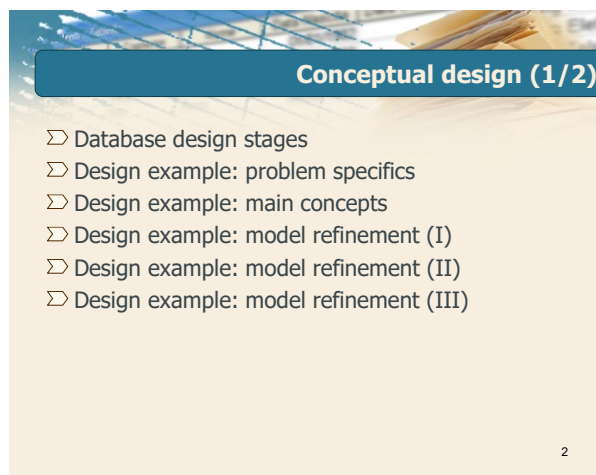
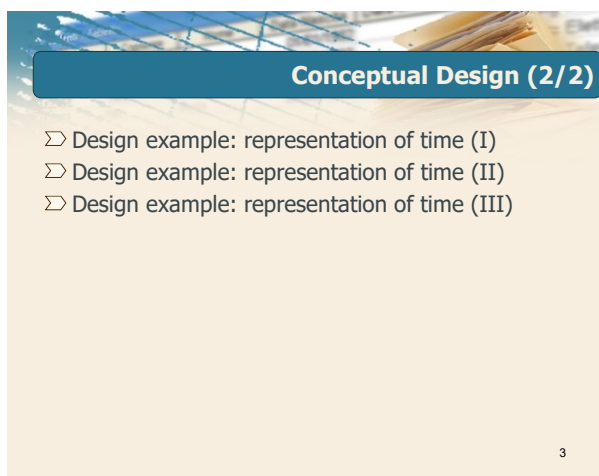




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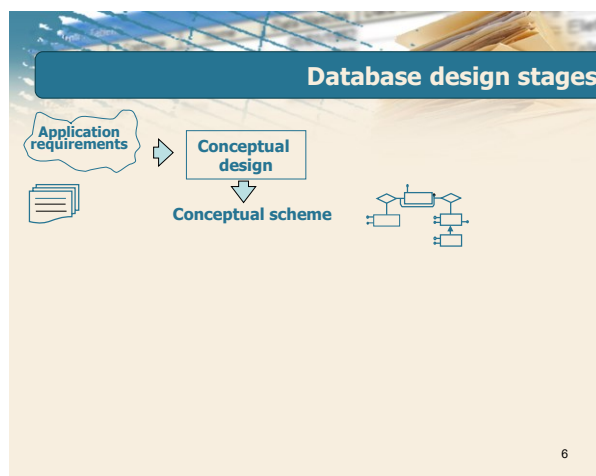
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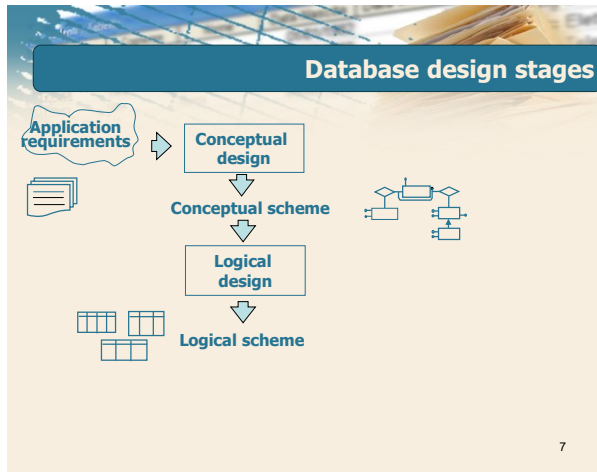
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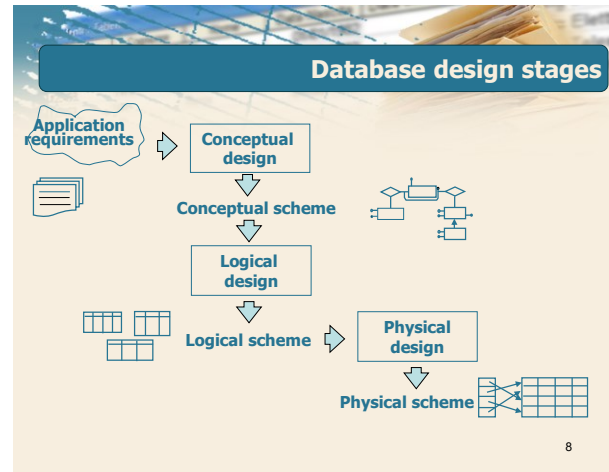


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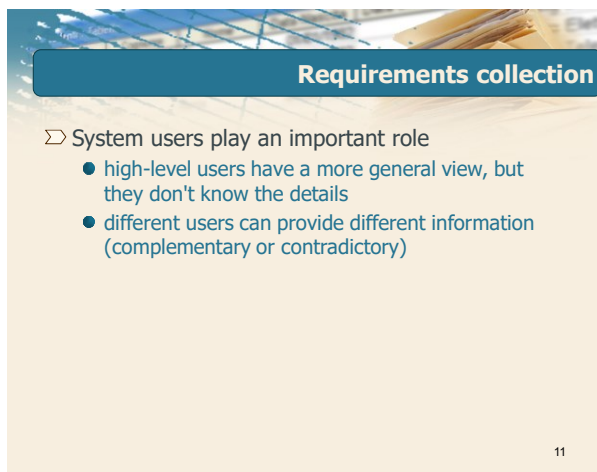
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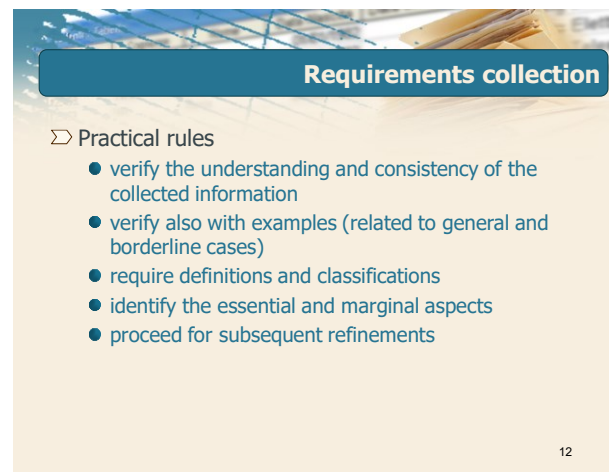
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Requirements analysis

Practical rules

- choose the right abstraction level
- standardize the structure of the sentences
- avoid convoluted sentences
- identify synonyms/homonyms and unify the terms
- make the reference between terms explicit
- build a glossary of terms

13

13

Conceptual design

Various project strategies have been proposed

The most effective strategy is hybrid

- the basic concepts are identified (the most relevant entities and relationships)
- the initial project is progressively refined by adding the attributes, the cardinality of the relationships, the hierarchies, other entities and relationships

If the problem is highly complex, it can be broken down into subproblems to solve separately and integrate later

14

14

Conceptual design: general criteria

If a concept has significant properties or describes classes of objects with autonomous existence

- entity

If a concept has a simple structure and has no relevant properties

- attribute (possibly multivalued)

If two or more concepts are related

- relation

If a concept is a particular case of another one

- hierarchy

15

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Quality of a conceptual scheme

Correctness

- use of appropriate model constructs
- verification of syntactic and semantic errors

Completeness

- representation of all the concepts of interest

Minimality

- every specifications is represented only once in the scheme
- verification and documentation of any redundancies

Legibility

16

16

Problem specifics

We want to represent a database for the management of a medical examination booking system within a Local Health Authority (ASL), considering the following information. Each patient is characterized by health card number, name, surname, address, date of birth, place of birth and age. ASL hospitals are characterized by a numerical code, name and address.

18

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Conceptual design

Design example: problem specifics

17

Problem specifics

Each hospital is divided into departments identified by a unique numeric code and characterized by department name and telephone number.
The department staff is identified by a Social Security Number (SSN).
Name, surname and address are also known.
Among the staff, for department doctors the list of specializations achieved is known and for the voluntary staff the name of the association they belong to (if available) is stored.

19

19

Problem specifics

The medical examinations that can be performed are characterized by a numerical code and a textual description (e.g., X-ray exam, etc.).
For specialist examinations, the doctor who carries out the visit and a description of the diet to follow (if necessary) are also stored.
The laboratories that perform the tests are identified by a unique code within the hospital and they are characterized by the name of the laboratory, the location plan and the room number.

20

20

Problem specifics

For each member of the laboratory staff, the days and laboratories in which he/she works are stored. Pay attention to the fact that during the same day each staff member can work in more than one laboratory.

21

21

Problem specifics

Each exam requires a reservation.
For each exam reservation made by a patient, the date and time of the exam, the laboratory where it is performed, the cost of the ticket and the information about the exam being urgent or not are stored. Please note that each patient can make multiple reservations for the same exam on different dates and the same exam cannot be repeated on the same day by the same patient, even in different laboratories.

