Politecnico di Torino

Logic design

Example

0

Example of relational logic design

- Introduction
- ER schema restructing
- Translation of the entities without an external identifier
- Translation of the entities with an external identifier
- Translation of the relationships

1

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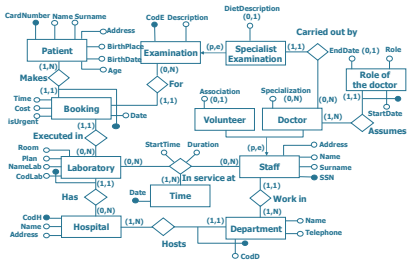
Introduction

Example of relational logic design

2

Starting conceptual model



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Restructing the ER model

Example of relational logic design

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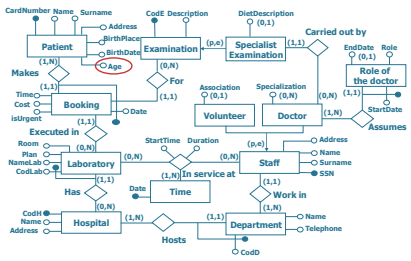
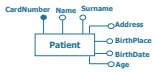
Analysis of the derived attributes



5

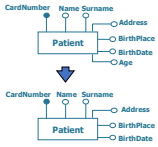
Derived Age attribute



- 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

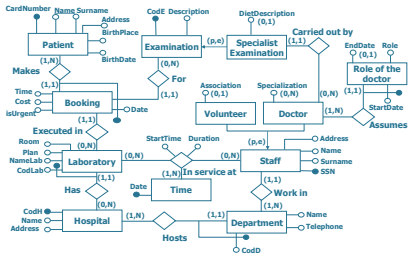
6

Eliminating the Age attribute



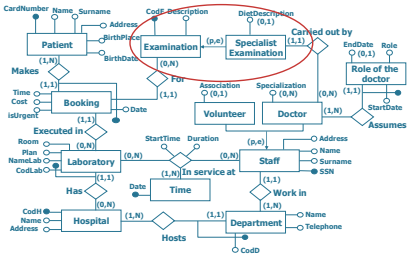
7

Restructured schema (n. 1)



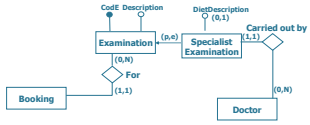
8

Removing generalizations



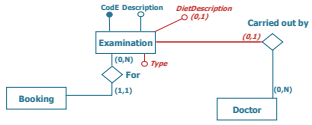
9

Removing generalizations



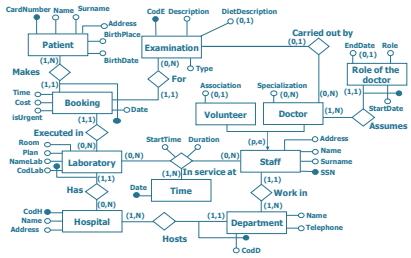
10

Merge into the parent entity



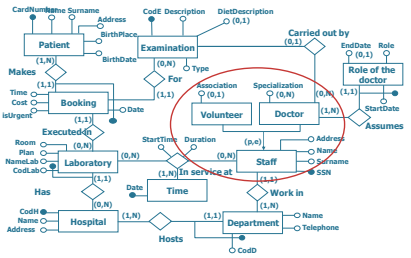
11

Restructured schema (n.2)



