



Design of databases

Example of relational logic design




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Example of relational logic design

- Introduction
- ER scheme restructuring
- Translation of the entities with an external identifier
- Translation of the entities without an external identifier
- Translation of the relationships




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Example of relational logic design

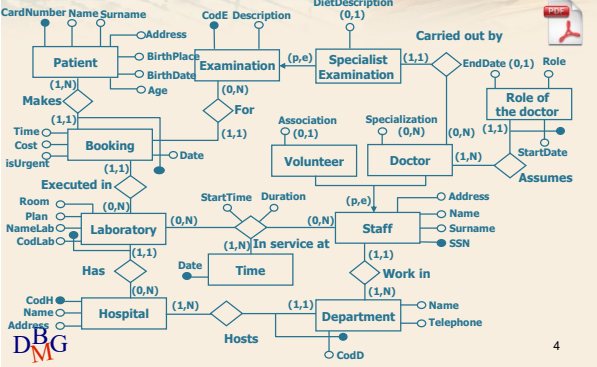
Introduction




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Starting conceptual model






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Example of relational logic design

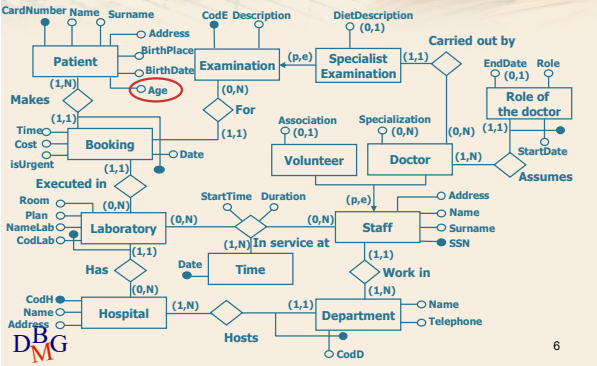
ER scheme restructuring




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Analysis of the derived attributes





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Derived Age attribute

CardNumber Name Surname
Address
BirthPlace
BirthDate
Age

Patient

▷ The Age attribute can be removed since

- It can be easily calculated from the date of birth (BirthDate)
- It is not generally present in a query

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Elimination of the Age attribute

CardNumber Name Surname
Address
BirthPlace
BirthDate

Patient

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Simplified scheme (n. 1)

CardNumber Name Surname Address BirthPlace BirthDate
CodE Description DietDescription (0,1)
Carried out by (1,1)
EndDate Role (0,1)
StartDate (1,1)
Assumes (1,N)
Volunteer Doctor
Association (0,1) Specialization (0,N)
Made by (1,1)
Time Cost isUrgent (1,1)
Date (1,1)
Executed in (0,N)
Room Plan NameLab CodLab (1,1)
Laboratory
Has (0,N)
CodH Name Address (1,1)
Hospital
In service at (1,N)
Date (1,1)
Time
Work in (1,N)
Staff
Name Surname SSN (1,1)
Department
Name Telephone (1,1)
Hosts (1,N)
CodD (1,1)

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Elimination of the hierarchies

CardNumber Name Surname Address BirthPlace BirthDate
CodE Description DietDescription (0,1)
Carried out by (1,1)
EndDate Role (0,1)
StartDate (1,1)
Assumes (1,N)
Volunteer Doctor
Association (0,1) Specialization (0,N)
Made by (1,1)
Time Cost isUrgent (1,1)
Date (1,1)
Executed in (0,N)
Room Plan NameLab CodLab (1,1)
Laboratory
Has (0,N)
CodH Name Address (1,1)
Hospital
In service at (1,N)
Date (1,1)
Time
Work in (1,N)
Staff
Name Surname SSN (1,1)
Department
Name Telephone (1,1)
Hosts (1,N)
CodD (1,1)

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Examination of the hierarchies

CodE Description DietDescription (0,1)
Carried out by (1,1)
EndDate Role (0,1)
StartDate (1,1)
Assumes (1,N)
Volunteer Doctor
Association (0,1) Specialization (0,N)
Made by (1,1)
Time Cost isUrgent (1,1)
Date (1,1)
Executed in (0,N)
Room Plan NameLab CodLab (1,1)
Laboratory
Has (0,N)
CodH Name Address (1,1)
Hospital
In service at (1,N)
Date (1,1)
Time
Work in (1,N)
Staff
Name Surname SSN (1,1)
Department
Name Telephone (1,1)
Hosts (1,N)
CodD (1,1)