22

22

Problem specifics

Each doctor can take on different roles during his/her career (e.g. assistant, head physician, etc.). We want to keep track of the roles each doctor has taken on during his/her career and the related time periods (start date, end date). Keep in mind that each doctor cannot take on more than one role at the same time, but he/she can take on the same role in different time periods.

23

23

Conceptual design**Design example: main concepts**

24

Main concepts identification

- ⇒ Text analysis to identify the most important concepts
- the main entities of the ER diagram
 - any links between entities

25

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Patient Concept

Each *patient* is characterized by health card number, name, surname, address, date of birth, place of birth and age.

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Patient Concept



Patient

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Hospital concept

ASL *hospitals* are characterized by a numeric code, a name and an address.

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Hospital concept



Patient

Hospital

29

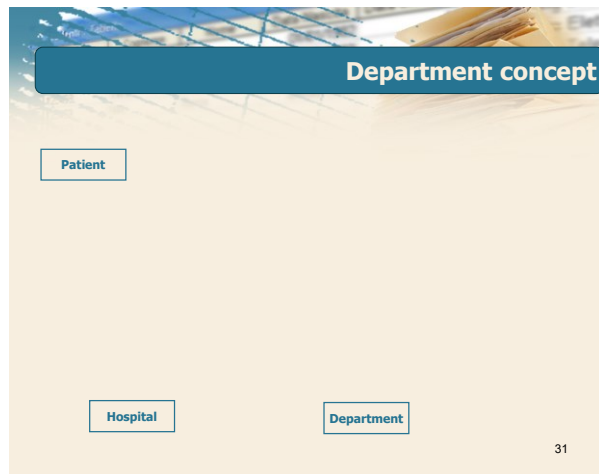
29

Department concept

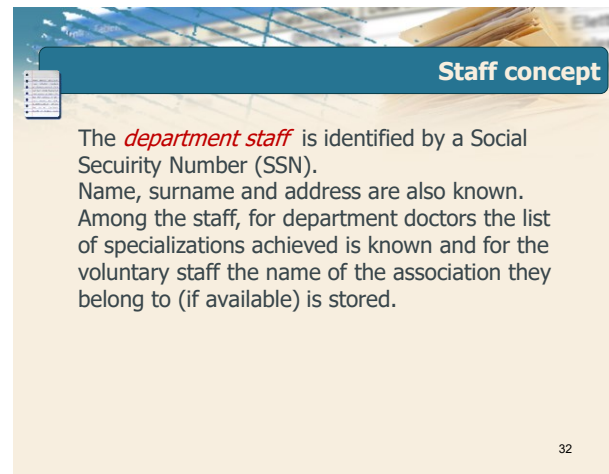
Each hospital is divided into *departments* identified by a unique numeric code and characterized by the department name and the telephone number.

30

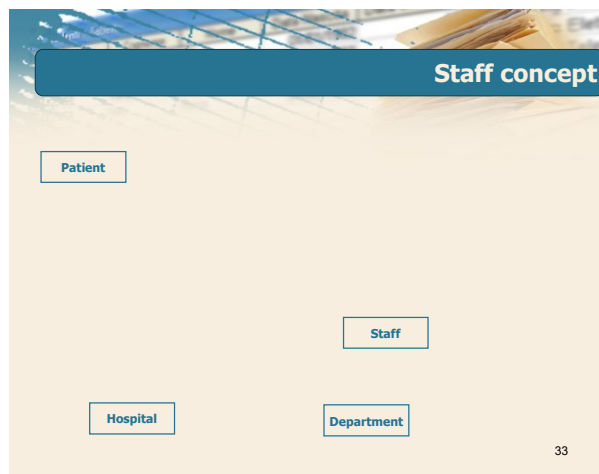
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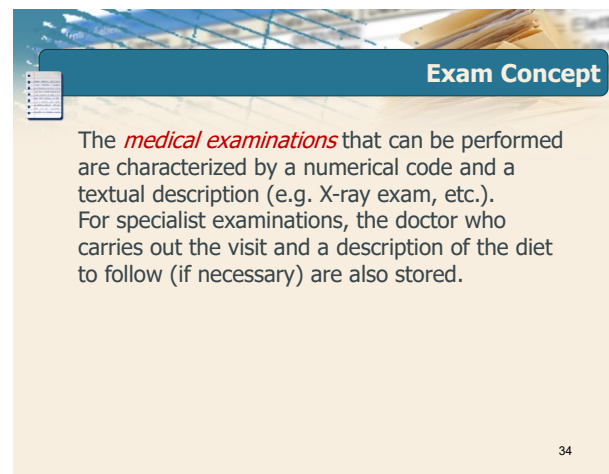
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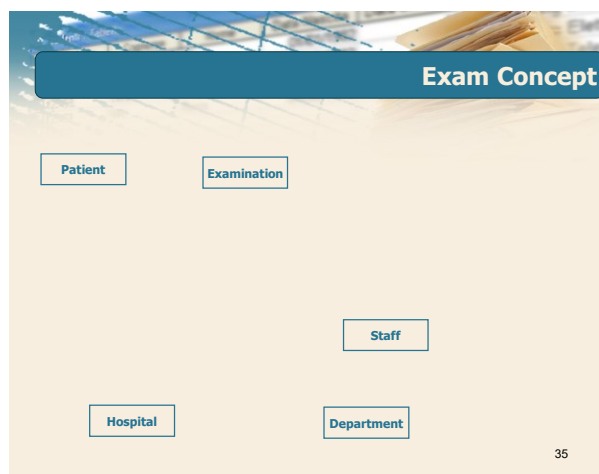
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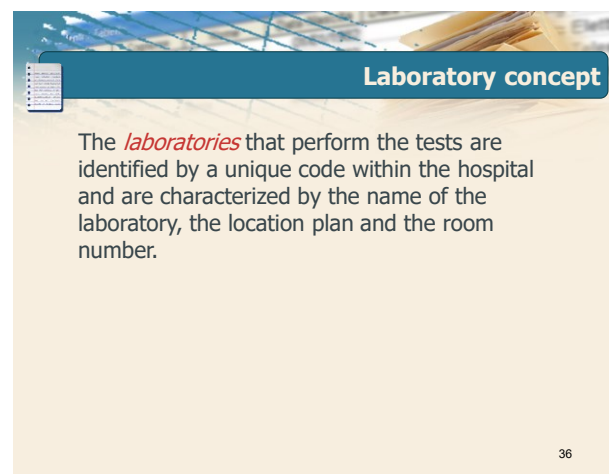
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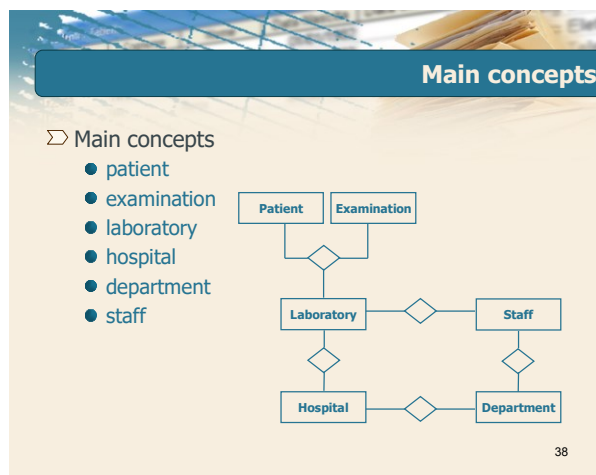