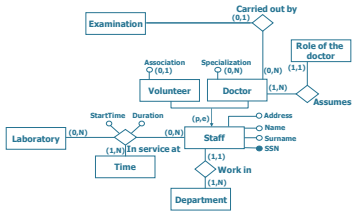
12

Removing generalizations



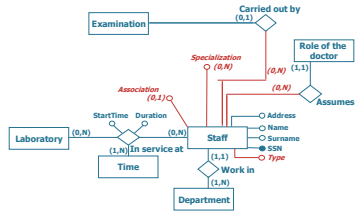
13

Staff generalization



14

Merge into the parent entity



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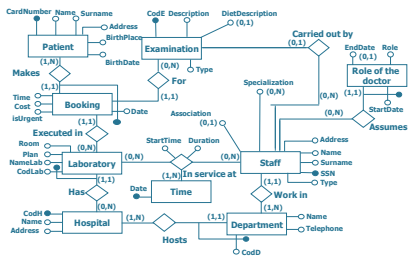
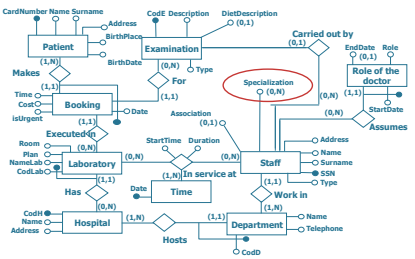
Restructured schema (n.3)



16

Removing multivalued attributes



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Removing multivalued Spacialization attribute

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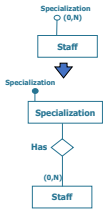
New specialization entity



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Cardinality of the *Has* relationship

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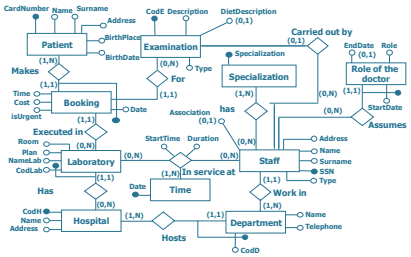
Restructured schema (final)



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Traslating entities without an external identifier

Example of relational logic design

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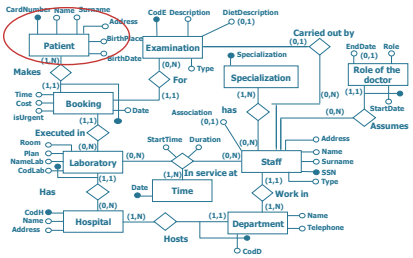
Translation of the Patient entity



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Translation of the Patient entity

Patient(<u>CardNumber</u>, Name, Surname, Address, BirthPlace, BirthDate)

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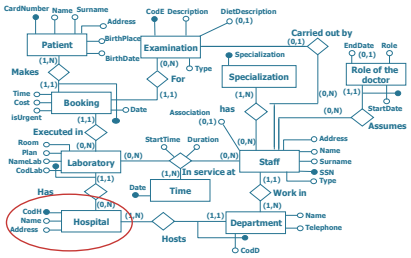
Translation of the Hospital entity



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Translation of the Hospital entity

Patient(<u>CardNumber</u>, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(<u>CodH</u>, Name, Address)

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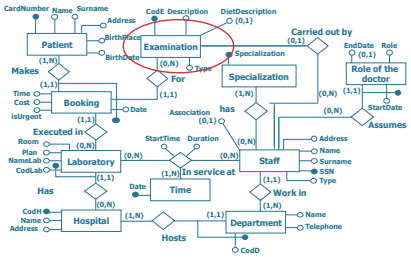
Translation of the Examination entity



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Translation of the Examination entity

Patient(<u>CardNumber</u>, Name, Surname, Address, BirthPlace, BirthDate)

Hospital(<u>CodH</u>, Name, Address)

Examination(<u>CodE</u>, Description, DietDescription, Type)*

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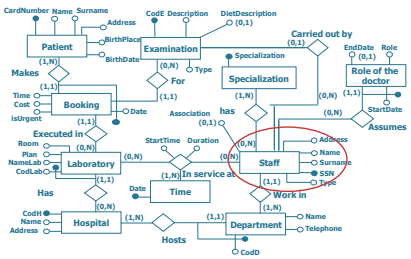
Translation of the Staff entity



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Translation of the Staff entity