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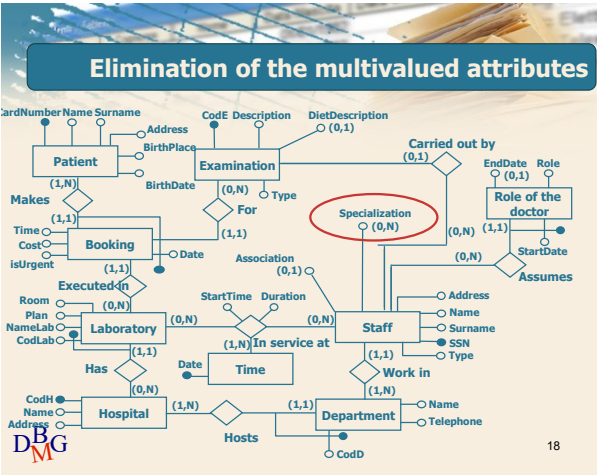
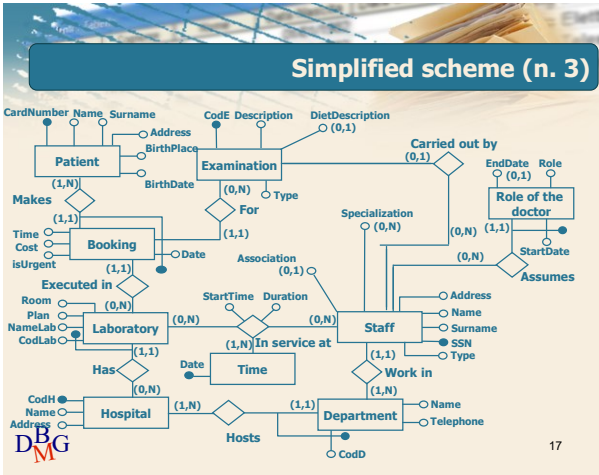
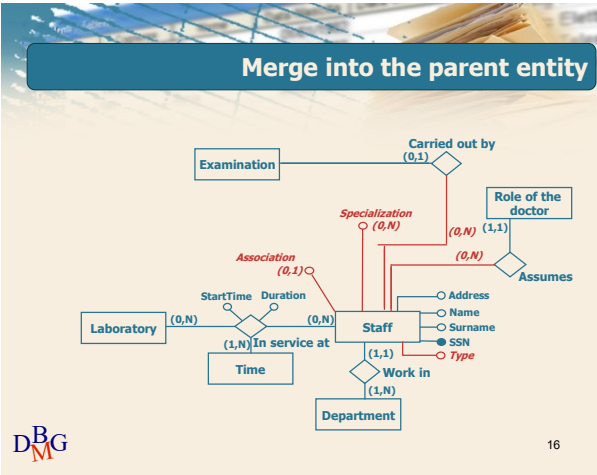
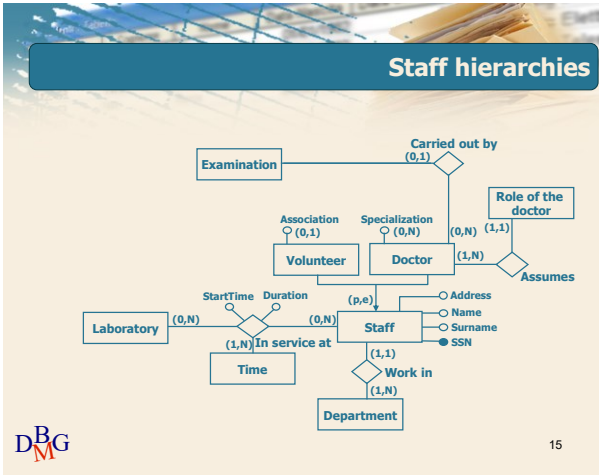
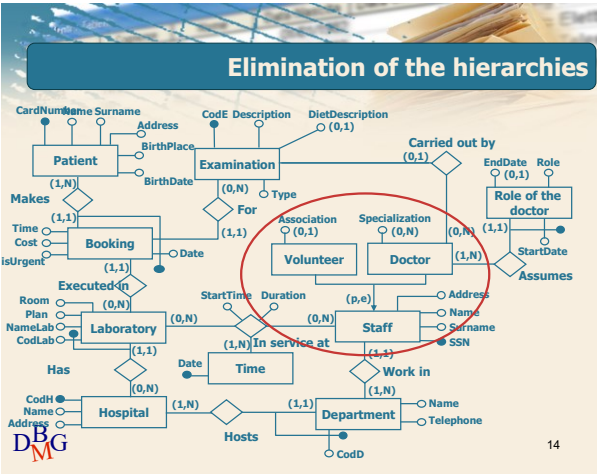
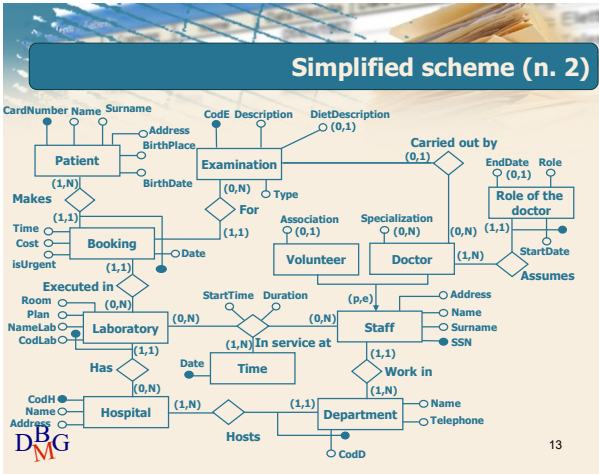
Merge into the parent entity