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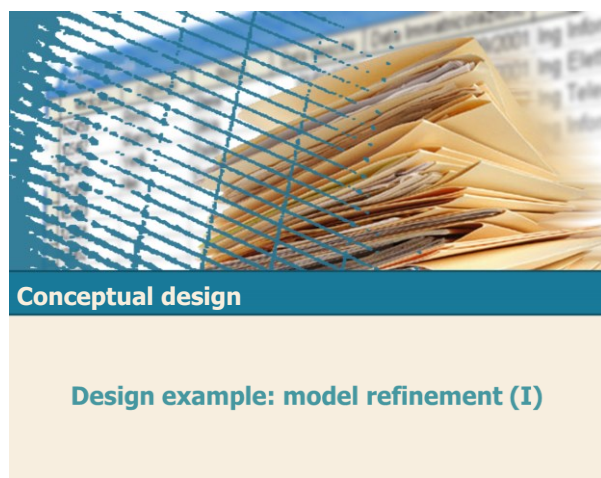
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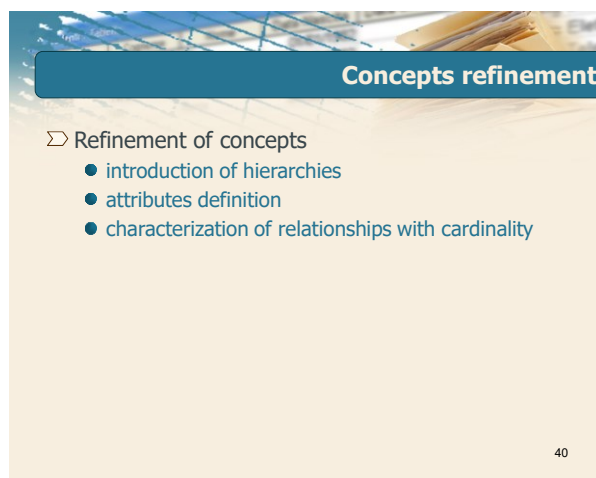
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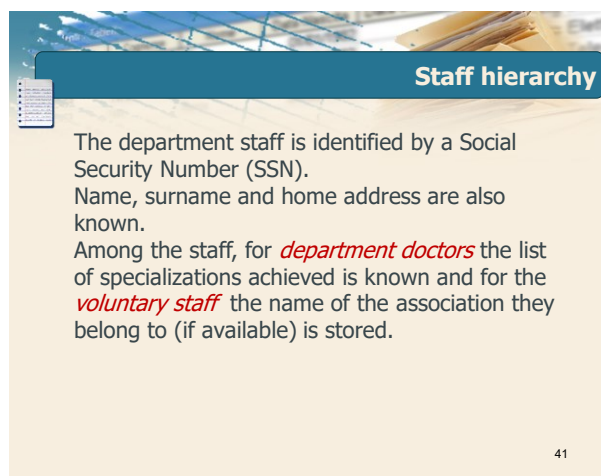
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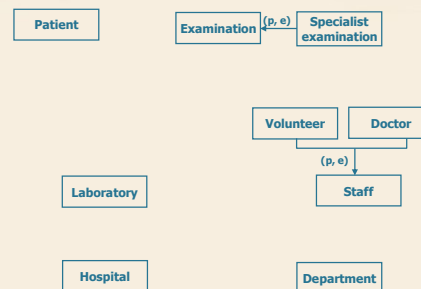
42

Exam hierarchy

The medical examinations that can be performed are characterized by a numerical code and a textual description (e.g. radiography, etc.). For *specialist examinations*, the doctor who carries out the visit and a description of the diet to follow (if necessary) are also stored.

43

Exam hierarchy



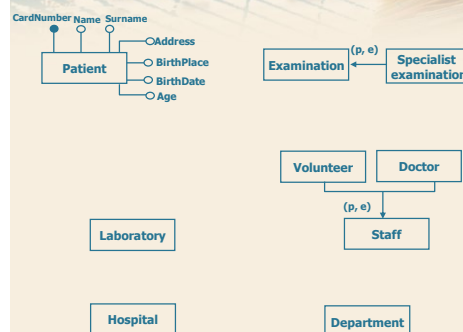
44

Refinement of the Patient entity

Each patient is characterized by health card number, name, surname, address, date of birth, place of birth and age.

45

Refinement of the Patient entity



46

Date of birth and Age Attributes

- ⊃ The Age attribute is redundant because it can be easily calculated starting from the date of birth (BirthDate)
- ⊃ This information must be attached to the conceptual model documentation
 - Age derivation rule from BirthDate
Age = Year (Today ()) - BirthDate
- ⊃ Any elimination of the Age attribute will be evaluated during the simplification phase of the ER scheme

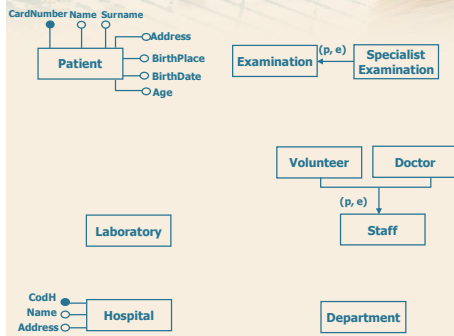
47

Refinement of the Hospital entity

ASL hospitals are characterized by a numerical code, name and address.

48

Refinement of the Hospital entity



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Conceptual design

Design example: model refinement (II)

50

Relationship between Staff and Department

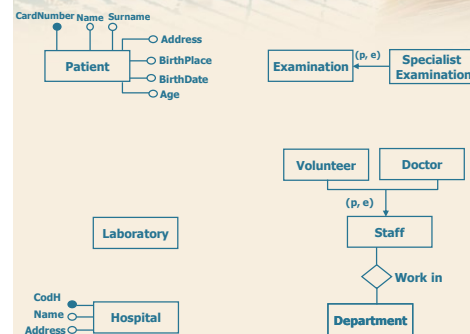
The department staff is identified by a Social Security Number (SSN). Name, surname and address are also known.

Among the staff, for department doctors the list of specializations achieved is known and for the voluntary staff the name of the association they belong to (if available) is stored.

51

51

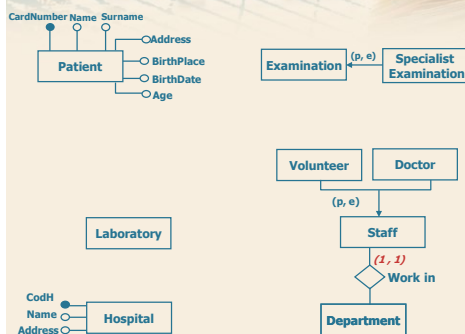
Relationship between Staff and Department



52

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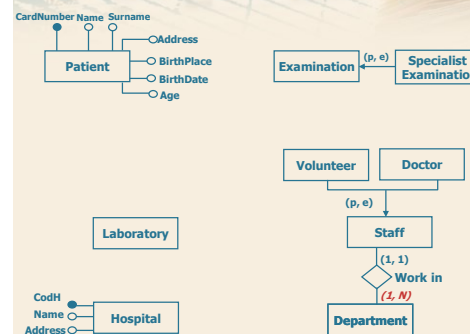
Cardinality of the Work in relationship



53

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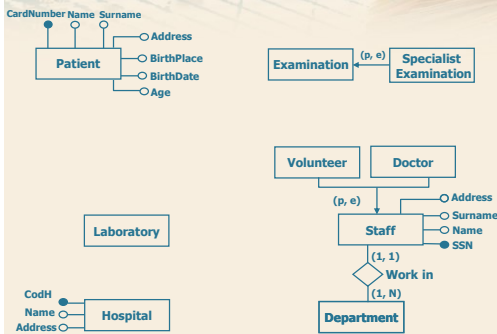
Cardinality of the Work in relationship



54

54

Refinement of the Staff entity



55

Refinement of the Medical and Volunteer entities

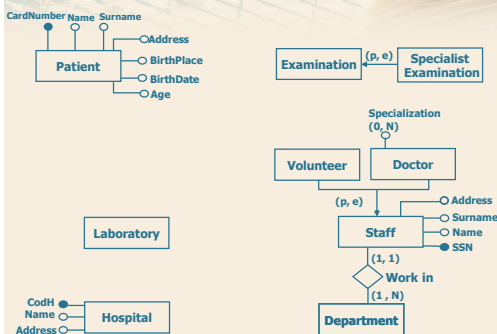
The department staff is identified by a Social Security Number (SSN).

Name, surname and address are also known.

Among the staff, for department doctors the list of specializations achieved is known and for the voluntary staff the name of the association they belong to (if available) is stored.

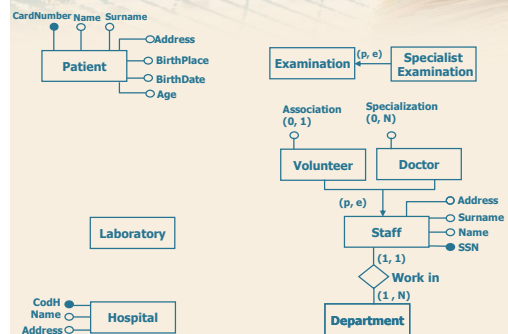
56

Refinement of the Medical entity



57

Refinement of the Volunteer entity



58

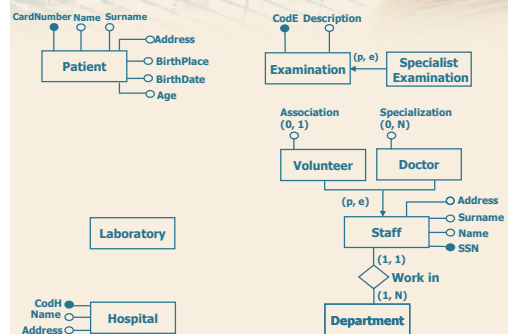
Refinement of the Exam entity

The medical examinations that can be performed are characterized by a numerical code and a textual description (e.g. X-ray exam, etc.).

For specialist examinations, the doctor who carries out the visit and a description of the diet to follow (if necessary) are also stored.

59

Refinement of the Exam entity



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Refinement of the Specialist Examination entity

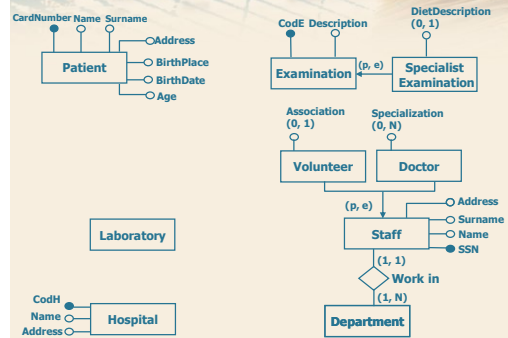
The medical examinations that can be performed are characterized by a numerical code and a textual description (e.g. radiography, etc.).

