**Sample Project Chapter 3 - Creating the E-R Diagram for The Art Gallery Project**

* Step 3.1 - Make a list of all entities and their associated attributes.

This step may take several attempts, and different designers will arrive at different solutions. In identifying entities, we examine the data dictionary and the cross-reference table that we developed in previous steps. Most of the data items there represent attributes rather than entities. We should avoid the temptation to make all forms, reports or transactions entities. Our job is to try to use abstraction to group the attributes into entities for the mini-world we are modeling, which covers only a small part of the gallery’s activities. Besides examining the documents we have already developed, we think about the enterprise and ask ourselves what are the persons, places, events, objects, or concepts in the mini-world that we need to keep information about. The cross-reference table can help here. If several attributes tend to appear together on reports, they may be attributes of the same entity. The original data dictionary may have some items generated for reports that we need not store in the database, such as the date the report was generated. They can be dropped from the list of attributes. By examining the data dictionary and asking ourselves what people are important in the Art Gallery, we would certainly identify artists, collectors, and buyers as entities, and probably those potential customers who filled out the forms and whom we want to place on our mailing list. Thinking about what events are important, the sale of an artwork is a central event, and an art show is an event of some importance. The salesperson who sells a work of art could also be an entity. The work of art is an object of great importance to the gallery, so it could be an entity. Note that we do not make the gallery itself an entity, since it is the enterprise.

The entities appear to be:

Artist

Artwork

Buyer

Collector

Potential customer

Sale

Show

Salesperson

Owner

In identifying the attributes for an entity, we try to find data items that tell a single fact about an entity instance. For the Artist entity, we look for attributes whose value would tell us one piece of information about an artist. Grouping the items from the data dictionary, the attributes that seem to describe the artist (as opposed to his or her artworks or the sale or show thereof), are:

artistAddress, artistAreaCode, artistcity, artistFirstName, artistInterviewDate, artistInterviewerName, artistLastName, artistPhone, artistSalesLastYear, artistSalesYearToDate, artistSocialSecurityNumber, artistState, artistStreet, artistTelephoneNumber, artistTotalSalesforPeriod, artistTotalAskingPriceforPeriod, usualMedium, usualStyle, usualType.

Examining these more closely, we see that some of them form composite attributes, including:

artistAddress, consisting of artistStreet, artistCity, artistState, artistZip

artistName, consisting of artistFirstName, artistLastName

artistPhone, consisting of artistAreaCode, artistTelephoneNumber

We notice that some of the items are produced for a single report and have no meaning without knowing the parameters for the report, so they should be considered temporary (ephemeral) data that will not be stored. We include as ephemeral data artistTotalSalesforPeriod and artistTotalAskingPriceForPeriod, since they are dependent on the beginning and ending date that the user chooses to run the report for, and have little meaning without the report. We might consider treating artistSalesLastYear and artistSalesYearToDate the same way. However, the value of artistSalesLastYear could be computed at the end of each year, as required for tax reporting purposes, and is a constant for the entire year that follows, so it is a value we could compute once and store. Similarly, the artistSalesYearToDate could be computed once each week or once each month and stored. These two items have meaning that is independent of the report that produces them, provided, of course, that they are updated on a regular schedule. With these changes, our attribute list is shortened. Dropping the prefix artist that we had listed in the data dictionary for some of the attributes, we now have

Artist attributes are address(street, city, state, zip), interviewDate, interviewerName, name(first, last), phone(areaCode, number), salesLastYear, salesYearToDate, socialSecurityNumber, usualMedium, usualStyle, usualType

In the US, we would normally choose socialSecurityNumber as the primary key, since it has unique values. If the gallery sells only works owned by US artists who create them, this could work well, since the social security number would have to be provided by the artist for tax reporting purposes, so it would always be available. However, we cannot be sure that we will have the social security numbers of artists whose works are owned by collectors. It is also possible that we will have works by non-US artists, who do not have a social security number. Therefore, we might have null values for this attribute, so we cannot use it as the primary key. Instead, we will choose the artist name, which we have assumed is unique, and which should always be available.

