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**Section 1: Conceptual Design**

**Summary of the Problem Scenario**

**Extended Entity Relationship Diagram**

**Additional Assumptions**

**Section 1:Logical Design**

**Relational Mapping**

**Data Normalization**

**First Normal Form(1NF)**

**Airport**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| AirportCode | AirportName | City | Country | EstablishedYear |

The table **Airport** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Airline**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AirlineCode | AirlineName | Owner | FleetSize | Address | NoOfDestinations | HeadOfficeEmail | WebsiteURL | CommencementYear |

The table **Airline** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Aircraft**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| AircraftCode | Name | Model | Manufacturer | MaxNoOfSeats | AirlineCode | FlightNo |

The table **Aircraft** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Flight**

|  |  |  |  |
| --- | --- | --- | --- |
| FlightNo | FlightPath | AirlineCode | FlightType |

The table **Flight** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Reservation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| TicketNo | Class | SeatNo | CheckInTime | BaggageWeight | LegNo |

The table **Reservation** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Provide\_Services**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| AirlineCode | AirportCode | AirlineName | Owner | FleetSize | Address | NoOfDestinations | HeadOfficeEmail | WebsiteURL | CommencementYear | AirportName | City | Country | EstablishedYear |

The table **Provide\_Services** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Airline\_Contact\_No**

|  |  |
| --- | --- |
| AirlineCode | ContactNo |

The table **Airline\_Contact\_No** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Schedule\_Days**

|  |  |  |  |
| --- | --- | --- | --- |
| FlightNo | FlightDate | EstimatedArrivalTime | EstimatedDepartureTime |

The table **Schedule\_Days** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Landing Take\_Off**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FlightNo | AirportName |  | FlightNo | AirportName |

The tables **Landing** and **Take\_Off** do not have composite or multivalued attributes and are not consisted of nested relations. Therefore both tables are already in 1NF.

**Pilot**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| StaffID | FirstName | LastName | PassportNo | Adress | Gender | Designation | DateJoined | AirlineTraining Details | AcadamicEducation Details | TotalFlying Hours | LegNo | AirlineCode |

The table **Pilot** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**FlightAttendant**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| StaffID | FirstName | LastName | PassportNo | Adress | Gender | Designation | DateJoined | AirlineTrainingDetails | AcadamicEducationDetails | TotalFlyingHours | LegNo | AirlineCode |

The table **FlightAttendant** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Passenger**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PassportNo | FirstName | LastName | Gender | Nationality | DOB | PassportIssueDate | PassportExpiryDate | TicketNo |

The table **Passenger** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**SpecialRequirements**

|  |  |
| --- | --- |
| PassportNo | RequirementDetails |

The table **SpecialRequirements** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Minor**

|  |  |
| --- | --- |
| PassportNo | AcconpanyPassportNumber |

The table **Minor** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Arrival**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LegNo | ArrivalTerminalNo | ArrivalTime | BaggageBeltNo | FlightStatus | DateOfFlight | AircrewCheckInTime | AircraftCode | FlightNo |

The table **Arrival** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Departure**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| LegNo | DepartureTerminalNo | GateNo | BoardingTime | DepartureTime | FlightStatus | DateOfFlight | AircrewCheckInTime | AircraftCode | FlightNo |

The table **Departure** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Delayed**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| LegNo | Reason | FlightStatus | DateOfFlight | AircrewCheckInTime | AircraftCode | FlightNo |

The table **Delayed** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Canceled**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| LegNo | Reason | FlightStatus | DateOfFlight | AircrewCheckInTime | AircraftCode | FlightNo |

The table **Canceled** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Passenger\_Contact\_No**

|  |  |
| --- | --- |
| PassportNo | ContactNo |

The table **Passenger\_Contact\_No** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Pilot\_Contact\_No**

|  |  |
| --- | --- |
| StaffID | ContactNo |

The table **Pilot\_Contact\_No** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**FlightAttendant\_Contact\_No**

|  |  |
| --- | --- |
| StaffID | ContactNo |

The table **FlightAttendant\_Contact\_No** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**PilotFlownAircrafts**

|  |  |  |
| --- | --- | --- |
| StaffID | AircraftModel | FlyingHours |

The table **PilotFlownAircrafts** does not have composite or multivalued attributes and isn't consisted of nested relations. Therefore the table is already in 1NF.

**Second Normal Form(2NF)**

# Airport

Air

portCode

AirportName

City

Country

EstablishedYear

FD1

The table **Airport** is already in 1NF.