For specialist examinations, the doctor who carries out the visit and a description of the diet to follow (if necessary) are also stored.

61

61

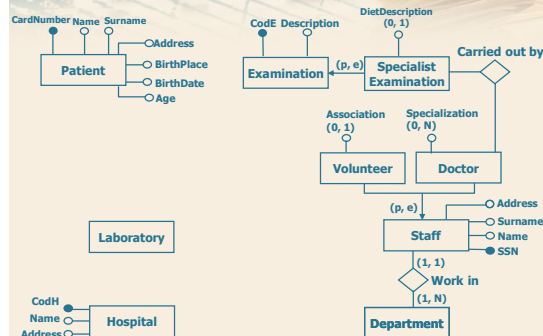
Refinement of the Specialist Examination entity



62

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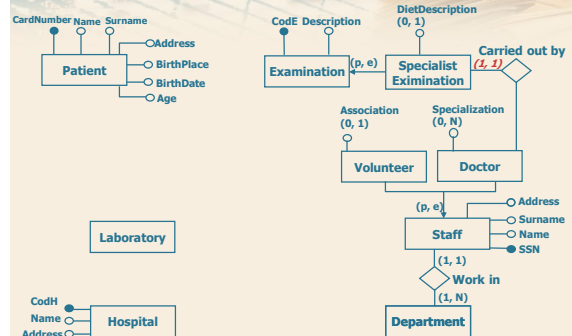
Relationship between Doctor and Specialist Examination



63

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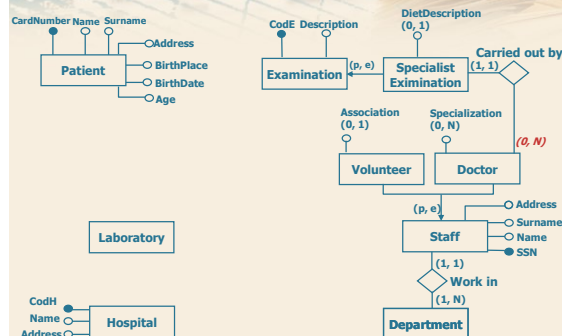
Cardinality of the Carried out by relationship



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Cardinality of the Carried out by relationship



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Conceptual design

Design example: model refinement (III)

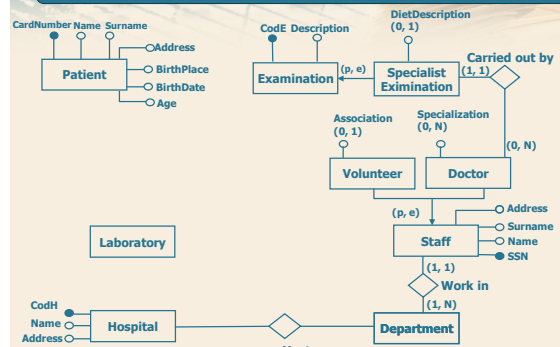
66

Relationship between Department and Hospital

Each hospital is divided into departments identified by a unique numeric code and characterized by the department name and the telephone number.

67

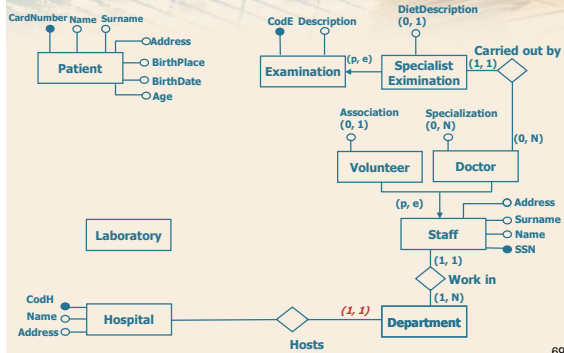
Relationship between Department and Hospital



68

68

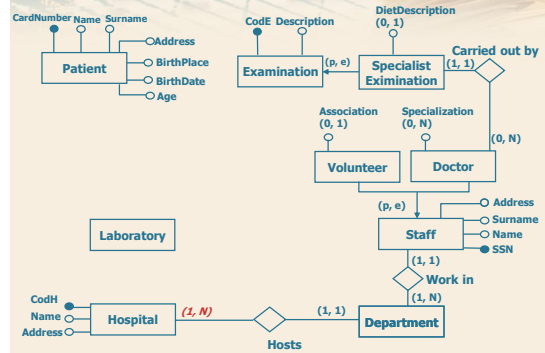
Cardinality of the Hosts relationship



69

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Cardinality of the Hosts relationship



70

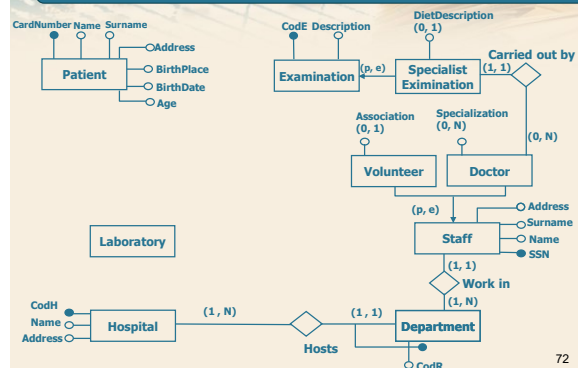
Department entity identifier

Each hospital is divided into departments identified by a unique numeric code and characterized by the department name and the telephone number.

71

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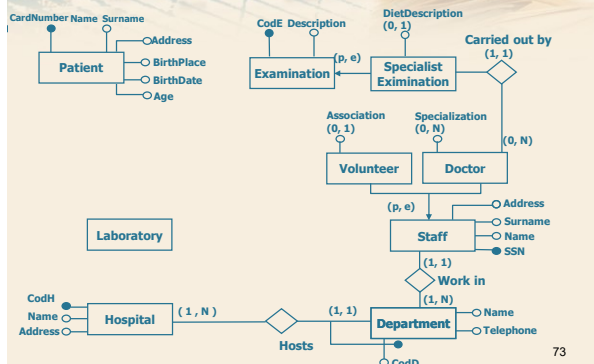
Department entity identifier



72

71

Refinement of the Department entity



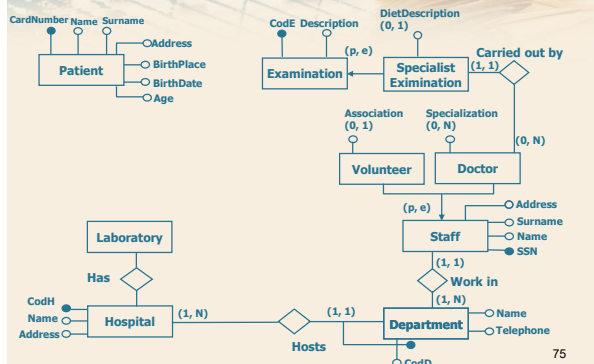
73

Relationship between Laboratory and Hospital

The laboratories that perform the tests are identified by a unique code within the hospital and are characterized by the name of the laboratory, the location plan and the room number.

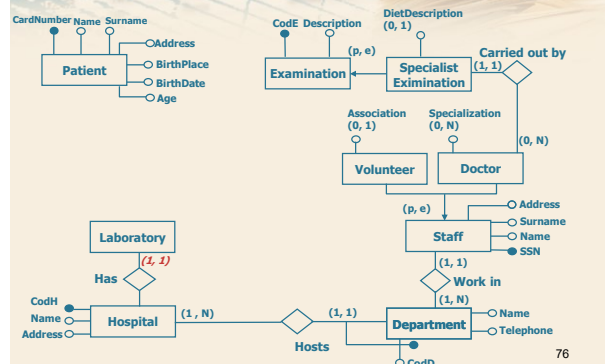
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Relationship between Laboratory and Hospital



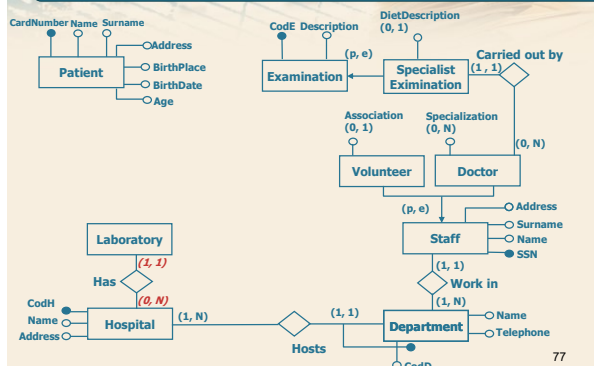
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Cardinality of the Has relationship



76

Cardinality of the Has relationship



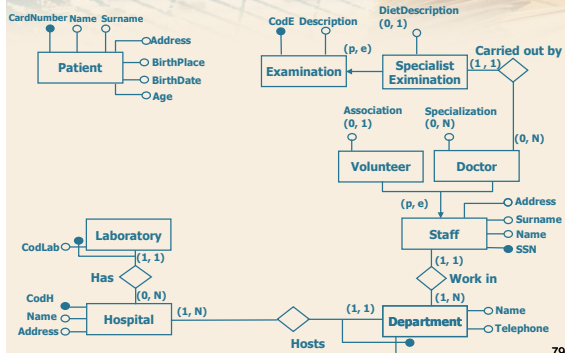
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Relationship between Laboratory and Hospital

The laboratories that perform the tests are identified by a unique code within the hospital and they are characterized by the name of the laboratory, the location plan and the room number.