**Artwork**

When we examine the data dictionary for items that describe the work of art, we find the candidates for attributes are:

askingPrice, dateListed, dateReturned, dateShown, status, medium, size, style, title, type, yearCompleted

We do not include on the list the attributes that describe the artist, which is a different entity. We also ignore the attributes that describe the owner of the work, since that person will be either the artist or a collector, which will be a separate entity. This leaves just a few attributes for the work.

Artwork attributes are askingPrice, dateListed, dateReturned, dateShown, status, medium, size, style, title, type, yearCompleted

We note that Artwork does not have a key. If we knew the artist of the work, then title would be the key. Since it requires the key of another entity to be used, Artwork is a weak entity, dependent on Artist. We use title as a partial key, a discriminator for this entity.

**Buyer**

Potential attributes are:

buyerAddress, buyerAreaCode, buyerCity, buyerFirstName, buyerLastName, buyerState, buyerStreet, buyerTelephoneNumber, buyerZip, purchasesLastYear, purchasesYearToDate

Grouping the composites, as before, and dropping the buyer prefix, we get

Buyer with attributes name(firstName, lastName), address(street, city, state, zip), phone(areaCode, telephoneNumber), purchasesLastYear, purchasesYearToDate

We do not have social security number, which would provide unique values for a key, and we do not wish to ask buyers to provide their social security numbers for privacy reasons. We assumed names of buyers were not unique, so we cannot use name as a key. Phone appears to be a possibility for a key, but only if no two buyers would have the same telephone number. To allow for the possibility that, for example, two members of the same household who might both be buyers, we will add the name to the phone number and use the combination as the composite primary key.

**Collector**

Looking through the data dictionary for attributes of Collector the candidates include:

collectionArtistFirstName, collectionArtistLastName, collectionMedium, collectionStyle, collectionType, collectorAddress, collectorAreaCode, collectorCity, collectorFirstName, collectorInterviewDate, collectorInterviewerName, collectorLastName, collectorPhone, collectorSalesLastYear, collectorSalesYearToDate, collectorSocialSecurityNumber, collectorState, collectorStreet, collectorTelephoneNumber, collectorTotalSalesforPeriod, collectorTotalAskingPriceforPeriod

Some of these form composite attributes, including

address, consisting of street, city, state, and zip

name, consisting of firstName and lastName

phone, consisting of areaCode and telephoneNumber

We drop ephemeral data, including collectorTotalSalesforPeriod and collectorTotalAskingPriceforPeriod, but we keep collectorSalesLastYear and collectorSalesYearToDate, which have meaning independent of the reports that generate them

Again dropping the prefix, this leaves

Collector with attributes name(firstName, lastName), address(street, city, state, zip), interviewDate, interviewerName, phone(areaCode, telephonenumber), salesLastYear, salesYearToDate, collectionArtistFirstName, collectionArtistLastName, collectionMedium, collectionStyle, collectionType, SalesLastYear, SalesYearToDate, SocialSecurityNumber

We note that, unlike buyers, collectors must provide their social security numbers, since the gallery is obliged to report to the government the social security number of the recipient and the amount for any payments for works sold. We will use the social security number as the primary key.

**Potential customer**

Recall that a potential customer is a person who has filled out a form indicating an interest in the gallery’s works, but who has yet not bought any artwork. Attributes to be considered are:

potentialCustomerAddress, potentialCustomerAreaCode, potentialCustomerCity, potentialCustomerDateFilledIn, potentialCustomerFirstName, potentialCustomerLastName, potentialCustomerState, potentialCustomerStreet, potentialCustomerTelephoneNumber, potentialCustomerPreferredArtist, potentialCustomerPreferredMedium, potentialCustomerPreferredStyle, potentialCustomerPreferredType, potentialCustomerZip

Grouping the composite attributes and dropping the prefix, we have

Potential customer with attributes address(street, city, state, zip), phone(areaCode, telephoneNumber), name(firstName, lastName),dateFilledIn, preferredArtist, preferredMedium, preferredStyle, preferredType.

