

AIRPORT PROJECT CONCEPTS

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1. After mapping ER to relational model

- a. Mapping of Regular Entity types:
For each strong Entity type E, a relation R is created which includes all the attributes of the entity type E. One or more attributes are chosen as the primary key of the relation R.
We have created a relation for each of the entity type.
- b. Mapping of Weak Entity types:
For each weak Entity type E, a relation R is created which includes all the attributes of the entity type E. Now add a foreign key attribute in R which references to the primary key attribute of the owner entity type, which is described by the identifying relationship of E.
We add Airport_code for ATC and Employee_number for DEPENDENTS.
- c. Mapping of 1:1 binary relationship types:
Choose any relation, say S, and add a foreign key attribute in S which references to the primary key attribute of other participating entity type.
We have added a foreign key Ticket_number in the relation PASSENGER.
- d. Mapping of 1:N binary relationship types:
Choose the relation, say S, which represents the participating entity type at the N-side of the relationship type. Add a foreign key attribute in S which references to the primary key attribute of the other participating entity type.
We have added Airport_code in EMPLOYEE, Head_PN (Passport_number of head of the family/friends) in PASSENGER.
- e. Mapping of M:N binary relationship types:
Create a new relation R for each of the M:N relationship types and include the primary keys of both the participating entity types as the foreign key attributes of R.
We have added a new relation CONTAINS which has Airport_code and Airline_ID as its attributes.
- f. Mapping of N-ary relationship types:
For each n-ary relationship type R, create a new relationship relation S to represent R.
Include as foreign key attributes in S the primary keys of the relations that represent the participating entity types.
We have created a new relation JOURNEY which includes the primary key attributes of all the participating entity types.

AIRPORT

| | | | |
|------|---------------------|------|---------|
| Name | <u>Airport_code</u> | Type | Country |
|------|---------------------|------|---------|

EMPLOYEE

| | | | | | | |
|---------------------|------------------------|------|---------------|--------------|-------------|--------|
| <u>Airport_code</u> | <u>Employee_number</u> | Name | Date_of_birth | Phone_number | Designation | Salary |
|---------------------|------------------------|------|---------------|--------------|-------------|--------|

AIRLINE

| | | |
|-------------------|------|-------|
| <u>Airline_ID</u> | Name | Owner |
|-------------------|------|-------|

CONTAINS

| | |
|---------------------|-------------------|
| <u>Airport_code</u> | <u>Airline_ID</u> |
|---------------------|-------------------|

FLIGHT

| | | | | | | |
|----------------------|--------|-------------|--------|---------|-----------|----------------|
| <u>Flight_number</u> | Source | Destination | Status | Arrival | Departure | Occupancy_rate |
|----------------------|--------|-------------|--------|---------|-----------|----------------|

CREW MEMBER

| | | | |
|------|------------------|-------------|---------------|
| Name | <u>Member_ID</u> | Designation | Flight_number |
|------|------------------|-------------|---------------|

TICKET

| | | | | |
|----------------------|---------------|-------|-------------|-------|
| <u>Ticket_number</u> | Flight_number | Price | Seat_number | Class |
|----------------------|---------------|-------|-------------|-------|

PASSENGER

| | | | | | | | |
|------------------------|------|---------|---------------|--------|--------------|---------------|---------|
| <u>Passport_number</u> | Name | Address | Date_of_birth | Gender | Phone_number | Ticket_number | Head_PN |
|------------------------|------|---------|---------------|--------|--------------|---------------|---------|

JOURNEY

| | | | | |
|-------------------|----------------------|------------------|------------------------|----------|
| <u>Airline_ID</u> | <u>Flight_number</u> | <u>Member_ID</u> | <u>Passport_number</u> | Duration |
|-------------------|----------------------|------------------|------------------------|----------|

ATC

| | | |
|---------------------|-------------------|--------------|
| <u>Airport_code</u> | Number_of_members | Airport_name |
|---------------------|-------------------|--------------|

DEPENDENTS

| | | | | |
|------------------------|------|---------------|--------|--------------|
| <u>Employee_number</u> | Name | Date_of_birth | Gender | Relationship |
|------------------------|------|---------------|--------|--------------|

2. Relational model after conversion to 1NF

In order to remove multivalued attributes of the relation R, we create a new relation S and include primary key attribute of R and multivalued attribute of R as the primary key attributes of S. Also, remove the multivalued attribute from the relation R.

In order to remove composite attributes of the relation R, we create a new relation S and include primary key attribute of R and add some attributes (which describe the composite attribute of R) to S. Also, remove the composite attribute from the relation R.

We have split PASSENGER into PASSENGER_1, PASSENGER_2 and PASSENGER_3 Where PASSENGER_2 handles multivalued attribute Phone_number and PASSENGER_3 handles composite attribute Address. We have added attributes Area, City, Country and Pin_code in relation PASSENGER_3 to describe the address of a passenger.