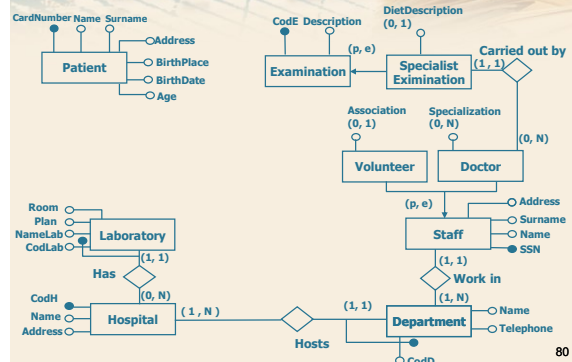
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Laboratory entity identifier



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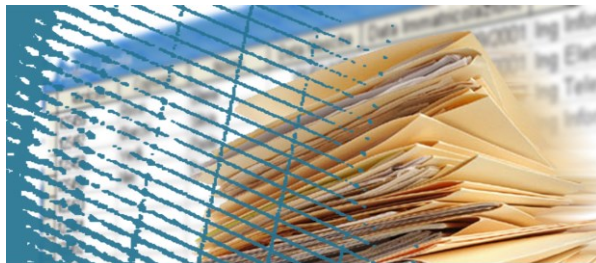
Refinement of the Laboratory entity



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Conceptual design – time I

Design example: representation of time

81

Representation of time

- It is necessary to explicitly represent the passage of time in the case of
 - representation of events
 - changes in the information content of entities or time attributes

82

82

Representation of time

- It is necessary to explicitly represent the passage of time in the case of
 - representation of events
 - changes in the information content of entities or time attributes
- Various modes of representation are possible
 - by means of N-ary relationships with a time entity
 - through historicized entities
 - through binary relationships with a time entity

83

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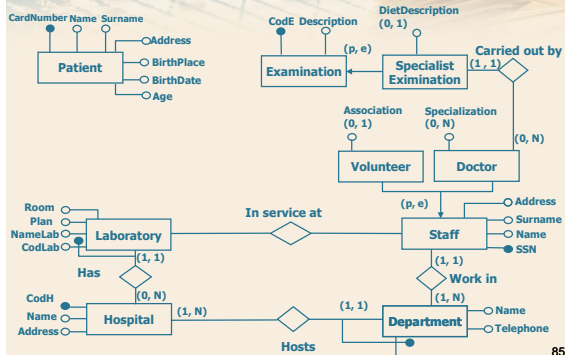
Relationship between Staff and Laboratory

For each member of the laboratory staff, the days and laboratories in which he/she works are stored. It should be borne in mind that during the same day each member of the staff can work in several laboratories.

84

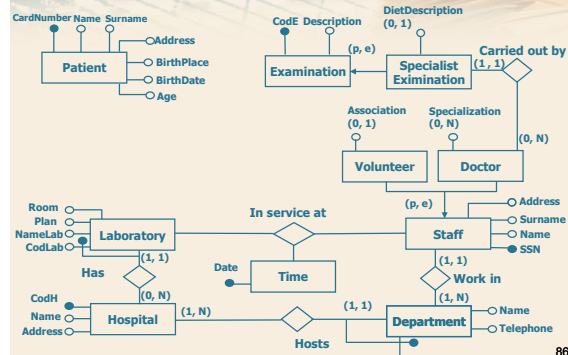
84

Relationship between Staff and Laboratory



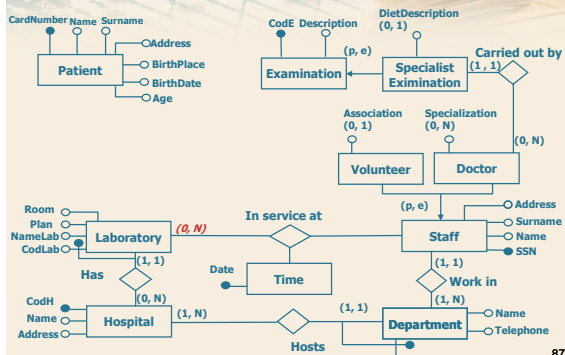
85

Historicalization of the In service at relationship



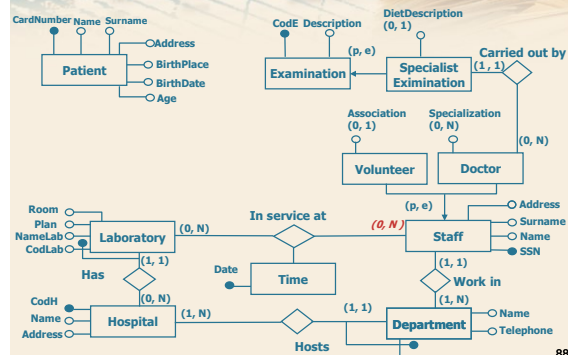
86

Cardinality of the In service at relationship



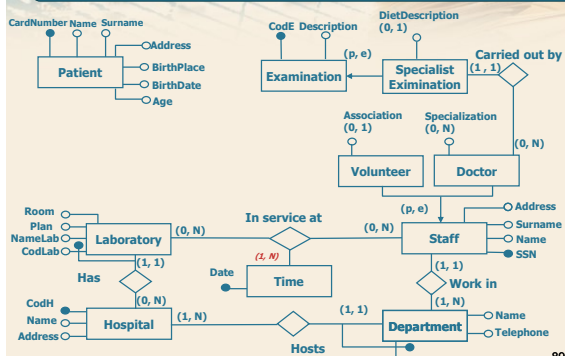
87

Cardinality of the In service at relationship



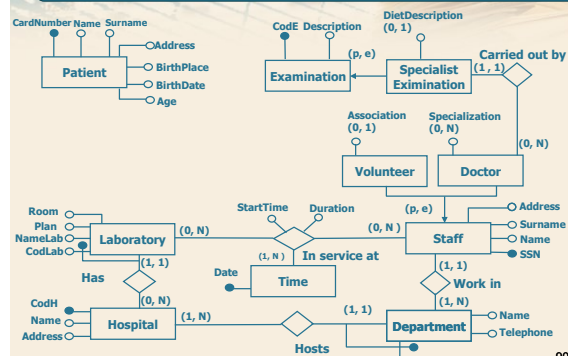
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Cardinality of the In service at relationship

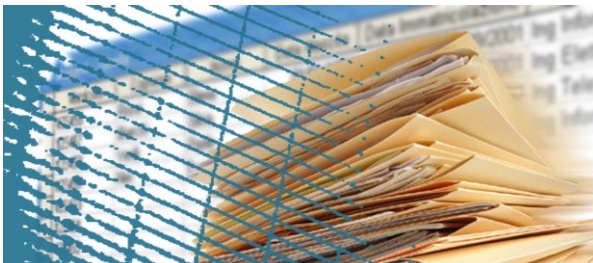


89

Refinement of the In service at relationship



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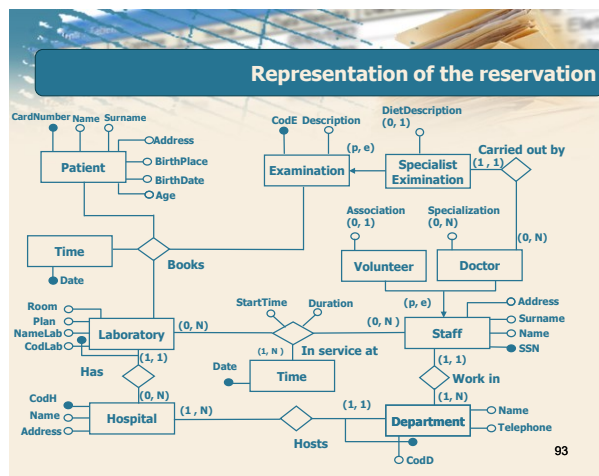
Conceptual design – time II

91

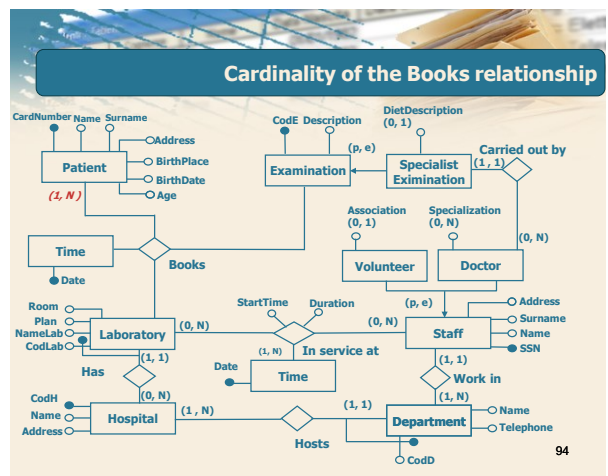
Representation of the reservation

Each exam requires a reservation. For each exam reservation made by a patient, the date and time of the exam, the laboratory where it is performed, the cost of the ticket and the information about the exam being urgent or not are stored. Please note that each patient can make multiple reservations for the same exam on different dates and the same exam cannot be repeated on the same day by the same patient, even in different laboratories.