All the non primary key attributes of the table **Airport** depends on it's super key which is AirportCode**.**

Therefore, the functional dependency (FD1) of the table Airport is a full functional dependency. There are no partial dependencies so the table **Airport** is in 2NF

# Airline

AirlineCode

AirlineName

Owner

FleetSize

Address

NoOfDestinations

HeadOfficeEmail

WebsiteURL

CommencementYear

FD1

The table **Airline** is in 1NF.

All the non primary key attributes of the table **Airline** depends on it's super key which is AirlineCode**.**

Therefore, the functional dependency (FD1) of the table **Airline** is a full functional dependency. There are no partial dependencies so the table **Airline** is in 2NF.

**Aircraft**

AircraftCode

Name

Model

Manufacturer

MaxNoOfSeats

AirlineCode

FlightNo

FD1

The table **Aircraft** is in 1NF.

All the non primary key attributes of the table **Aircraft** depends on it's super key which is AircraftCode**.**

Therefore, the functional dependency (FD1) of the table **Aircraft** is a full functional dependency. There are no partial functional dependencies so the table **Aircraft** is in 2NF.

# Flight

Fli

g

htNo

FlightPath

AirlineCode

FlightType

FD1

The table **Flight** is in 1NF.

All the non primary key attributes of the table **Flight** depends on it's super key which is FlightNo**.**

Therefore, the functional dependency (FD1) of the table **Flight** is a full functional dependency. There are no partial functional dependencies so the table **Flight** is in 2NF.

# Reservation

TicketNo

Class

SeatNo

CheckInTime

BaggageWeight

LegNo

FD1

The table **Reservation** is in 1NF.

All the non primary key attributes of the table **Reservation** depends on it's super key which is TicketNo**.**

Therefore, the functional dependency (FD1) of the table **Reservation** is a full functional dependency.

There are no partial functional dependencies so the table **Reservation** is in 2NF.

**PilotFlownAircrafts**

StaffID

AircraftModel

FlyingHours

FD1

The table **PilotFlownAircrafts** is in 1NF.

It has a functional dependency which is FD1 and it is a full functional dependency because all the non primary key attributes depend on the primary key completely. The table **PilotFlownAircrafts** does not have any partial functional dependencies. Therefore it's in 2NF. **FlightAttendant**

StaffID

FirstName

LastName

PassportNo

Designation

DateJoined

AirlineTrainingDetails

AcadamicEducationDetails

Adress

Gender

TotalFlyingHours

FD1

AirlineCode

LegNo

The table **FlightAttendant** is in 1NF.

It has a functional dependency which is FD1 and it is a full functional dependency because all the non primary key attributes depend on the primary key completely. The table **FlightAttendant** does not have any partial functional dependencies. Therefore it's in 2NF.

# Passenger

Pass

portNo

FirstName

LastName

Nationality

DOB

PassportIssueDate

PassportExpiryDate

Gender

FD1

TicketNo

The table **Passenger** is in 1NF.

It has a functional dependency which is FD1 and it is a full functional dependency because all the non primary key attributes depend on the primary key completely. The table **Passenger** does not have any partial functional dependencies. Therefore it's in 2NF.

**SpecialRequirements**

Pass

portNo

RequirementDetails

FD1

The table **SpecialRequirements** is in 1NF.

It has a functional dependency which is FD1 and it is a full functional dependency because all the non primary key attributes depend on the primary key completely. The table **SpecialRequirements** does not have any partial functional dependencies. Therefore it's in 2NF. **Minor**

Pass

portNo

AcconpanyPassportNumber

FD1

The table **Minor** is in 1NF.

It has a functional dependency which is FD1 and it is a full functional dependency because all the non primary key attributes depend on the primary key completely. The table **Minor** does not have any partial functional dependencies. Therefore it's in 2NF.

**Arrival**

Le

g

No

ArrivalTerminalNo

ArrivalTime

BaggageBeltNo

FD1

FlightStatus

DateOfFlight

AircrewCheckInTime

FlightNo

AircraftCode

The table **Arrival** is in 1NF.

It has a functional dependency which is FD1 and it is a full functional dependency because all the non primary key attributes depend on the primary key completely. The table **Arrival** does not have any partial functional dependencies. Therefore it's in 2NF.

# Departure

Le

g

No

DepartureTerminalNo

GateNo

BoardingTime

DepartureTime

FD1

FlightStatus

DateOfFlight

AircrewCheckInTime

FlightNo

AircraftCode

The table **Departure** is in 1NF.

It has a functional dependency which is FD1 and it is a full functional dependency because all the non primary key attributes depend on the primary key completely. The table **Departure** does not have any partial functional dependencies. Therefore it's in 2NF.