For the same reasons as we did with buyer, we will add the name to the phone number and use the combination as the composite primary key.

**Show**

Potential attributes are:

showFeaturedArtist, showClosingDate, showTheme, showTitle, showOpeningDate

We note that a show always has a unique title, and it may have either a featured artist or a theme. None of the attributes are composites or ephemeral, so we keep all of them. Since the title is unique, we use that as the key. We have

Show with attributes FeaturedArtist, ClosingDate, Theme, Title, OpeningDate

**Sale**

Potential attributes are:

amountRemittedtoOwner saleDate, saleInvoiceNumber, salePrice, saleSalesPersonCommission saleTax, SaleTotal

We could have considered the title of the artwork, the buyer’s name, the artist’s name, the name of the collector (if any), and the salesperson’s name, but we note that these are separate entities for artwork, buyer, artist, collector and salesperson, so we do not include these attributes here. We will keep the salesperson commission, since that attribute describes a single sale, and will have different amounts for different sales by the same salesperson.

Since none of the listed attributes are composite or ephemeral data, we leave all of them, so we have

Sale with attributes amountRemittedToOwner, saleDate, InvoiceNumber, salePrice, saleSalesPersonCommission, saleTax, SaleTotal

We will use the invoice number as the primary key. We also note that there would be no sale without an artwork, a buyer, and a salesperson, so the Sale entity is existence dependent on all of them. Therefore there is total participation of Sale in its relationships to Artwork, Buyer¸ and Salesperson. However, since it has its own primary key, it is not a weak entity.

**Salesperson**

In choosing attributes for Salesperson we will not include information about the individual sales that a salesperson has made, since the sale data is already listed for that entity. Salesperson then has potential attributes:

salesPersonAddress, salesPersonFirstName, salesPersonLastName, salesPersonName, salespersonSocialSecurityNumber, salespersonCommissionForPeriod,

salespersonTotalSalesForPeriod

We can specify the individual components of the address and telephone number, and make a composite attribute for the name. We drop the sales and commission total for a period, because this is ephemeral data. This leaves our final entity as

Salesperson with attributes name(firstName, lastName), socialSecurityNumber, address(street, city, state, zip)

We will use socialSecurityNumber as the primary key, since we will always have that value for any employee of the gallery.

**Owner**

Potential attributes are:ownerAddress, ownerAreaCode, ownercity, ownerFirstName, ownerLastName, ownerPhone, ownerSocialSecurityNumber, ownerState, ownerStreet, ownerTelephoneNumber,ownerZip

However, since an owner is either the artist of the work or a collector, and we have data items that correspond to these for both of those entities, we already have the values of all the owner data items, so we drop the Owner entity.

Examining the data dictionary to see if there are any attributes unaccounted for, we see dateOfReport, reportEndingDate, reportStartingDate, totalAskingPriceforPeriod, totalAllSalesforWeek,all of which appeared on reports. We note that all of these are either calculated or ephemeral data that does not have to be stored. We also see several attributes for the owner of an artwork, but we note that since an owner is either an artist or a collector, we already have the values of those attributes stored for those entities.

* Step 3.2 - Make a list of relationships to be represented, and any descriptive attributes for them.

Our entities are Artist, Collector, Buyer, PotentialCustomer, Artwork, Show, Sale, and Salesperson. Looking for relationships among them, we find the following.

**Creates** Artist is related to Artwork: Every artwork in the gallery has an artist who created it. In fact, Artwork does not have a key without Artist, since title is not unique. Therefore, we will make Artwork a weak entity, dependent on Artist through the Creates relationship.

**Owns** In some instances the artwork is not owned by the artist who created it. For those entity instances, Artwork is also related to Collector, through the Owns relationship.

