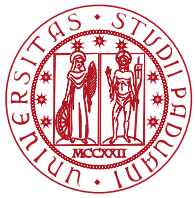

UNIVERSITÀ DEGLI STUDI DI PADOVA

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Database Management Systems, A.Y. 2017/2018
Master Degree in Computer Engineering
Master Degree in ICT for Internet and Multimedia

Homework 2 – Conceptual Design

Deadline: April 13, 2018

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Variations to the Requirement Analysis

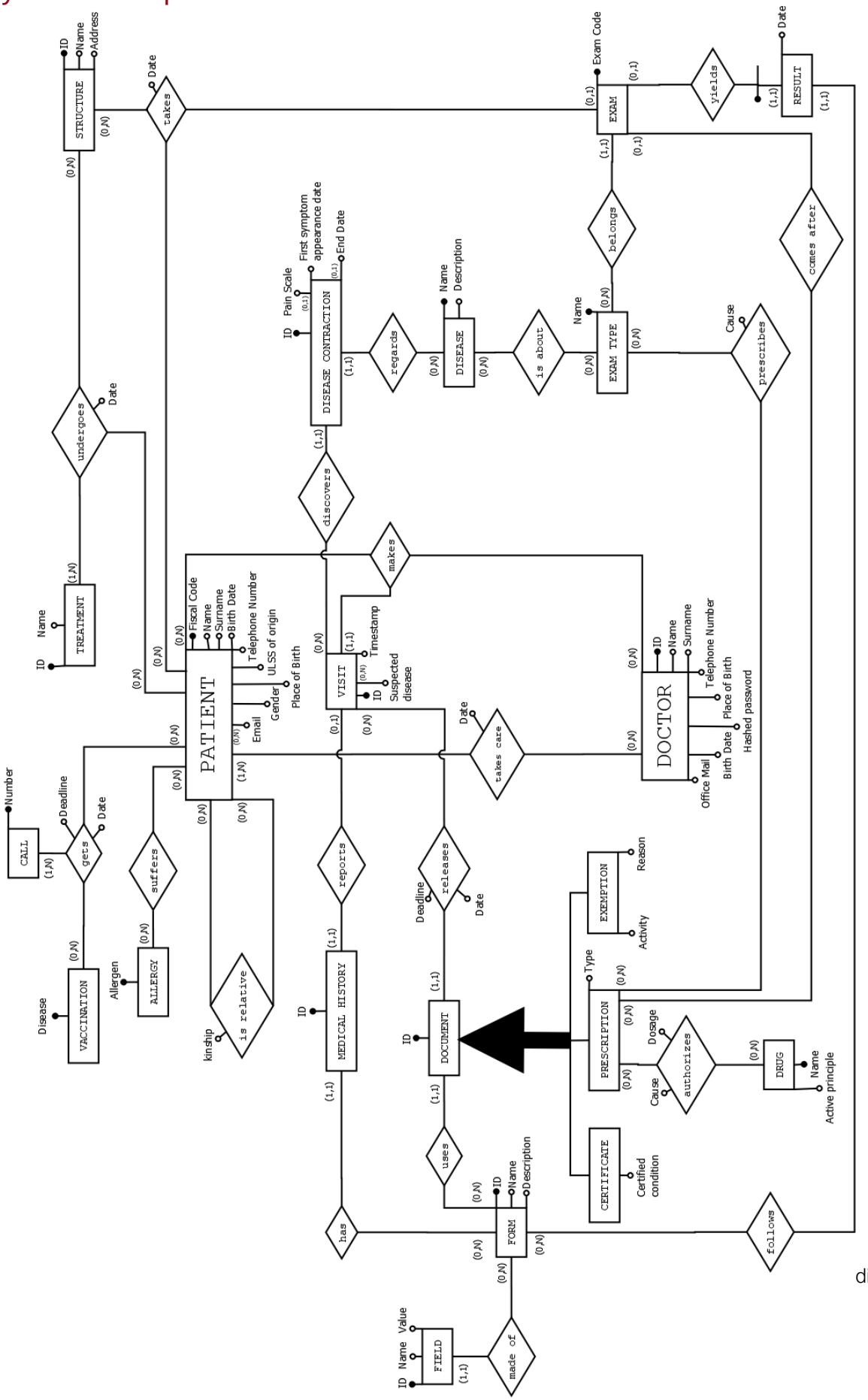
A further interview with Dr. Rossi lead to the following adjustments to the requirement analysis:

- Vaccinations for certain diseases need to be repeated in order to enforce the protection against the targeted pathogen. It is thus necessary to store with vaccination even the "call" in which they were performed and the relative deadline before the next renewal.
- Medical History, also known as anamnesis, is part of the Patient's History. The former is only the collection from the patient's speech (and/or his relatives' one) of all the information and sensation that can help the doctor with the diagnosis of diseases**,** while the latter is a collection of Medical History and all the past diseases, treatments, exams, prescriptions, vaccinations, certificates, exemptions and allergies of the patient.
  Furthermore Dr. Rossi required a pre-defined form for anamnesis, with the following fields: birth modalities, contracted common childhood diseases, weaning, school attendance, military lever (males only), menstruations(females only), pregnancies (females only), children (females only)feeding, smoking habits, diuresis, sleep, left-handed or right handed, kind of work and

work-shifts, physical activity, drug addiction, ethnicity, marital status, height, weight, economic conditions, over-the-counter drugs, additional notes.