# Delayed Canceled

g

No

Le

Reason

No

g

Le

Reason

FD1

FD1

FlightStatus

DateOfFlight

AircrewCheckIn

Time

FlightStatus

DateOfFlight

AircrewCheckInTime

FlightNo

Aircraft

Code

FlightNo

Aircraft

Code

The tables **Delayed** and **Canceled** are in 1NF. Theyhave functional dependencies FD1 in each. The functional dependencies of both tables are full functional dependencies because all the non primary key attributes of each table depends completely on the primary key of the respective table.

None of the tables have partial functional dependencies. Therefore both tables are in 2NF.

# Passenger\_Contact\_No PassportNo ContactNo

FD1

The table **Passenger\_Contact\_No** does not have non primary key attributes. They are already in 1NF. Therefore the table **Passenger\_Contact\_No** is in 2NF

# Pilot\_Contact\_No

**ContactNo ContactNo**

# StaffID ContactNo

FD1

# FlightAttendant\_Contact\_No

FD1

# StaffID ContactNo

FD1

The tables **Pilot\_Contact\_No** and **FlightAttendant\_Contact\_No** do not have non primary key attributes. They are already in 1NF. Therefore both tables are in 2NF.

**Third Normal Form(3NF)**

# Airport

Air

portCode

AirportName

City

Country

EstablishedYear

FD1

The table **Airport** is in 2NF. It doesn't have transitive dependencies. All the non primary key attributes depend on the primary key of the table which is AirportCode. It has a functional dependency named FD1 and it's determinent is the super key of the table. Therefore the table **Airport** is in 3NF.

# Airline

AirlineCode

AirlineName

Owner

FleetSize

Address

NoOfDestinations

HeadOfficeEmail

WebsiteURL

CommencementYear

FD1

The table **Airline** is in 2NF. It doesn't have transitive dependencies. All the non primary key attributes depend on the primary key of the table which is AirlineCode. It has a functional dependency named FD1 and it's determinent is the super key of the table. Therefore the table **Airline** is in 3NF.

**Aircraft**

AircraftCode

Name

Model

Manufacturer

MaxNoOfSeats

AirlineCode

FlightNo

FD1

The table **Aircraft** is in 2NF. It doesn't have transitive dependencies. All the non primary key attributes depend on the primary key of the table which is AircraftCode. It has a functional dependency named FD1 and it's determinent is the super key of the table. Therefore the table **Aircraft** is in 3NF.

# Flight

Fli

g

htNo

FlightPath

AirlineCode

FlightType

FD1

The table **Flight** is in 2NF. It doesn't have transitive dependencies. All the non primary key attributes depend on the primary key of the table which is FlightNo. It has a functional dependency named FD1 and it's determinent is the super key of the table. Therefore the table **Flight** is in 3NF.

# Reservation

TicketNo

Class

SeatNo

CheckInTime

BaggageWeight

LegNo

FD1

The table **Reservation** is in 2NF. It doesn't have transitive dependencies. All the non primary key attributes depend on the primary key of the table which is TicketNo. It has a functional dependency named FD1 and it's determinent is the super key of the table.

Therefore the table **Reservation** is in 3NF.

# Provide\_Services

AirlineCode AirlineCode

Air

portCode

AirlineName

Owner

FleetSize

Address

NoOfDestinations

HeadOfficeEmail

WebsiteURL

CommencementYear

AirportName

City

Country

EstablishedYear

FD1

The table **Provide\_Services** is in 2NF. It doesn't have transitive dependencies. All the non primary key attributes depend on the primary key of the table which is AirlineCode AirportCode.

It has a functional dependency named FD1 and it's determinent is the super key of the table. Therefore the table **Provide\_Services** is in 3NF.

AirlineCode

**Airline\_Contact\_No**

ContactNo

FD1

The table **Airline\_Contact\_No** is in 2NF. It doesn't have transitive dependencies.

It has a functional dependency named FD1 and it's dependent which is ContactNo is a prime attribute. Therefore the table **Airline\_Contact\_No** is in 3NF.

# Landing

Fli

g

htNo

Air

portName

FD1

The table **Landing** is in 2NF. It doesn't have transitive dependencies.

It has a functional dependency named FD1 and it's dependent which is AirportName is a prime attribute. Therefore the table **Landing** is in 3NF.

# Take\_Off

Fli

g

htNo

Air

portName

FD1

The table **Take\_Off** is in 2NF. It doesn't have transitive dependencies.

It has a functional dependency named FD1 and it's dependent which is AirportName is a prime attribute. Therefore the table **Take\_Off** is in 3NF.