AIRPORT

| | | | |
|------|---------------------|------|---------|
| Name | <u>Airport_code</u> | Type | Country |
|------|---------------------|------|---------|

EMPLOYEE

| | | | | | | |
|------------------------|---------------------|------|---------------|--------------|-------------|--------|
| <u>Employee_number</u> | <u>Airport_code</u> | Name | Date_of_birth | Phone_number | Designation | Salary |
|------------------------|---------------------|------|---------------|--------------|-------------|--------|

AIRLINE

| | | |
|-------------------|------|-------|
| <u>Airline_ID</u> | Name | Owner |
|-------------------|------|-------|

CONTAINS

| | |
|---------------------|-------------------|
| <u>Airport_code</u> | <u>Airline_ID</u> |
|---------------------|-------------------|

FLIGHT

| | | | | | | |
|----------------------|--------|-------------|--------|---------|-----------|----------------|
| <u>Flight_number</u> | Source | Destination | Status | Arrival | Departure | Occupancy_rate |
|----------------------|--------|-------------|--------|---------|-----------|----------------|

CREW MEMBER

| | | | |
|------|------------------|-------------|---------------|
| Name | <u>Member_ID</u> | Designation | Flight_number |
|------|------------------|-------------|---------------|

TICKET

| | | | | |
|----------------------|---------------|-------|-------------|-------|
| <u>Ticket_number</u> | Flight_number | Price | Seat_number | Class |
|----------------------|---------------|-------|-------------|-------|

PASSENGER_1

| | | | | | |
|------------------------|------|---------------|--------|---------|---------------|
| <u>Passport_number</u> | Name | Date_of_birth | Gender | Head_PN | Ticket_number |
|------------------------|------|---------------|--------|---------|---------------|

PASSENGER_2

| | |
|------------------------|---------------------|
| <u>Passport_number</u> | <u>Phone_number</u> |
|------------------------|---------------------|

PASSENGER_3

| | | | | |
|------------------------|------|------|---------|----------|
| <u>Passport_number</u> | Area | City | Country | Pin_code |
|------------------------|------|------|---------|----------|

JOURNEY

| | | | | |
|-------------------|----------------------|------------------|------------------------|----------|
| <u>Airline_ID</u> | <u>Flight_number</u> | <u>Member_ID</u> | <u>Passport_number</u> | Duration |
|-------------------|----------------------|------------------|------------------------|----------|

ATC

| | | |
|---------------------|-------------------|--------------|
| <u>Airport_code</u> | Number_of_members | Airport_name |
|---------------------|-------------------|--------------|

DEPENDENTS

| | | | | |
|------------------------|------|---------------|--------|--------------|
| <u>Employee_number</u> | Name | Date_of_birth | Gender | Relationship |
|------------------------|------|---------------|--------|--------------|

3. Relational model after conversion to 2NF

Every non-prime attribute should be fully functionally dependent on a primary key or a set of primary key attributes.

In order to follow 2NF, we have split EMPLOYEE into EMPLOYEE_1 and EMPLOYEE_2. EMPLOYEE_1 has Airport_code as its primary key and other attributes Designation and Salary are fully functionally dependent on it.

EMPLOYEE_2 has Employee_Number as its primary key and attributes Name, Date_of_birth and Phone_number are fully functionally dependent on it.

AIRPORT

| | | | |
|------|---------------------|------|---------|
| Name | <u>Airport_code</u> | Type | Country |
|------|---------------------|------|---------|

EMPLOYEE_1

| | | |
|---------------------|-------------|--------|
| <u>Airport_code</u> | Designation | Salary |
|---------------------|-------------|--------|

EMPLOYEE_2

| | | | |
|------------------------|------|---------------|--------------|
| <u>Employee_number</u> | Name | Date_of_birth | Phone_number |
|------------------------|------|---------------|--------------|

AIRLINE

| | | |
|-------------------|------|-------|
| <u>Airline_ID</u> | Name | Owner |
|-------------------|------|-------|

CONTAINS

| | |
|---------------------|-------------------|
| <u>Airport_code</u> | <u>Airline_ID</u> |
|---------------------|-------------------|

FLIGHT

| | | | | | | |
|----------------------|--------|-------------|--------|---------|-----------|----------------|
| <u>Flight_number</u> | Source | Destination | Status | Arrival | Departure | Occupancy_rate |
|----------------------|--------|-------------|--------|---------|-----------|----------------|

CREW MEMBER

| | | | |
|------|------------------|-------------|---------------|
| Name | <u>Member_ID</u> | Designation | Flight_number |
|------|------------------|-------------|---------------|

TICKET

| | | | | |
|----------------------|---------------|-------|-------------|-------|
| <u>Ticket_number</u> | Flight_number | Price | Seat_number | Class |
|----------------------|---------------|-------|-------------|-------|