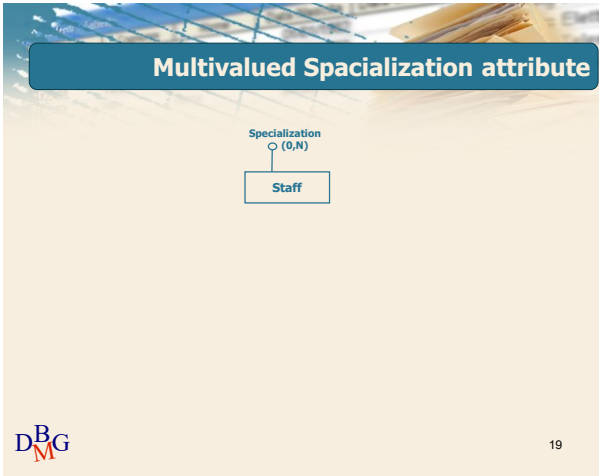
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Carried out by (1,1)
EndDate Role (0,1)
StartDate (1,1)
Assumes (1,N)
Volunteer Doctor
Association (0,1) Specialization (0,N)
Made by (1,1)
Time Cost isUrgent (1,1)
Date (1,1)
Executed in (0,N)
Room Plan NameLab CodLab (1,1)
Laboratory
Has (0,N)
CodH Name Address (1,1)
Hospital
In service at (1,N)
Date (1,1)
Time
Work in (1,N)
Staff
Name Surname SSN (1,1)
Department
Name Telephone (1,1)
Hosts (1,N)
CodD (1,1)

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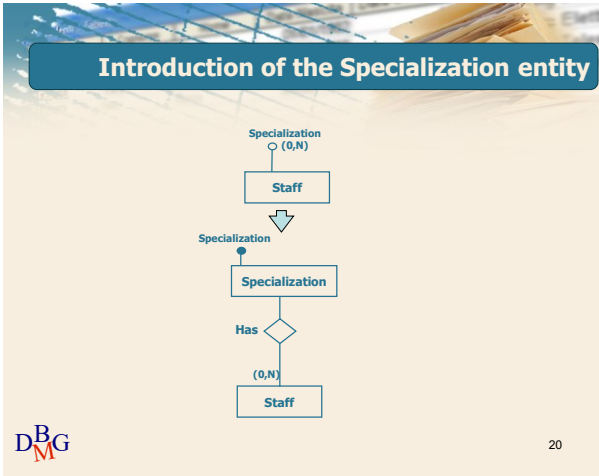
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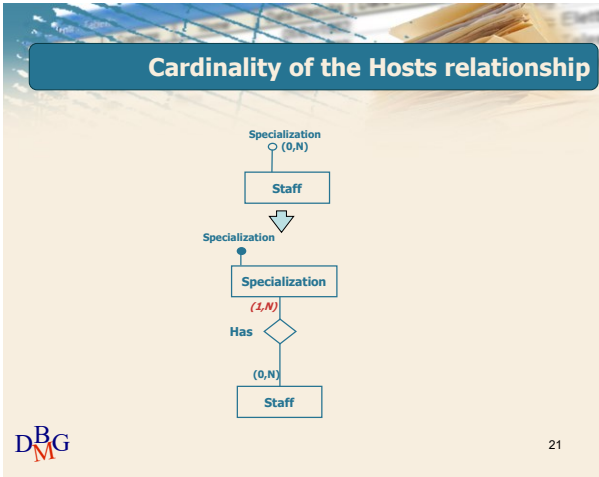




