>A set of exchanges that the Art Museum has made with other museums for a specified period of time. It concerns works from the Art Museum's collections sent outside, not the other way around! Each exchange entity can be distinguished by its number in the history of exchanges made, i.e. the ID number. Exchanges are numbered sequentially starting from 1. The entity is entered into the set at the time of the exchange and remains forever in order to maintain the history of exchanges in case of damage to the works and any subsequent investigations legal.</p>			
Name	Master key	Type/Field	Description
ID_Exchange	<b>Yes</b>	Natural number	Unique number for a given exchange
Start date	NO	Date in dd-mm-yyyy format	Exchange start date
End Date	NO	Date in dd-mm-yyyy format	Exchange End Date

Museums			
<p>Number of: up to 500 (permanent)</p> <p>A collection of museums to which the Art Museum lends its works for a specified period of time. Each museum entity can be clearly distinguished by its Tax Identification Number. An entity is added to the collection at the time of the first exchange with a given museum and remains there forever in order to maintain the history of exchanges on in the event of damage to the works and possible subsequent legal investigations.</p>			
Name	Key main	Type/Field	Description
Name	NO	A string of up to 50 characters of the Polish alphabet	Full name of the branch museum
Tax Identification Number	<b>Yes</b>	10-digit number, verified by the Ministry Finance (service available electronically or by phone)	Museum Tax Identification Number
Street	NO	A string of up to 30 characters of European alphabets	The street where it is located a branch of the museum
City	NO	A string of up to 30 characters of European alphabets	The city where it is located

			a branch of the museum
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Styles-Works			
<p>A set created because of a many-to-many relationship between the Artworks and Styles entity sets.</p> <p>Count: up to 10000 (permanent)</p> <p>This is a set of style assignments to a work of art. Each assignment can be distinguished uniquely by a pair of foreign keys, i.e. Work_ID and Style_Name. It is added to the set when the style is assigned to the work and is never removed in order to maintain the full history of actions performed on the works.</p>			
Name	Master key	Type/Field	Description
ID_Works	Yes	Natural number	Artwork ID Number
style_name	Yes	A string of up to 30 alphabet characters European	The name of the style it represents work

Works_Exhibitions			
<p>A set created due to a many-to-many relationship between the Art_Works and Exhibitions entity sets.</p> <p>Count: up to 20000 (permanent)</p> <p>A set of assignments of exhibitions to works of art. We can distinguish each assignment uniquely by a pair of foreign keys, i.e. the work's ID and the exhibition's ID. It is added to the set when the work is assigned to a given exhibition and will not be deleted in order to maintain a full history of actions performed on the works.</p>			
Name	Master key	Type/Field	Description
ID_of_Artwork	Yes	Natural number	Unique ID number of the artwork
ID_Exhibitions	Yes	Natural number	Unique exhibition ID number

Artworks_Auctions			
<p>A set created due to a many-to-many relationship between the Artworks and Auctions entity sets.</p> <p>Count: up to 10000 (permanent)</p> <p>A set of assignments of a work of art to an auction. We will distinguish each assignment unambiguously by a pair of foreign keys, i.e. the work ID and the auction ID. The entity is added to the set when assignment of the work to the auction and is never removed.</p>			
Name	Master key	Type/Field	Description
ID_of_Artwork	Yes	Natural number	Unique ID number of the artwork

Auction_ID	<b>Yes</b>	Natural number	Unique Auction ID
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#### Description of compounds