PASSENGER_1

| | | | | | |
|------------------------|------|---------------|--------|---------|---------------|
| <u>Passport_number</u> | Name | Date_of_birth | Gender | Head_PN | Ticket_number |
|------------------------|------|---------------|--------|---------|---------------|

PASSENGER_2

| | |
|------------------------|---------------------|
| <u>Passport_number</u> | <u>Phone_number</u> |
|------------------------|---------------------|

PASSENGER_3

| | | | | |
|------------------------|------|------|---------|----------|
| <u>Passport_number</u> | Area | City | Country | Pin_code |
|------------------------|------|------|---------|----------|

JOURNEY

| | | | | |
|-------------------|----------------------|------------------|------------------------|----------|
| <u>Airline_ID</u> | <u>Flight_number</u> | <u>Member_ID</u> | <u>Passport_number</u> | Duration |
|-------------------|----------------------|------------------|------------------------|----------|

ATC

| | | |
|---------------------|-------------------|--------------|
| <u>Airport_code</u> | Number_of_members | Airport_name |
|---------------------|-------------------|--------------|

DEPENDENTS

| | | | | |
|------------------------|------|---------------|--------|--------------|
| <u>Employee_number</u> | Name | Date_of_birth | Gender | Relationship |
|------------------------|------|---------------|--------|--------------|

4. Relational model after conversion to 3NF

There should not be any transitive dependency in the relations.

In the relation TICKET, we can see that Ticket_number, Class are fully functionally dependent on Ticket_number & Price is fully functionally dependent on Ticket_number, Class.

So, Price is transitively dependent on the primary key Ticket_number.

In order to convert to 3NF, we split the relation TICKET into Ticket_1 and TICKET_2.

TICKET_1 contains Flight_number, Class as primary keys and Price as the attribute.

TICKET_2 contains Ticket_number as the primary key and Flight_number, Seat_number and Class as the other attributes.

AIRPORT

| | | | |
|------|---------------------|------|---------|
| Name | <u>Airport_code</u> | Type | Country |
|------|---------------------|------|---------|

EMPLOYEE_1

| | | |
|---------------------|-------------|--------|
| <u>Airport_code</u> | Designation | Salary |
|---------------------|-------------|--------|

EMPLOYEE_2

| | | | |
|------------------------|------|---------------|--------------|
| <u>Employee_number</u> | Name | Date_of_birth | Phone_number |
|------------------------|------|---------------|--------------|

AIRLINE

| | | |
|-------------------|------|-------|
| <u>Airline_ID</u> | Name | Owner |
|-------------------|------|-------|

CONTAINS

| | |
|---------------------|-------------------|
| <u>Airport_code</u> | <u>Airline_ID</u> |
|---------------------|-------------------|

FLIGHT

| | | | | | | |
|----------------------|--------|-------------|--------|---------|-----------|----------------|
| <u>Flight_number</u> | Source | Destination | Status | Arrival | Departure | Occupancy_rate |
|----------------------|--------|-------------|--------|---------|-----------|----------------|

CREW MEMBER

| | | | |
|------|------------------|-------------|---------------|
| Name | <u>Member_ID</u> | Designation | Flight_number |
|------|------------------|-------------|---------------|

TICKET_1

| | | |
|----------------------|--------------|-------|
| <u>Flight_number</u> | <u>Class</u> | Price |
|----------------------|--------------|-------|

TICKET_2

| | | | |
|----------------------|---------------|-------------|-------|
| <u>Ticket_number</u> | Flight_number | Seat_number | Class |
|----------------------|---------------|-------------|-------|

PASSENGER_1

| | | | | | |
|------------------------|------|---------------|--------|---------|---------------|
| <u>Passport_number</u> | Name | Date_of_birth | Gender | Head_PN | Ticket_number |
|------------------------|------|---------------|--------|---------|---------------|

PASSENGER_2

| | |
|------------------------|---------------------|
| <u>Passport_number</u> | <u>Phone_number</u> |
|------------------------|---------------------|

PASSENGER_3

| | | | | |
|------------------------|------|------|---------|----------|
| <u>Passport_number</u> | Area | City | Country | Pin_code |
|------------------------|------|------|---------|----------|

JOURNEY

| | | | | |
|-------------------|----------------------|------------------|------------------------|----------|
| <u>Airline_ID</u> | <u>Flight_number</u> | <u>Member_ID</u> | <u>Passport_number</u> | Duration |
|-------------------|----------------------|------------------|------------------------|----------|

ATC

| | | |
|---------------------|-------------------|--------------|
| <u>Airport_code</u> | Number_of_members | Airport_name |
|---------------------|-------------------|--------------|

DEPENDENTS

| | | | | |
|------------------------|------|---------------|--------|--------------|
| <u>Employee_number</u> | Name | Date_of_birth | Gender | Relationship |
|------------------------|------|---------------|--------|--------------|