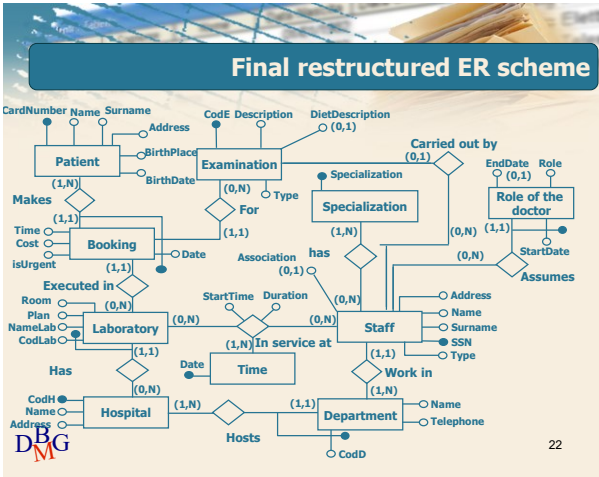
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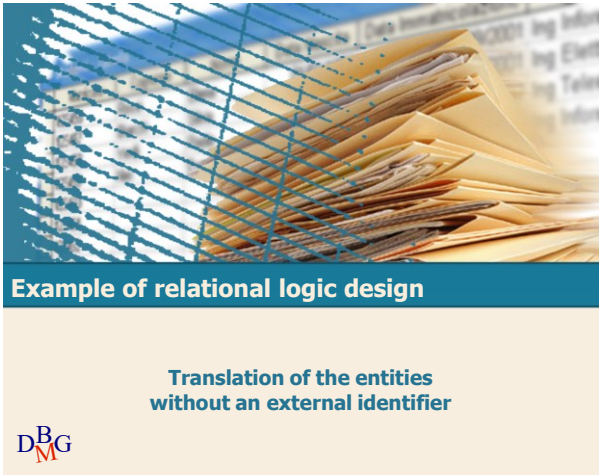
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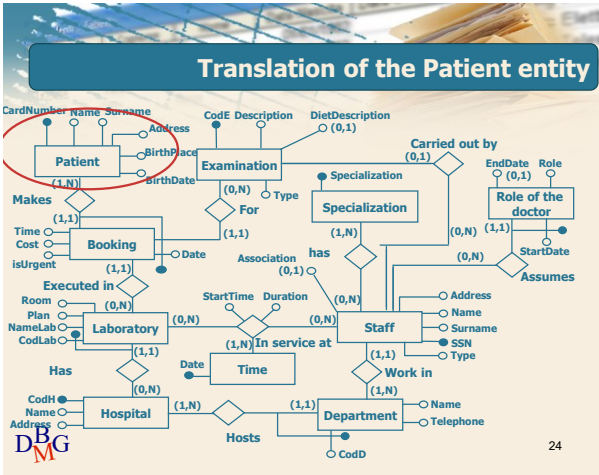
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Translation of the Patient Entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)

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Translation of the Hospital entity

CardNumber Name Surname Address BirthPlace BirthDate

CodE Description DietDescription

Carried out by

EndDate Role

Role of the doctor

Assumes

Makes

Time Cost

isUrgent

Executed in

Room Plan

NameLab CodLab

Has

CodH Name Address

Hospital

Hosts

Department

Name Telephone

CodD

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Translation of the Hospital Entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

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Translation of the Examination entity

CardNumber Name Surname Address BirthPlace BirthDate

CodE Description DietDescription

Carried out by

EndDate Role

Role of the doctor

Assumes

Makes

Time Cost

isUrgent

Executed in

Room Plan

NameLab CodLab

Has

CodH Name Address

Hospital

Hosts

Department

Name Telephone

CodD

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Translation of the Examination entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type)

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Translation of the Staff entity

CardNumber Name Surname Address BirthPlace BirthDate

CodE Description DietDescription

Carried out by

EndDate Role

Role of the doctor

Assumes

Makes

Time Cost

isUrgent

Executed in

Room Plan

NameLab CodLab

Has

CodH Name Address

Hospital

Hosts

Department

Name Telephone

CodD

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Translation of the Staff entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type)