Name	Entity set 1	Entity Set 2	Cardinality relationship	Description
creates	Works_of_art	Authors	1..n : 0..1	The Association assigns the works of art they create to their authors. The works of art should have an assigned author, due to the later possibilities of managing the works by the author (e.g. a vernissage of one author, users search for a database of specific authors). Each author can create many works, but there may also be works without author (e.g. a sculpture of unknown origin found in the tomb of a pharaoh) – hence the optionality. The connection is created when it is added to the set works of art the works of a given person or in the case of finding a previously unknown author.
has	Works_of_art	Starting_prices and	1 : 0..1	The association assigns a price to works of art starting bid at the auction. It is worth separating such relationship (not to record the price as an attribute of the work of art), because a significant minority of works will be sold and it will save empty fields in the database table. Knowing the starting price of the work is necessary for the efficient start of the auction in the auction house. Not every work will be put up for sale, which means that not all works will have a starting price – hence optionality. A work can have only one starting price at a time - we do not record the history of past prices. The connection is established when the work is put up for auction and its price is set by the employees. In case the work is not sold, the association will not must be removed (but can be) because the reserve price can be used in the next auction. The relationship will be deleted if suddenly will refrain from selling the work.
consists of	Customers	Offers	1 : 0..n	The Association assigns to clients the submitted them the auction offers. The association is needed to

				<p>be able to determine what price a particular person offered client - this is essential in determining the winner of the auction. Each client can submit multiple bids - but does not have to, hence the optionality, but each must be made by only one customer. The relationship is established when the customer makes an offer to buy for a specific amount and is not liquidated due to the need to determine the auction results and subsequent legal issues.</p>
refers to	Exchanges	Works_of_art	1..n : 1	<p>The association assigns each exchange between museums to the works it concerns. The association is necessary for logistical reasons and security to efficiently maintain information about each exchange. A work of art can participate in many exchanges due to the exchange history is kept, however each exchange concerns only one work, because exchanges are understood by the Museum as the simultaneous journey of one work, not many. The connection exists from the moment the exchange is established and is not removed due to the history kept for legal purposes, e.g. seeking compensation.</p>
is from who	Museums	Exchanges	1 : 0..n	<p>The Association assigns each exchange to the museum with which it is associated. The Association is needed for logistical and security reasons to efficiently maintain information about each exchange. Each museum can establish many exchanges at the same time, but there are many of them also because of the history of exchanges kept from legal notices. However, there may be partner museums with which no agreement has been reached yet no exchange – hence optionality. Each exchange is connected with only one museum, because exchanges are understood by the Art Museum as a simultaneous journey of one work - if there is one work, it cannot be in several places at the same time. The relationship exists from the moment the exchange is established and is not removed due to the history kept.</p>
has	Auctions	Offers	1 : 0..n	<p>The Association assigns an auction to each offer, concerns. The relationship is needed so that every customer can bid at an auction and it was obvious what the auction was about applies. Each client has the right to bid an unlimited number of times - this is only for the museum's profit. Each of his submitted bids can only apply to one work in order to maintain order in the database. It may also turn out that it will not be</p>

				<p>no bids have been placed for a given auction – hence the optionality. The connection exists from the moment the bid is placed and is not removed due to the history being kept in order to determine the auction results and subsequent legal safeguards.</p>
is from	Style	Styles-Works	1 : 1..n	<p>The Association assigns to each style a work that represents it. There is no work without style – hence the lack of optionality. The relationship represents reality in the world – a work can be made in many styles, and style is not limited to just one work. Hence it results many-to-many relationship and current association table. The relationship exists from the moment it is added works of art in a given style and is not removed from attention to the story being told.</p>
is from	Styles-Works	Works_of_art	1..n : 1	<p>The association assigns to each work the style in which it is made. There is no work without style – hence the lack of optionality. The relationship represents reality in the world - a work can be made in many styles, and style is not limited to just one work. Hence the relationship of many to many and the current association table. The relationship exists from the moment the artwork is added in a given style and is not removed due to held story.</p>
refers to	Works_of_art	Offers	1 : 0..n	<p>The Association assigns to each customer's offer a work of art to which the offer relates. The Association is needed so that each customer can bid on the auction and it is known which work the auction concerns - the auction entity set itself does not define this.</p> <p>Each client has the right to bid on one work an unlimited number of times - often the bidding is fierce and heated. However, not every work in The museum is for sale, hence the optionality. The relationship exists from the moment the offer is made by customer and is not deleted due to the history of the auction being kept for the purpose of selecting winners and possible decisions complaints.</p>
it holds in	Exhibitions	Branches	0..n : 1	<p>The Association assigns each exhibition to the branch in which it is located. The Association is needed to efficiently identify the location of exhibitions in branches, and consequently, efficient location of works. The Association represents reality in the Art Museum - in one branches often have more than one exhibition, and the Art Museum does not divide exhibitions between more than one branch. It may happen that the new branch is in</p>