**IsSold** Artwork is related to Sale. Sale has total participation in this relationship.

**SoldBy** Sale is related to Salesperson. Sale has total participation in this relationship as well.

**SoldTo** Sale is related to Buyer

**ShownIn** Artwork is related to Show

**PreferredBy** PotentialCustomer does not appear to be strongly related to any other entity. However, a potential customer can identify an artist as a preference, so we could relate **PotentialCustomer** to Artist Having this relationship means that we no longer need **preferredArtist** as an attribute of PotentialCustomer in the E-R diagram.

**CollectedBy**: Since a collector may collect works predominantly by one Artist, we can add a relationship between Artist and Collector. Having this relationship means that we no longer need collectionArtistFirstName or collectionArtistLastName as attributes of Collector in the E-R diagram.

**FeaturedIn** We add this relationship to connect an artist to the “one-person” shows where that person’s work is featured. Having this relationship means that we no longer need to keep showFeaturedArtist as an attribute of Show.

Since there were no remaining attributes on the data dictionary, there are no attributes that depend on relationships in this example.

* Step 3.3 - Draw an E-R diagram to represent the enterprise. Be sure to identify relationship participation and cardinality constraints, any weak entity sets, and rolenames, if needed.



Note: The heavy line around the *Creates* diamond represents a double line.

**Artist**: address(street, city, state, zip), interviewDate, interviewerName, name(first, last), phone(areaCode, telephoneNumber), salesLastYear, salesYearToDate, socialSecurityNumber, usualMedium, usualStyle, usualType

**Artwork**: askingPrice, dateListed, dateReturned, dateShown, status,workMedium, workSize, workStyle, workTitle,workType, workYearCompleted

**Buyer**: name(firstName, lastName), address(street, city, state, zip), phone(areaCode, telephoneNumber), purchasesLastYear, purchasesYearToDate

**Collector**: name(firstName, lastName), address(street, city, state, zip), interviewDate, interviewerName, phone(areaCode, telephonenumber), salesLastYear, salesYearToDate, collectionMedium, collectionStyle, collectionType, SalesLastYear, SalesYearToDate, SocialSecurityNumber

**PotentialCustomer**: address(street, city, state, zip), phone(areaCode, telephoneNumber), name(firstName, lastName),dateFilledIn, preferredMedium, preferredStyle, preferredType.

**Show**: showClosingDate, showTheme, showTitle, showOpeningDate

**Sale**: amountRemittedToOwner, saleDate, InvoiceNumber, salePrice, saleSalesPersonCommission, saleTax, SaleTotal(*calculated field)*

**Salesperson**: name(firstName, lastName), socialSecurityNumber, address(street, city, state, zip)

Figure S.3.1 - E-R Diagram for The Art Gallery

An E-R diagram drawn using Visio is shown in *ERDiagram-FigS.3.1*. To construct it, we used the steps described next.

We start the diagram with the Artist entity. We concluded previously that Artwork is a weak entity with reference to Artist, so we draw a double rectangle for Artwork, and a double diamond for the Creates relationship. Each artist may have zero or many artworks in the gallery. We use a single line to allow for the possibility that an artist has been interviewed but none of his or her artworks have been selected yet. Each artwork must have exactly one artist, so Artwork has total participation in the relationship. An artist can create many works of art, but an artwork has only one artist. This is a 1:M relationship.

Next we add the Collector entity. The Owns relationship between Collector and Artwork is also 1:M. A collector may not yet have a work of art in the gallery (partial participation), but an artwork must have an owner. However, the owner may be the artist rather than a collector, so we choose partial participation for Artwork as well.

The CollectedBy relationship connected an Artist to the Collector(s), if any, who collect his or her works. Each artist may have many collectors, but a collector can optionally name one artist on the form, making this a 1:M relationship with partial participation on both sides.