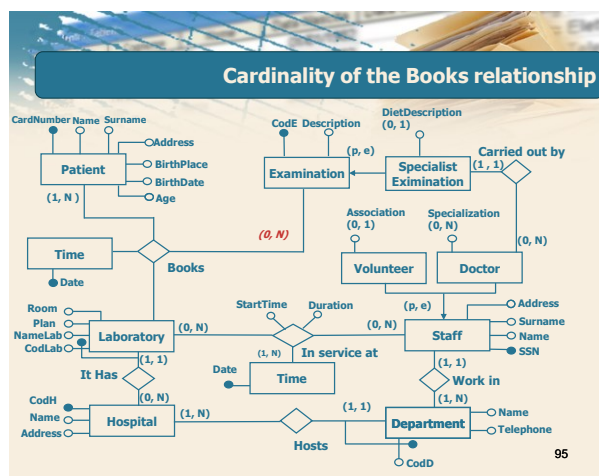
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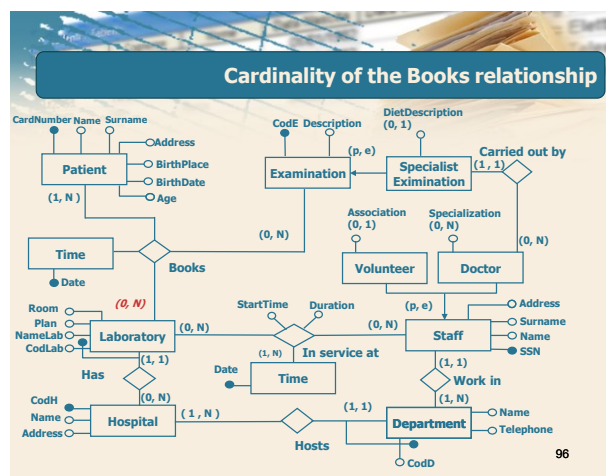
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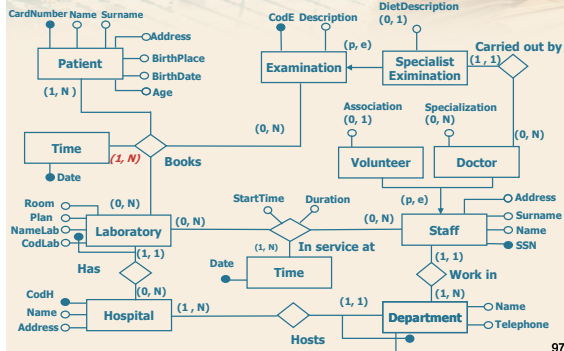


95



96

Cardinality of the Books relationship



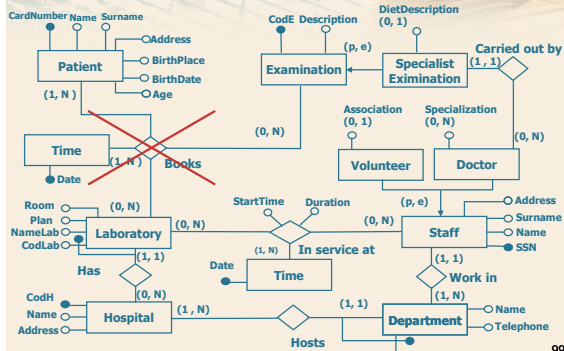
97

Reservation constraints

Each exam requires a reservation. For each exam reservation made by a patient, the date and time of the exam, the laboratory where it is performed, the cost of the ticket and the information about the exam being urgent or not are stored. *Please note that each patient can make multiple reservations for the same exam on different dates and the same exam cannot be repeated on the same day by the same patient, even in different laboratories.*

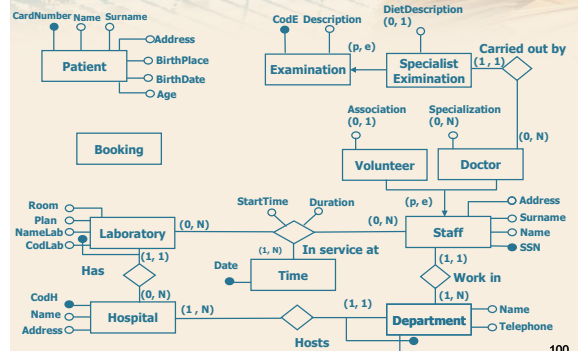
98

Representation of the booking



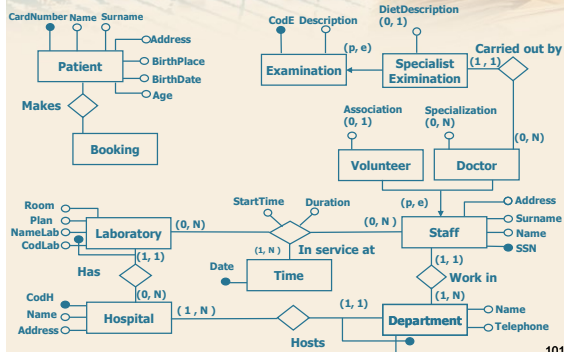
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Introduction of the Booking entity



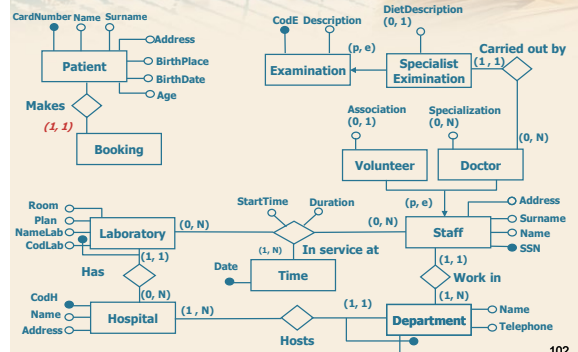
100

Relationship between Booking and Patient



101

Cardinality of the Makes relationship



102

97

98

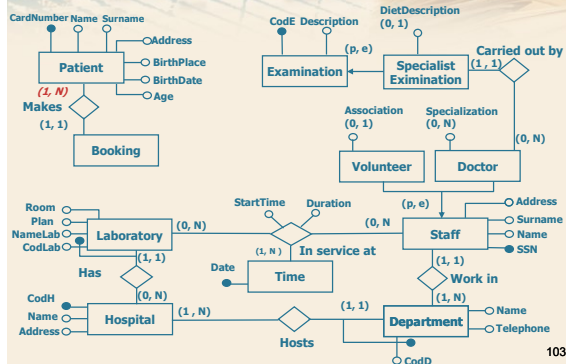
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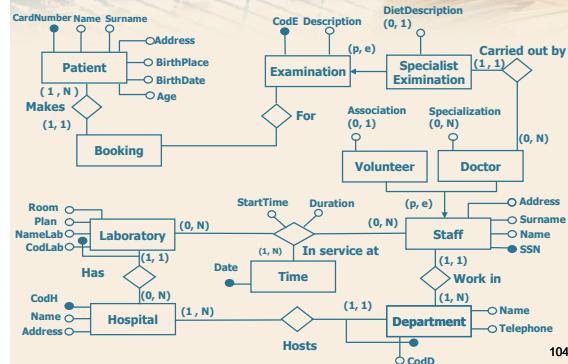
Cardinality of the Makes relationship



103

103

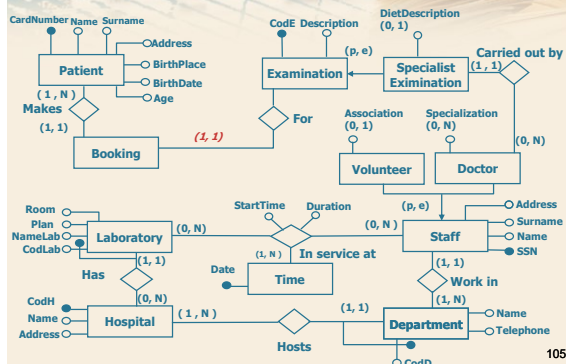
Relationship between Booking and Examination