Staff(SSN, Name, Surname, Address, Association*, Type)

DBMG

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Translation of the Time entity

DBMG

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Translation of the Time entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type)

Staff(SSN, Name, Surname, Address, Association*, Type)

Time(Date)

DBMG

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Translation of the Specialization entity

DBMG

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Translation of the Specialization entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type)

Staff(SSN, Name, Surname, Address, Association*, Type)

Time(Date)

Specialization(Specialization)

DBMG

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Example of relational logic design

Translation of the entities with an external identifier

DBMG

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Translation of the Laboratory entity

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Translation of the Laboratory entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*, Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH

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Translation of the Laboratory entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*, Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH, NameLab, Plan, Room)

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Translation of the Department entity

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Translation of the Department entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*, Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH, NameLab, Plan, Room)
Department(CodD, CodH

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Translation of the Department entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*, Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH, NameLab, Plan, Room)
Department(CodD, CodH, Name, Telephone)

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Translation of the Booking entity

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Translation of the Booking entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*,Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH, NameLab, Plan, Room)
Department(CodD, CodH, Name, Telephone)
Booking(CardNumber, CodE, Date,

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Translation of the Booking entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*,Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH, NameLab, Plan, Room)
Department(CodD, CodH, Name, Telephone)
Booking(CardNumber, CodE, Date, Time, Cost, isUrgent)

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Translation of the Role of the doctor entity

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Translation of the Role of the doctor entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*,Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH, NameLab, Plan, Room)
Department(CodD, CodH, Name, Telephone)
Booking(CardNumber, CodE, Date, Time, Cost, isUrgent)
DoctorRole(SSN, StartDate,

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Translation of the Role of the doctor entity

Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(CodH, Name, Address)
Examination(CodE, Description, DietDescription*, Type)
Staff(SSN, Name, Surname, Address, Association*,Type)
Time(Date)
Specialization(Specialization)
Laboratory(CodLab, CodH, NameLab, Plan, Room)
Department(CodD, CodH, Name, Telephone)
Booking(CardNumber, CodE, Date, Time, Cost, isUrgent)
DoctorRole(SSN, StartDate, EndDate, Role)*

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Example of relational logic design

Translation of the relationships

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Binary one-to-many Carried out by relationship

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Translation of the Carried out by relationship

Patient(CodTes, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type, *SSN**)

Staff(SSN, Name, Surname, Address, Association*,Type)

Time(Date)

Specialization(Specialization)

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Department(CodD, CodH, Name, Telephone)

Booking(CodTes, CodE, Date, Time, Cost, isUrgent)

DoctorRole(SSN, StartDate, EndDate*, Role)

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Binary one-to-many Work in relationship

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Translation of the Work in relationship

Patient(CodTes, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type, SSN*)

Staff(SSN, Name, Surname, Address, Association*,Type, *CodD*, *CodH*)

Time(Date)

Specialization(Specialization)

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Department(CodD, CodH, Name, Telephone)

Booking(CodTes, CodE, Date, Time, Cost, isUrgent)

DoctorRole(SSN, StartDate, EndDate*, Role)

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Binary one-to-many Executed in relationship

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Redundant tables elimination

Patient(CodTes, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type, SSN*)

Staff(SSN, Name, Surname, Address, Association*,Type, CodD, CodH)

~~Time(Date)~~ ~~Specialization(Specialization)~~

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Department(CodD, CodH, Name, Telephone)

Booking(CodTes, CodE, Date, Time, Cost, isUrgent, CodLab, CodH)

DoctorRole(SSN, StartDate, EndDate*, Role)

HasSpecialization(SSN, Specialization)

InServiceAt(SSN, CodLab, CodH, Date, StartTime, Duration)

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Redundant tables elimination

Patient(CodTes, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type, SSN*)

Staff(SSN, Name, Surname, Address, Association*,Type, CodD, CodH)

~~Time(Date)~~

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Department(CodD, CodH, Name, Telephone)

Booking(CodTes, CodE, Date, Time, Cost, isUrgent, CodLab, CodH)

DoctorRole(SSN, StartDate, EndDate*, Role)

HasSpecialization(SSN, Specialization)

InServiceAt(SSN, CodLab, CodH, Date, StartTime, Duration)

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Final relational scheme

Patient(CodTes, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(CodH, Name, Address)

Examination(CodE, Description, DietDescription*, Type, SSN*)