Now we add the Sale entity. IsSold, the Artwork to Sale relationship is 1:1. In our list of assumptions, we said that each artwork is sold at most once, and each sale is for one artwork. An artwork may or may not be sold (partial participation), but a sale must have an artwork (total participation).

Next we add the Show entity. The Artwork to Show relationship, ShownIn, is M:N, since an artwork can appear in more than one show, and each show can show many works of art. It is partial participation for the Artwork, since not all artworks appear in shows, and total for Show, since a show must include at least one work of art.

The Artist to Show relationship, FeaturedIn, is 1:M, since a show has at most one featured artist, but an artist could be featured in more than one show. The participation is partial on both sides, since an artist does not have to be featured in any show, and a show may not have a featured artist.

We can add the Salesperson entity. Sale to Salesperson, SoldBy, is M:1. Each sale is made by just one salesperson, but a salesperson can make many sales. A sale requires a salesperson (total participation) but a new salesperson may not have made any sales yet (partial participation).

We can also add the Buyer entity. SoldTo, the Sale to Buyer relationship is M:1. A sale is to one buyer, but the same buyer can be involved in many sales. A sale must have a buyer (total participation) and a buyer, by definition, must be someone who has bought an artwork (total participation).

Lastly we add the PotentialCustomer entity. PreferredBy, the Artist to PotentialCustomer relationship, is 1:M, since a potential customer can identify one artist, but an artist may have many potential customers who prefer him or her. This is a partial relationship on both sides, since a potential customer does not have to state a preference for any artist, and an artist may have no potential customers who have chosen him or her as preferred.

* Step 3.4 - Update the data dictionary and list of assumptions as needed.

Revised Data Dictionary. Changes are in *italics*.

**amountRemittedtoOwner** The dollar amount of money sent to an owner for the sale of an artwork.

**artistAddress** The mailing address of an artist*; composite consisting of artistStreet, artistCity, artistState, artistZip.*

**artistAreaCode** The telephone area code of an artist*; part of the composite artistPhone*.

**artistCity** The city of the mailing address of an artist*; part of the composite artistAddress*

**artistFirstName** The given first name that an artist uses*; part of the composite artistName*.

**artistInterviewDate** The date an artist was interviewed by a representative of the gallery.

**artistInterviewerName** The first and last name of the gallery representative who interviewed an artist.

**artistLastName** The last (family) name of an artist*; part of the composite artistName*.

**artistName** The first and last name of an artist; *composite consisting of artistFirstName, artistLastName.*

**artistPhone** The complete telephone number of the artist*; composite consisting of artistAreaCode and artistTelephoneNumber.*

**artistSalesLastYear** The total dollar amount of sales of an artist’s works during the entire previous year.

**artistSalesYearToDate** The total dollar amount of sales of an artist’s works from the first day of the current year to the date of the report or transaction on which it appears

**artistSocialSecurityNumber** The social security number of an artist

**artistState** The state of the mailing address of an artist*; part of the composite artistAddress.*

**artistStreet** The house number and street of the mailing address of an artist*; part of the composite artistAddress*.

**artistTelephoneNumber** The telephone number of an artist, not including area code*; part of the composite artistPhone*.

***artistTotalSalesforPeriod*** *The total dollar amount of sales of an artist’s works for the period covered in a report or transaction (Item deleted)*

***artistTotalAskingPriceforPeriod*** *The total dollar value of an artist’s unsold works for sale in the gallery for the period covered in a report or transaction, computed as the sum of their asking prices. (Item deleted).*

**artistZip** The postal zip code of the mailing address of an artist*; part of the composite artistAddress*.

**askingPrice** The asking price of a work of art.

**buyerAddress** The mailing address of a buyer of an artwork of the gallery; *composite consisting of buyerStreet, buyerCity, buyerState, buyerZip.*.