104

104

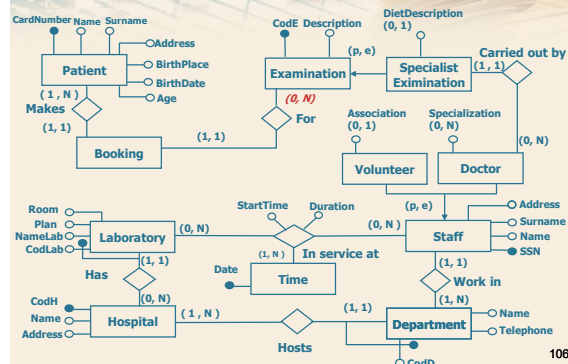
Cardinality of the For relationship



105

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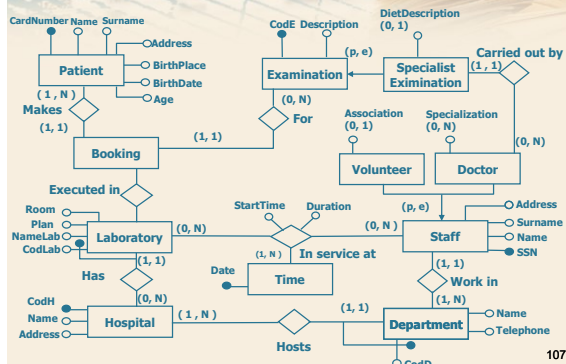
Cardinality of the For relationship



106

106

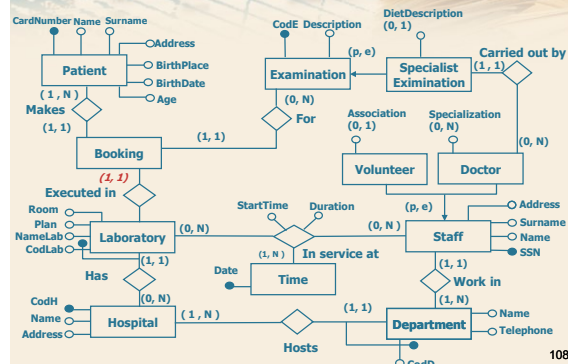
Relationship between Booking and Laboratory



107

107

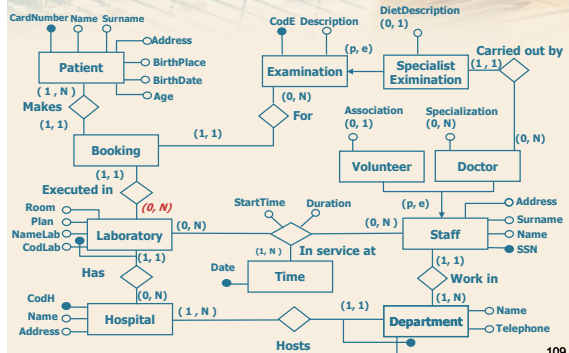
Cardinality of the Executed in relationship



108

108

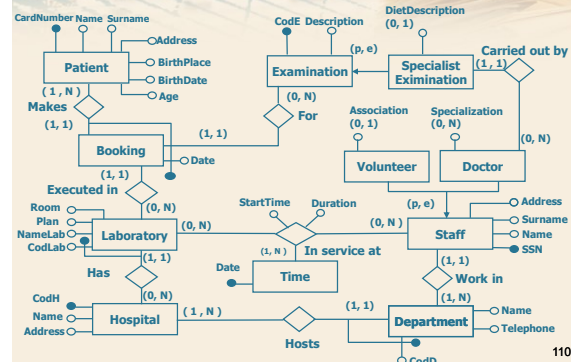
Cardinality of the Executed in relationship



109

109

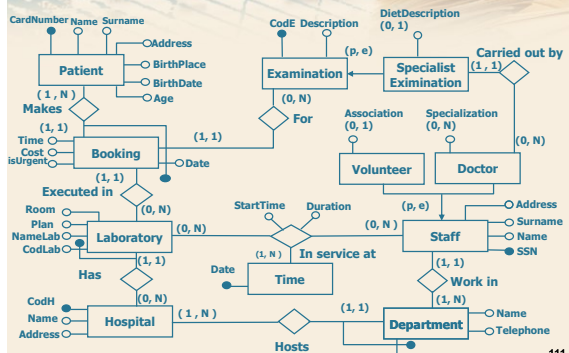
Booking entity identifier



110

110

Refinement of the Booking entity



111

111

Conceptual design – time III

112

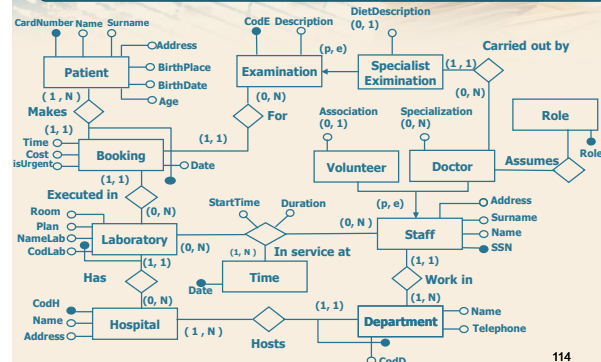
Relationship between Doctor and Role

Each doctor can take on different roles during his/her career (e.g. assistant, head physician, etc.). We want to keep track of the roles each doctor has taken on during his/her career and the related time periods (start date, end date). Keep in mind that each doctor cannot take on more than one role at the same time, but he/she can take on the same role in different time periods.

113

113

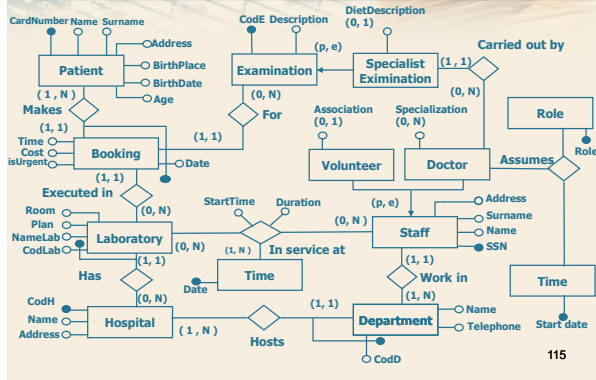
Relationship between Doctor and Role



114

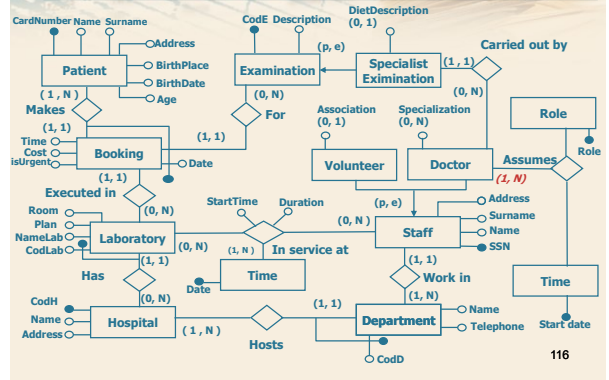
114

Historicization of the Assumes relationship



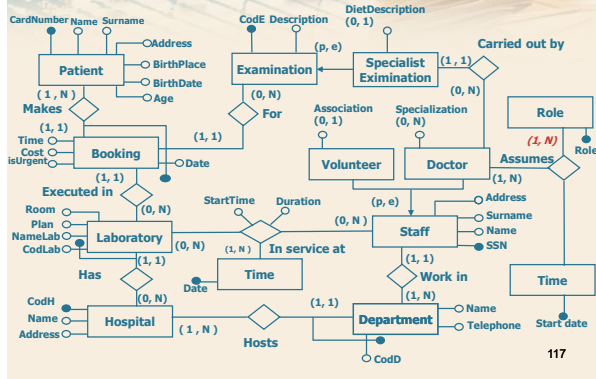
115

Cardinality of the Assumes relationship



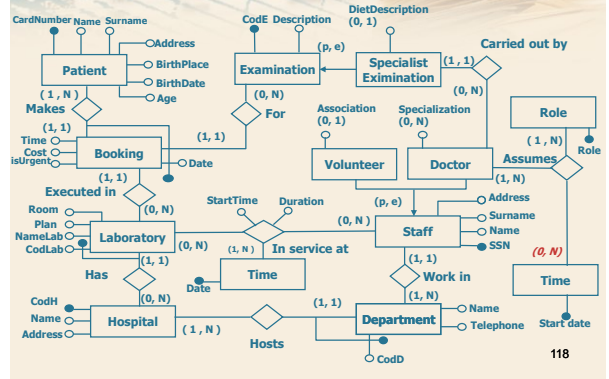
116

Cardinality of the Assumes relationship



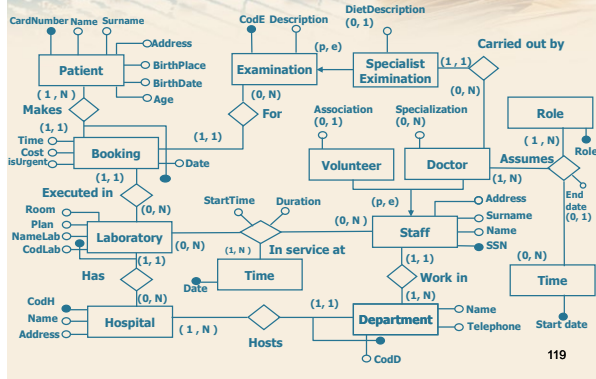
117

Cardinality of the Assumes relationship



118

Refinement of the Assumes relationship



119

Constraints on the Assumes relationship

Each doctor can take on different roles during his/her career (e.g. assistant, head physician, etc.).