Patient(<u>CardNumber</u>, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(<u>CodH</u>, Name, Address)
Examination(<u>CodE</u>, Description, DietDescription*, Type)
Staff(<u>SSN</u>, Name, Surname, Address, Association,Type)*

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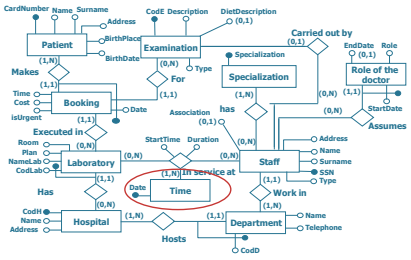
Translation of the Time entity



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Translation of the Time entity

Patient(<u>CardNumber</u>, Name, Surname, Address, BirthPlace, BirthDate)
Hospital(<u>CodH</u>, Name, Address)
Examination(<u>CodE</u>, Description, DietDescription*, Type)
Staff(<u>SSN</u>, Name, Surname, Address, Association*,Type)
Time(<u>Date</u>)

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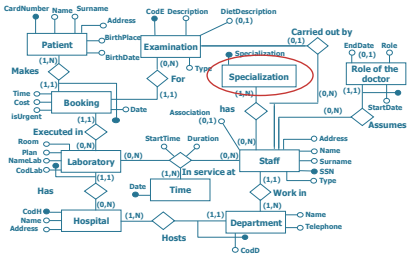
Translation of the Specialization entity



33

Translation of the Specialization entity

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

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Translating entities with an external identifier

Example of relational logic design

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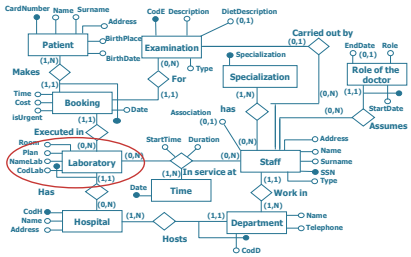
Translation of the Laboratory entity



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Translation of the Laboratory entity

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

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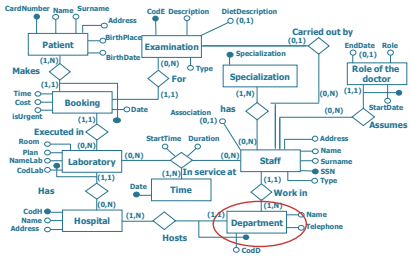
Translation of the Department entity



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Translation of the Department entity

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

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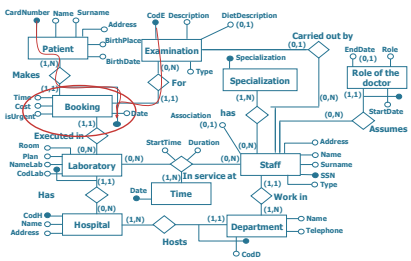
Translation of the Booking entity



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Translation of the Booking entity

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

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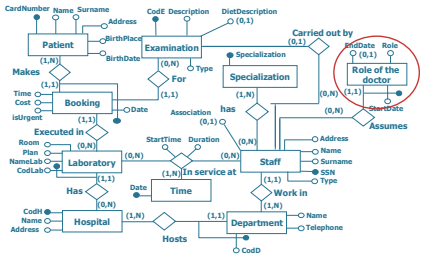
Translation of the Role of the doctor entity



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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, EndDate, Role)*

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Translating relationships

Example of relational logic design

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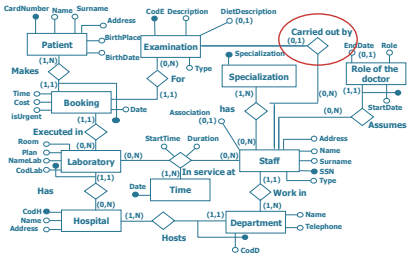
Binary one-to-many *Carried out by* relationship



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Binary one-to-many *Carried out by* relationship

Patient(CardNumber, 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(CardNumber, CodE, Date, Time, Cost, isUrgent)
DoctorRole(SSN, StartDate, EndDate*, Role)