**buyerAreaCode** The telephone area code of a buyer of an artwork of the gallery; *part of the composite buyerPhone*.

**buyerCity** The city of the mailing address of a buyer of an artwork of the gallery; *part of the composite buyerAddress*

**buyerFirstName** The first name of a buyer of an artwork of the gallery; *part of the composite buyerName*.

**buyerLastName** The last name of a buyer of an artwork of the gallery; *part of the composite buyerName*.

**buyerName** The first and last name of a buyer of an artwork of the gallery; *composite consisting of buyerFirstName, buyerLastName.*

**buyerPhone** The complete telephone number of a buyer of an artwork of the gallery; *composite consisting of buyerAreaCode and buyerTelephoneNumber .*

**buyerState** The state of the mailing address of a buyer of an artwork of the gallery; *part of the composite buyerAddress*

**buyerStreet** The house number and street of the mailing address of a buyer of an artwork of the gallery; *part of the composite buyerAddress*.

**buyerTelephoneNumber** The telephone number of a buyer of an artwork of the gallery, not including area code; *part of the composite buyerPhone*

**buyerZip** The postal zip code of the buyer of a work of art; *part of the composite buyerAddress*.

***collectionArtistFirstName*** *The first name of the artist featured in a group of artworks owned by a collector; part of composite collectionArtistName..No longer shown in E-R diagram.*

***collectionArtistLastName*** *The last name of the artist featured in a group of artworks owned by a collector part of composite collectionArtistName. No longer shown in E-R diagram.*

***collectionArtistName*** The first and last name of the artist featured in a group of artworks owned by a collector; *composite consisting of collectionArtistFirstName, collectionArtistLastName*

**collectionMedium** The medium used for a group of artworks owned by a collector

**collectionStyle** The style of a group of artworks owned by a collector.

**collectionType** The type of a group of artworks owned by a collector

**collectorAddress** The mailing address of a collector of works of art*; composite consisting of collectorStreet, collectorCity, collectorState, collectoZzip.*.

**collectorAreaCode** The telephone area code of a collector of works of art *; part of composite collectorPhone*.

**collectorCity** The city of the mailing address of a collector of works of art. *; part of composite collectorAddress*.

**collectorFirstName** The given first name of a collector of works of art; *part of composite collectorName.*

**collectorInterviewDate** The date a collector of works of art was interviewed by a representative of the gallery.

**collectorInterviewerName** The first and last name of the representative of the gallery who interviewed a collector of works of art.

**collectorLastName** The last (family) name of a collector of works of art.; *part of composite collectorName.*

**collectorName** The first and last name of a collector of works of art; *composite consisting of collectorFirstName, collectorLastName.*

**collectorPhone** The complete telephone number of a collector of works of art ; *composite consisting of collectorAreaCode, collectorTelephoneNumber.*

**collectorSalesLastYear** The total dollar amount of sales of the collectors’ artworks during the entire previous year.

**collectorSalesYearToDate** The total dollar amount of sales of the collecor’s artworks from the first day of the current year to the date of the report or transaction on which it appears.

**collectorSocialSecurityNumber** The social security number of a collector of works of art.

**collectorState** The state of the mailing address of a collector of works of art*; part of composite collectorAddress*.

**collectorStreet** The house number and street of the mailing address of a collector of works of art*; part of composite collectorAddress*.

**collectorTelephoneNumber** The telephone number of a collector of works of art, not including area code *; part of composite collectorPhone*

***collectorTotalSalesforPeriod*** *The total dollar amount of sales of the collector’s works for the period covered in a report or transaction(Deleted item)*

***collectorTotalAskingPriceforPeriod*** *The total dollar value of the collector’s unsold works for sale in the gallery for the period covered in a report or transaction., computed as the sum of their asking prices (Deleted item)*,

**collectorZip** The postal zip code of the mailing address of a collector of works of art*; part of composite collectorAddress*.

**dateListed** The date a work of art is first offered for sale in the gallery.

**dateReturned** The date a work of art is returned to its owner.

**dateShown** The date a work of art is featured in an art show by the gallery. Since we have decided that an artwork can appear in more than one show, this could potentially have several values. We will assume the value is always the latest date the artwork was shown.