# Schedule\_Days

Fli

g

htNo

Fli

g

htDate

EstimatedArrivalTime

EstimatedDepartureTime

FD1

The table **Schedule\_Days** is in 2NF. It doesn't have transitive dependencies. All the non primary key attributes depend on the composite primary key of the table which is FlightNo FlightDate.

It has a functional dependency named FD1 and it's determinent is the super key of the table. Therefore the table **Schedule\_Days** is in 3NF.

# Pilot

StaffID

FirstName

LastName

PassportNo

Designation

DateJoined

AirlineTraining

Details

AcadamicEducation

Details

Adress

Gender

TotalFlying

Hours

FD1

AirlineCode

LegNo

The table **Pilot** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key which is StaffID

There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **Pilot** is in 3NF.

**PilotFlownAircrafts**

StaffID

AircraftModel

FlyingHours

FD1

The table **PilotFlownAircrafts** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key which is StaffID. There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **PilotFlownAircrafts** is in 3NF.

# FlightAttendant

StaffID

FirstName

LastName

PassportNo

Designation

DateJoined

AirlineTrainingDetails

AcadamicEducationDetails

Adress

Gender

TotalFlyingHours

FD1

AirlineCode

LegNo

The table **FlightAttendant** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key. There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **FlightAttendant** is in 3NF.

# Passenger

Pass

portNo

FirstName

LastName

Nationality

DOB

PassportIssueDate

PassportExpiryDate

Gender

FD1

TicketNo

The table **Passenger** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key. There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **Passenger** is in 3NF.

**SpecialRequirements**

Pass

portNo

RequirementDetails

FD1

The table **SpecialRequirements** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key. There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **SpecialRequirements** is in 3NF.

# Minor

Pass

portNo

AcconpanyPassportNumber

FD1

The table **Minor** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key. There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **Minor** is in 3NF.

# Arrival

Le

g

No

ArrivalTerminalNo

ArrivalTime

BaggageBeltNo

FD1

FlightStatus

DateOfFlight

AircrewCheckInTime

FlightNo

AircraftCode

The table **Arrival** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key. There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **Arrival** is in 3NF.

# Departure

Le

g

No

DepartureTerminalNo

GateNo

BoardingTime

DepartureTime

FD1

FlightStatus

DateOfFlight

AircrewCheckInTime

FlightNo

AircraftCode

The table **Departure** is in 2NF and it does not have any transitive functional dependencies and all the non primary key attributes depend on the primary key. There's only one functional dependency (FD1) and it's determinent is a super key. Therefore the table **Departure** is in 3NF.

# Delayed Canceled

g

No

Le

Reason

No

g

Le

Reason

FD1

FD1

FlightStatus

DateOfFlight

AircrewCheckIn

Time

FlightStatus

DateOfFlight

AircrewCheckInTime

FlightNo

Aircraft

Code

FlightNo

Aircraft

Code

The tables **Delayed** and **Canceled** are in 2NF and they do not have any transitive functional dependencies.

All the non primary key attributes depends on the primary key.

The tables **Delayed** and**Canceled** each has a functional dependency called FD1 and their determinents are a super keys. Therefore the table **Departure** is in 3NF.

# Passenger\_Contact\_No PassportNo ContactNo

FD1

The table **Passenger\_Contact\_No** is in 2NF and it does not have any transitive functional dependencies.

The table **Passenger\_Contact\_No** has a functional dependency called FD1 and it's dependent is a prime attribute. Therefore the table **Passenger\_Contact\_No** is in 3NF.

**Pilot\_Contact\_No FlightAttendant\_Contact\_No** StaffID ContactNo StaffID ContactNo

FD1

FD1

The tables **Pilot\_Contact\_No** and **FlightAttendant\_Contact\_No** are in 2NF and they do not have any transitive functional dependencies.

The tables **Pilot\_Contact\_No** and **FlightAttendant\_Contact\_No** each has a functional dependency called FD1 and their dependents are prime attributes. Therefore the tables **Pilot\_Contact\_No** and **FlightAttendant\_Contact\_No** are in 3NF.

**Boyce Code Normal Form(BCNF)**

**Data Dictionary**

**Section 2:Database Schema**

**Data Definition**

**Database Diagram**

**Sample Records**

**Section 3:Report Generation**

**SQL Triggers**

**User Define Functions**

**Database Views**

**Stored Procedures**

**Section 4:Conclusion**

**Justification of the Solution**

**Limitations of the Project**

**Future Modifications**

**Work Load Matrix**

**Peer Review Form**