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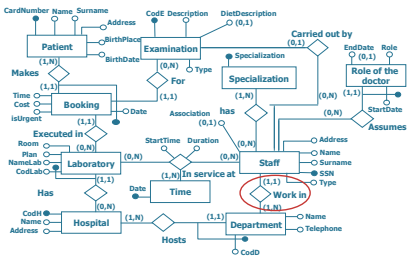
Binary one-to-many *Work in* relationship



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Binary one-to-many *Work in* relationship

Patient(CardNumber, 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(CardNumber, CodE, Date, Time, Cost, isUrgent)
DoctorRole(SSN, StartDate, EndDate*, Role)

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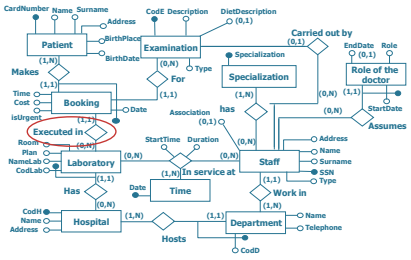
Binary one-to-many *Executed in* relationship



49

Binary one-to-many *Executed in* relationship

Patient(CardNumber, 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(CardNumber, CodE, Date, Time, Cost, isUrgent, *CodLab, CodH*)
DoctorRole(SSN, StartDate, EndDate*, Role)

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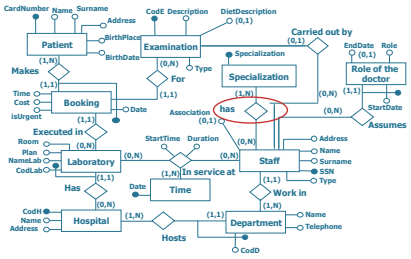
Binary many-to-many *has* relationship



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Binary many-to-many *has* relationship

Patient(CardNumber, 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(CardNumber, CodE, Date, Time, Cost, isUrgent, CodLab, CodH)
DoctorRole(SSN, StartDate, EndDate*, Role)
HasSpecialization(SSN, Specialization)

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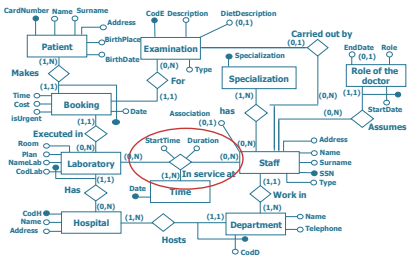
Ternary many-to-many *In service at* relationship



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Ternary many-to-many *In service at* relationship

Patient(CardNumber, 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(CardNumber, 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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Eliminating redundant tables

Patient(CardNumber, 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(CardNumber, 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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Eliminating redundant tables

Patient(CardNumber, 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(CardNumber, 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 schema

Patient(CardNumber, 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(CardNumber, 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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Referential integrity constraints

Example of relational logic design

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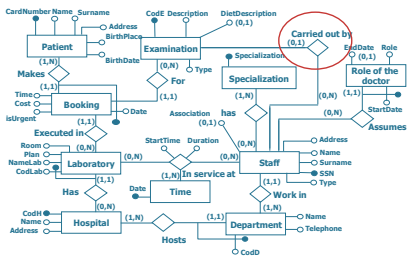

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Referential integrity: *Carried out by* relationship

- 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)

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Referential integrity: *Makes* relationship

- Involved tables

Booking(*CardNumber*, CodE, Date, Time, Cost, isUrgent, CodLab, CodH)
Patient(CardNumber, Name, Surname, Address, BirthPlace, BirthDate)

- Referential integrity constraint

Booking(CardNumber) REFERENCES Patient(CardNumber)

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Referential integrity: *For* relationship

- Involved tables

Booking(CardNumber, *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(CardNumber, 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)

67

Referential integrity: *Has* 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(CardNumber) REFERENCES Patient(CardNumber)
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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