***dateOfReport*** *The date that a report was generated (Item not stored)*

**medium** The medium of a work of art. Examples of valid values are oil, pastel, watercolor, watermedia, acrylic, marble, steel, copper, wood, fiber, other

***ownerAddress*** *The mailing address of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerAreaCode*** *The telephone area code of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownercity*** *The city of the mailing address of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerFirstName*** *The given first name that the owner of a work of art uses. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerLastName*** *The last (family) name of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerPhone*** *The complete telephone number of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerSocialSecurityNumber*** *The social security number of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerState*** *The state of the mailing address of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerStreet*** *The house number and street of the mailing address of the owner of a work of art. (Item deleted; owner replaced by either Artist or Collector.)*

***ownerTelephoneNumber*** *The telephone number of the owner of a work of art, not including area code. ( Item deleted; owner replaced by either Artist or Collector.)*

***ownerZip*** *The postal zip code of the mailing address of the owner of a work of art. ( Item deleted; owner replaced by either Artist or Collector.)*

**potentialCustomerAddress** The mailing address of a potential customer of the gallery*; composite consisting of potentialCustomerStreet, potentialCustomerCity, potentialCustomerState, potentialCustomerZip*

**potentialCustomerAreaCode** The telephone area code of a potential customer of the

gallery; *part of the composite potentialCustomerPhone.*

**potentialCustomerCity** The city of the mailing address of a potential customer of the gallery*; part of the composite potentialCustomerAddress*.

**potentialCustomerDateFilledIn** The date a customer information form was filled in.

**potentialCustomerFirstName** The first name of a potential customer of the gallery*; part of the composite* ***potentialCustomerName***.

**potentialCustomerLastName** The last name of a potential customer of the gallery *; part of the composite potentialCustomerName*.

**potentialCustomerName**. The first and last name of a potential customer of the gallery; c*omposite consisting of potentialCustomerFirstName, potentialCustomerLastName.*.

**potentialCustomerPhone** The complete telephone number of a potential customer of the gallery*; composite consisting of potentialCustomerAreaCode, potentialCustomerTelephoneNumber*.

**potentialCustomerState** The state of the mailing address of a potential customer of the gallery *; part of the composite potentialCustomerAddress*.

**potentialCustomerStreet** The house number and street of the mailing address of a potential customer of the gallery *; part of the composite potentialCustomerAddress*.

**potentialCustomerTelephoneNumber** The telephone number of a potential customer of the gallery, not including area code*; part of the composite potentialCustomerPhone*.

**potentialCustomerZip** The postal zip code of the mailing address of a potential customer of the gallery *; part of the composite potentialCustomerAddress*.

***preferredArtist*** *The name of the artist chosen as a preference by a potential customer of the gallery.Deleted in the E-R diagram.*

**preferredMedium** The medium chosen as a preference by a potential customer of the gallery

**preferredStyle** The style chosen as a preference by a potential customer of the gallery

**preferredType** The type chosen as a preference by a potential customer of the gallery

**purchasesLastYear** The total dollar amount of sales to a buyer during the entire previous year.

**purchasesYearToDate** The total dollar amount of sales to a buyer from the first day of the current year to the date of the report or transaction on which it appears

***reportStartingDate*** *The date chosen as the earliest date for information to be used in a report.Item deleted.*

***reportEndingDate*** *The date chosen as the latest date for information to be used in a report. Item deleted.*

**saleDate** The date a work of art was sold by the gallery.

**saleInvoiceNumber** The number printed on the invoice for a sale of a work of art.

**salePrice** The price at which a work of art was sold by the gallery.

**salesPersonAddress** The full address of a sales associate who works in the gallery*; composite consisting of salesPersonStreet, salesPersonCity, salesPersonState, salesPersonZip.* salesPersonFirstName The given first name of a sales associate who works in the gallery*; part of composite salesPersonName.*

**SalesPersonLastName** The last (family) name of a sales associate who works in the gallery *; part of composite salesPersonName.*.

