**Simulation Midterm**

***Question 1***

Normalize to 3NF the following initial design. Your answer must include steps,

reasoning, small table with data to support your reasoning.

VIDEO (Vid, title , (ClienID, Name, Date\_rented), SupplierID, SupplierName)

Identify primary key, foreign key of each entity of the final design. Draw the Entity

Relationship Diagram of the final design.

The initial design above, VIDEO, is not in 1FN because there is a repeating group of columns which are ClienID, Name and Date\_rented.

1. 1st Normal Form

These following rules must be respected for the table to be in 1FN :

* Each column of the table must be single-valued.
* Each column should have a unique name.
* A column should contain the same type of values.
* The order of the data stored does not matter.

VIDEO1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Vid | title | ClientID | Name | Date\_rented | SupplierID | SupplierName |
| 1 | Abc | 1 | Lai | 10/10/2020 | 1 | Xyz |
| 1 | Abc | 2 | Gao | 11/11/2020 | 2 | Uvw |
| 2 | Def | 3 | Chen | 10/10/2020 | 2 | Uvw |

The primary key is a composite key of Vid and ClientID because they are in a many-to-many relationship : a video can be opted by more than one client, and a client can opt for more than one video.

Now we have the following design in 1FN :

VIDEO1 (Vid, title, ClientID, Name, Date\_rented, SupplierID, SupplierName)

The design above, VIDEO1, is not in 2FN because there are partial dependencies.

1. 2nd Normal Form

These following rules must be respected for the table to be in 2FN :

* The table should be in 1st Normal Form.
* The table should not have any partial dependencies.

By observing the table VIDEO1, we notice 4 partial dependencies :

* title, SupplierID and SupplierName only depend on Vid and not necessarily on ClientID.
* Name only depends on ClientID and not necessarily on Vid.

Date\_rented is functionally dependent on the whole primary key (Vid + ClientID). It is impossible to find a specific Date\_rented record with Vid only or with ClientID only in this case, which means Date\_rented is not a partial dependency.

We are to divide the table VIDEO1 in 3 new tables to remove the partial dependencies :

* Video2 (Vid, title, SupplierID, SupplierName)
* Client2 (ClientID, Name)
* Date2 (Vid, ClientID, Date\_rented)

Video2 Client2

|  |  |  |  |
| --- | --- | --- | --- |
| Vid | title | SupplierID | SupplierName |
| 1 | Abc | 1 | Xyz |
| 1 | Abc | 2 | Uvw |
| 2 | Def | 2 | Uvw |

|  |  |
| --- | --- |
| ClientID | Name |
| 1 | Lai |
| 2 | Gao |
| 3 | Chen |

Date2

|  |  |  |
| --- | --- | --- |
| Vid | ClientID | Date\_rented |
| 1 | 1 | 10/10/2020 |
| 1 | 2 | 11/11/2020 |
| 2 | 3 | 10/10/2020 |

PK in Video2 = Vid

PK in Client2 = ClientID

PK in Date2 = Vid + ClientID (composite key)

FK1 in Date2 = Vid

FK2 in Date2 = ClientID

The following design is not in 3FN because there is a transitive dependency :

Video2 (Vid, title, SupplierID, SupplierName)

Client2 (ClientID, Name)

Date2 (Vid, ClientID, Date\_rented)

1. 3rd Normal Form

These following rules must be respected for the table to be in 3FN :

* The table should be in 2nd Normal Form.
* The table should not have any transitive dependencies.

By observing the table Video2, we notice a transitive dependency :

The SupplierName only depends on SupplierID and not necessarily on the primary key of Vid. SupplierID is not part of the primary key in the table Video2.

We are to divide the table Video2 in two tables which results to this following design to remove the transitive dependency :

* Video3 (Vid, title, SupplierID)
* Client2 (ClientID, Name)
* Date2 (Vid, ClientID, Date\_rented)
* Supplier3 (SupplierID, SupplierName)

Video3 Client2

|  |  |  |
| --- | --- | --- |
| Vid | title | SupplierID |
| 1 | Abc | 1 |
| 1 | Abc | 2 |
| 2 | Def | 2 |

|  |  |
| --- | --- |
| ClientID | Name |
| 1 | Lai |
| 2 | Gao |
| 3 | Chen |

Date2 Supplier3

|  |  |  |
| --- | --- | --- |
| Vid | ClientID | Date\_rented |
| 1 | 1 | 10/10/2020 |
| 1 | 2 | 11/11/2020 |
| 2 | 3 | 10/10/2020 |

|  |  |
| --- | --- |
| SupplierID | SupplierName |
| 1 | Xyz |
| 2 | Uvw |
| 2 | Uvw |

PK in Supplier3 = SupplierID

PK in Video3 = Vid

FK in Video3 = SupplierID

PK in Client2 = ClientID

PK in Date2 = Vid + ClientID (composite key)

FK1 in Date2 = Vid

FK2 in Date2 = ClientID