Staff(SSN, Name, Surname, Address, Association*,Type, CodD, CodH)

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Department(CodD, CodH, Name, Telephone)

Booking(CodTes, CodE, Date, Time, Cost, isUrgent, CodLab, CodH)

DoctorRole(SSN, StartDate, EndDate*, Role)

HasSpecialization(SSN, Specialization)

InServiceAt(SSN, CodLab, CodH, Date, StartTime, Duration)

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Example of relational logic design

Referential integrity constraints

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Referential integrity: Carried out by relationship

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Referential integrity: Carried out by relationship

➤ Involved tables

Examination(CodE, Description, DietDescription*, Type, SSN*)

Staff(SSN, Name, Surname, Address, Association*,Type, CodD, CodH)

➤ Referential integrity constraint

Examination(SSN) REFERENCES Staff(SSN)

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Referential integrity: Work in relationship

Involved tables

Staff(SSN, Name, Surname, Address, Association*,Type,
CodD, CodH)

Department(CodD, CodH, Name, Telephone)

Referential integrity constraint

Staff(CodD,CodH) REFERENCES Department(CodD,CodH)

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Referential integrity: Hosts relationship

Involved tables

Department(CodD, CodH, Name, Telephone)

Hospital(CodH, Name, Address)

Referential integrity constraint

Department(CodH) REFERENCES Hospital(CodH)

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Referential integrity: Has relationship

Involved tables

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Hospital(CodH, Name, Address)

Referential integrity constraint

Laboratory(CodH) REFERENCES Hospital(CodH)

69

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Referential integrity: Makes relationship

Involved tables

Booking(CodTes, CodE, Date, Time, Cost, isUrgent,
CodLab, CodH)

Patient(CodTes, Name, Surname, Address, BirthPlace, BirthDate)

Referential integrity constraint

Booking(CodTes) REFERENCES Patient(CodTes)

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Referential integrity: For relationship

Involved tables

Booking(CodTes, CodE, Date, Time, Cost, isUrgent,
CodLab, CodH)

Examination(CodE, Description, DietDescription*, Type, SSN*)

Referential integrity constraint

Booking(CodE) REFERENCES Examination(CodE)

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Referential integrity: Executed in relationship

Involved tables

Booking(CodTes, CodE, Date, Time, Cost, isUrgent,
CodLab, CodH)

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Referential integrity constraint

Booking(CodLab,CodH) REFERENCES Laboratory(CodLab,CodH)

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Referential integrity: Assumes relationship

Involved tables

DoctorRole(SSN, StartDate, EndDate*, Role)

Staff(SSN, Name, Surname, Address, Association*, Type, CodD, CodH)

Referential integrity constraint

DoctorRole(SSN) REFERENCES Staff(SSN)

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Referential integrity: Hosts relationship

Involved tables

HasSpecialization(SSN, Specialization)

Staff(SSN, Name, Surname, Address, Association*, Type, CodD, CodH)

Referential integrity constraint

HasSpecialization(SSN) REFERENCES Staff(SSN)

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Referential integrity: In service at relationship

Involved tables

InServiceAt(SSN, CodLab, CodH, Date, StartTime, Duration)

Staff(SSN, Name, Surname, Address, Association*, Type, CodD, CodH)

Referential integrity constraint

InServiceAt(SSN) REFERENCES Staff(SSN)

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Referential integrity: In service at relationship

Involved tables

InServiceAt(SSN, CodLab, CodH, Date, StartTime, Duration)

Laboratory(CodLab, CodH, NameLab, Plan, Room)

Referential integrity constraint

InServiceAt(CodLab, CodH) REFERENCES Laboratory(CodLab, CodH)

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Referential integrity constraints

Examination(SSN) REFERENCES Staff(SSN)

Staff(CodD, CodH) REFERENCES Department(CodD, CodH)

Department(CodH) REFERENCES Hospital(CodH)

Laboratory(CodH) REFERENCES Hospital(CodH)

Booking(CodTes) REFERENCES Patient(CodTes)

Booking(CodE) REFERENCES Examination(CodE)

Booking(CodLab, CodH) REFERENCES Laboratory(CodLab, CodH)

DoctorRole(SSN) REFERENCES Staff(SSN)

HasSpecialization(SSN) REFERENCES Staff(SSN)

InServiceAt(SSN) REFERENCES Staff(SSN)

InServiceAt(CodLab, CodH) REFERENCES Laboratory(CodLab, CodH)

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