***salesPersonName***The first and last name of a sales associate who works in the gallery; c*omposite consisting of salesPersonFirstName, salesPersonLastName.*

**salesPersonSocialSecurityNumber** The social security number of a sales associate who works in the gallery.

***salesPersonCommissionForPeriod*** *The total dollar amount of commission earned by a salesperson for a specific period.(Deleted item)*

***salesPersonTotalSalesForPeriod*** *The total dollar amount of sales, not including tax, made by a salesperson during a specific period.(Deleted item)*

**saleSalesPersonCommission** The dollar amount of commission for a salesperson for the sale of a work of art.

**saleTax** The dollar amount of sales tax for the sale of an artwork.

**saleTotal** The total dollar amount of a sale, including price and tax, for an artwork*; calculated from salePrice and saleTax.*

**showClosingDate** The final date that an artshow is open to the public.

***showFeaturedArtist*** *The first and last name of an artist featured in an artshow. Deleted in the E-R diagram.*

**showTheme** The theme of an artshow.

**showTitle** The title given to an artshow.

**showOpeningDate** The first date that an artshow is open to the public.

**size** The size of a work of art, expressed in inches. For two-dimensional works, given as length by width; for three-dimensional works, given as length by width by height

**status** The sales status of a work of art. Possible values are sold or unsold.

**style** The artistic style of a work of art. Examples of valid values are contemporary, impressionist, folk, other.

**title** The title of a work of art.

***totalAllSalesForWeek*** *The total dollar amount of sales for the gallery for a specific week, not including tax.(Item deleted)*

***totalAskingPriceForPeriod*** *The sum of asking prices for all works during the period chosen for a report.(Item deleted)*

**type** The type of a work of art. Examples of valid values are painting, sculpture, collage, other.

**usualMedium** The medium the artist usually works in. Examples of valid values are oil, pastel, watercolor, watermedia, acrylic, marble, steel, copper, wood, fiber, other.

**usualStyle.** The usual artistic style of the artist’s works. Examples of valid values are contemporary, impressionist, folk, other.

**usualType** The type of artwork the artist normally produces. Examples of valid values are painting, sculpture, collage, other.

**yearCompleted** The year that a work of art was completed.

The list of assumptions has some minor changes, indicated in italics below.

1. Artist names are unique, but customer names and collector names are not.
2. For privacy reasons, only people who may receive payments from the gallery are asked to provide their social security numbers, because these payments have to be reported for income tax purposes. Therefore, the gallery keeps social security numbers for salespersons, collectors, and artists, but not for buyers or potential customers
3. An artist may have many works for sale in the gallery.
4. Each work is an original, one-of-a-kind piece. No prints or reproductions are sold.
5. Two works of art may have the same title, but the combination of title and artist name is unique.
6. A work of art can be owned either by the artist who created it or by another person, referred to here as a collector.
7. Even if the work of art is owned by a collector, it is important to keep information about the artist who created it, since that is a factor in determining its value.
8. A work of art is sold by the gallery only once. The gallery does not resell its own works.
9. A work of art may appear in more than one show. Some works do not appear in any show.
10. Payment for all sales is made immediately and in full at the time of purchase. Payment may be by credit, cash, or check. The owner is paid the balance and the salesperson is paid the commission at the end of the week.
11. The database does not include payroll information, except for the commission to be paid to salespeople for sales of artwork.
12. There are lists of valid values for type, style, and medium of artworks. Each has a value “other” for works that do not fit existing values.
13. Information about works not selected to be listed by the gallery is discarded.
14. Lists of artists, collectors, buyers, and potential customers are evaluated periodically to determine whether they should be dropped.
15. *Titles of art shows are unique. Each art show also has either a single featured artist or a theme.*
16. *An art show normally features many works of art, but it is possible that a single important piece of art is shown.*