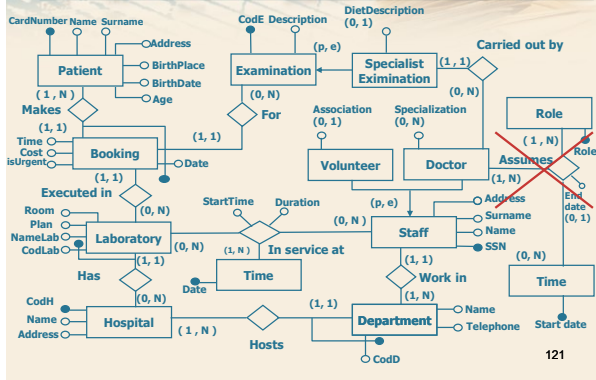
We want to keep track of the roles each doctor has taken on during his/her career and the related time periods (start date, end date).

Keep in mind that each doctor cannot take on more than one role at the same time, but he/she can take on the same role in different time periods.

120

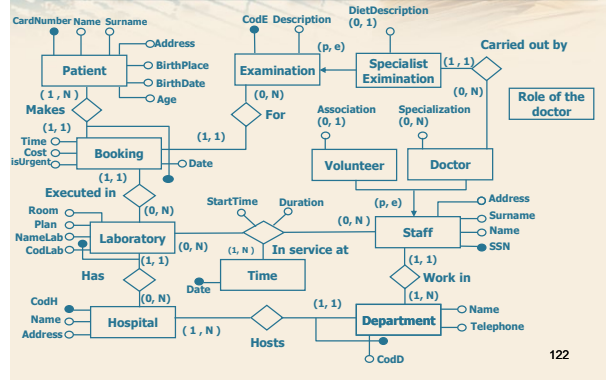
120

Historicization of the Assumes relationship



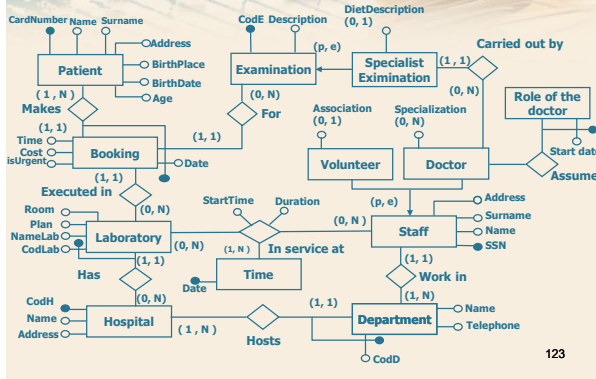
121

Introduction of the Role of the doctor entity



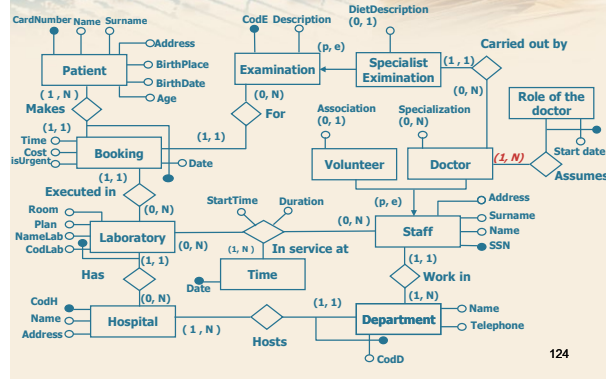
122

Historicization of the Role of the doctor



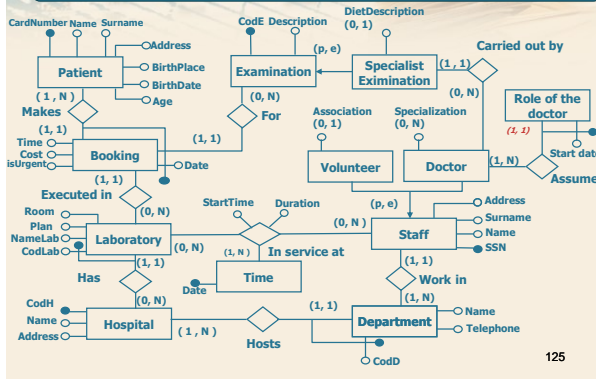
123

Cardinality of the Assumes relationship



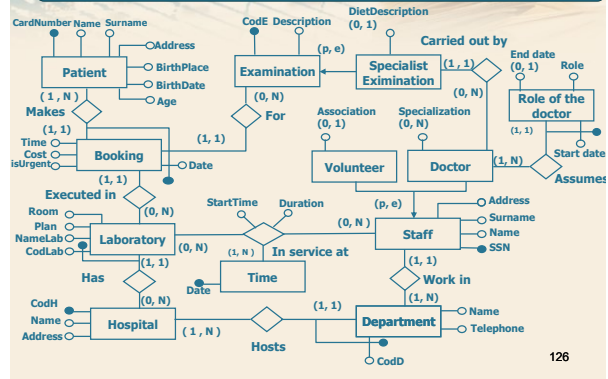
124

Cardinality of the Assumes relationship

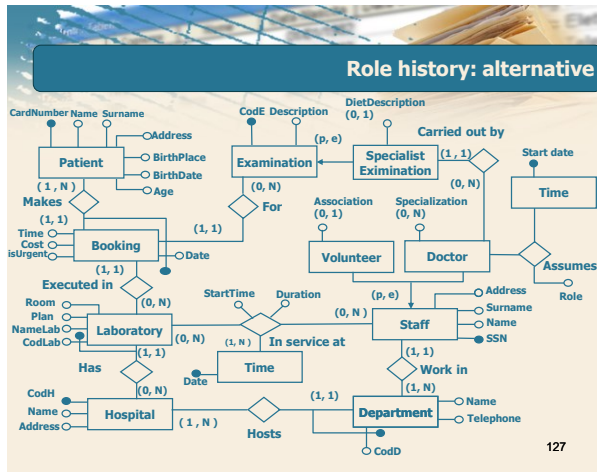


125

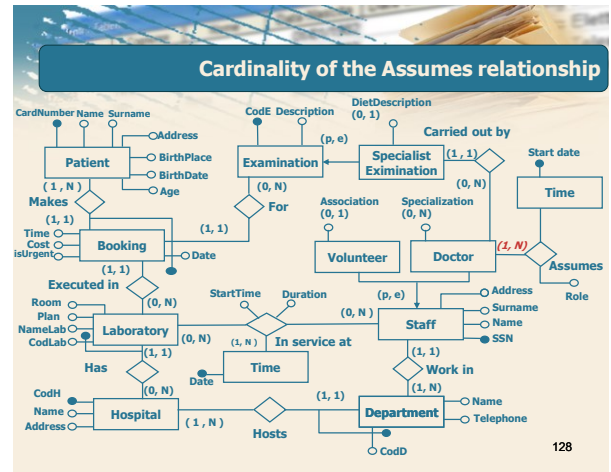
Refinement of the Role of the doctor entity



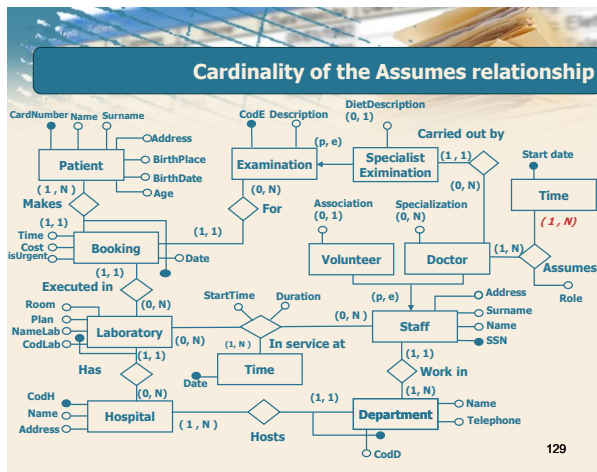
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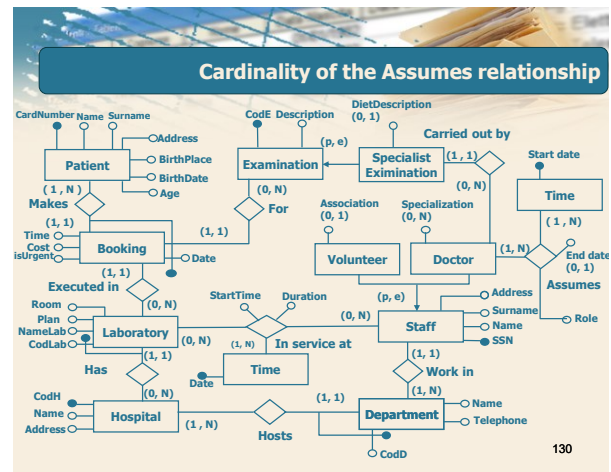
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