				construction or renovation and not have any exhibition - hence the optionality. The association has existed since the creation a given exhibition in a branch and is not removed due to held story.
is on	Works_of_art	Works_Exhibitions	1 : 0..n	<p>The Association assigns each work of art an exhibition, where it is located for a specific period of time. The Association is necessary for efficient identification of the work's location and for adding works to exhibitions for a specific period of time, so that they could not be loaned out to another museum. The Association represents reality in the world - each exhibition contains many works, so that the exhibitions are interesting. Due to the history of exhibitions in which the work was displayed, the work may be displayed in many exhibitions (but not simultaneously!), hence the connection many to many. The optionality results from the fact that when the exhibition is still under construction, it may already be in the database, but not yet contain works. The link exists from the moment the work of art is added to the exhibition and is not removed due to the fact that it is held history.</p>
is on	Exhibitions	Works_Exhibitions	1 : 0..n	<p>The association assigns works of art to each exhibition located on it. The connection is necessary for efficient identification of the work's location and for adding works to exhibitions for a specific time, so that they could not be loaned out to another museum. The Association represents reality in the world - each exhibition contains many works, so that the exhibitions are interestingly containing more than one work. Due to the history of exhibitions in which the work has been, the work may be in many exhibitions (but not simultaneously!), hence the many-to-many relationship. The optionality results from the fact that when the exhibition is still under construction, it may already be in the database, but not contain any more works. The connection exists from the moment the work of art is added to the exhibition and does not is deleted due to history retention.</p>
has	Works_of_art	Artworks_Auctions	1 : 0..n	<p>The Association assigns the works to auctions at which they are presented. they are. The connection is necessary to determine what works are currently or were once for sale at a given auction. Each auction concerns one or more works, and due to the history of all auctions kept, the work may be on multiple auctions, hence the connection many to many and the current associative table. Please note that not all works are for sale - hence</p>

				optionality The connection exists from the moment the work of art is added to the auction and is not removed due to held story.
has	Artworks_Auctions	Auctions	0..n : 1	The association assigns the works of art they own to auctions. The association is necessary for statements about what works are currently or were once for sale at a given auction. Each auction concerns one or more works, and due to the history of all auctions is kept, the work may be on many auctions, hence the connection between many to many and the current association table. Please note that not all works are for sale - hence the optionality. The association exists from the moment the work of art is added to the auction and is not removed due to the history kept.

## Relational database schema

Works\_of\_art(ID of Artwork , Title, Year, Type, Position, Author\_ID REF Authors)

- Museums(Tax Identification Number , Name, Street, City)

- Authors(Author ID , Name, Surname, Nickname, Year\_of\_birth, Year\_of\_death)

- Starting\_prices(Work ID REF Works\_of\_art, Value)

- Customers(Customer ID , Name, Surname, City, Street, Postal\_code, Phone\_number)

- Offers(Customer ID REF Customers, Auction ID REF Auctions, ID of Artwork REF Art\_works, Price)

- Auctions(Auction ID , Name, Start\_date, End\_date)

- Artworks\_Auctions(ID of Artwork REF Works\_of\_art, Auction ID REF Auctions)

- Styles(Name , Start\_year, End\_year)

- Style\_Works(ID of Artwork REF Works\_of\_art, style name REF Styles)

- Branches(Tax Identification Number , Name, City, Street, Postcode)

- Works\_Exhibitions(ID of Artwork REF Works\_of\_art, ID Exhibitions REF Exhibitions)

Exhibitions(ID Exhibitions , Name, Type, Start\_date, End\_date, Sold\_tickets, Branch\_ID REF Branches)

- Exchanges(**Exchange ID** , Start\_date, End\_date, NIP\_Museum REF Museums,  
ID\_Works REF Works\_of\_art)