- Doctors also need to retrieve information about kinships between patients in order to ease the diagnosis of certain inherited and kinship-related diseases.
- Exam results shall be stored with the date they are handed to the doctor's studio.
- More functional requirements have been added. The complete list can be found in the "Functional Requirements Satisfaction Check" section at the end of this document.

Entity-Relationship Schema



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Data Dictionary

Entities Table

Entity	Description	Attributes	Identifier
Doctor	Someone providing medical care	• ID, unique identifier for the doctor made by 4 numbers, text; • Hashed password, doctor personal password saved in hashed form for security, text; • Name, the name of the doctor, text; • Surname, the surname of the doctor, text; • Birth Date, date of birth of the doctor, date; • Place of Birth, place where the doctor is born, text; • Telephone Number, telephone number of the doctor, text; • Office Mail, the professional email address of the doctor, text.	ID
Patient	Someone under medical care	• Fiscal Code, unique alphanumeric string provided by the country administration, text; • Name, the name of the patient, text; • Surname, the surname of the patient, text; • Gender, gender of the patient, text; • Birth Date, date of birth of the patient, date; • Place of Birth, place where the patient is born, text; • Telephone Number, telephone number of the patient, text; • ULSS of origin, ULSS from where the patient belongs to, text; • Email, the personal email of the patient, text, (0,N).	Fiscal Code
Visit	The meeting of Doctor	• ID, an increasing number, (long)	ID

	and Patient aimed to check Patient's health conditions	integer; • Suspected disease, a disease the doctor suspects the patient to suffer, without having the required certainties for a diagnosis, text, (0,N); • Timestamp, a timestamp including time and date of the visit, timestamp.	
Medical History	Collection of data regarding past diseases and treatments related to the patient	• ID, unique identifier computed by combining fiscal code and an incremental number to take into account of previous versions, text.	ID
Vaccination	Preventive immunization to a certain disease	• Disease, the name of the disease the vaccination is about, text.	Disease
Call	Number of times a vaccination has been repeated	• Number, the number of the call, integer.	Number
Allergy	Hypersensitivity of the patient's body to a certain substance	• Allergen, the name of the substance that the patient is allergic to, text.	Allergen
Treatment	Management and care of a patient to combat a specific medical condition, uniquely defined by name and date	• ID, combination of unique identifier provided by the structure and the structure name, text; • Name, the name of the treatment, text.	ID
Structure	Hospital or clinic in which the patient has taken an exam or received some treatment	• ID, unique identifier of the structure, provided by the national system, text; • Name, the name of the structure, text; • Address, the address of the structure, text.	ID
Disease contraction	The act of getting a disease	• ID, combination of the patient's ID, disease name and a counter, text; • First symptom appearance date, date of the day in which the first symptom of the disease occurred, date; • End date, the date when the	ID

		disease ended, date, (0,1). • Pain scale, subjective number from 1 to 10 with which the patient describes how much he/she's suffering, integer, (0,1).	
Disease	Health problem affecting a patient	• Name, the name of the disease, text; • Description, the description of the disease, text.	Name
Exam	Series of tests targeted to check specific health conditions of the patient. Actual realization of Exam Type.	• Exam Code, unique identifier provided by the national system, text.	Exam Code
Exam Type	The typology of the exam taken by the patient	• Name, the specific name for exam typology, text.	Name
Result	Outcome of a specific exam	• Date, the date in which the result for the exam is delivered to the Doctor, date.	Exam Code (Exam)
Form	Generic template for an official document	• ID, progressive number identifying the form for a specific exam result or document, integer; • Name, the name of the form, text; • Description, a brief description of what the form describes, text.	ID
Field	Part of a form containing a specific value	• ID, progressive number identifying the field for a specific form, integer; • Name, the name of the field, text; • Value, the value of the field, text.	ID
Document	Medical document released by the doctor. It is a generalization of certificates, prescriptions and exemptions	• ID, combination of visit identifier and document type, which is specific of whether it is an exemption, certificate or prescription, text.	ID
Certificate	Document written by the doctor to provide a promissory note	• Certified Condition, the condition for which the certificate is released, text.	ID (Document)

	regarding health conditions of the patient		
Exemption	Document attesting someone's authorization not to pay taxes for a certain medical performance	• Reason, the motivation for which the exemption is given, text; • Activity, the activity targeted by the exemption, text.	ID (Document)
Prescription	Medication suggested by the doctor	• Type, the type of the medical prescription, text.	ID (Document)
Drug	Substance to be taken by the patient to modify a certain health condition	• Name, the commercial name of the drug, text; • Active Principle: the active principle of the Drug, text.	Name

Relationship Table

Relationship	Description	Component Entities	Attributes
Takes care	Link between a doctor and a patient	• Doctor, (0,N); • Patient, (1,N).	• Date, the date from which the doctor has started taking care of the patient, date.
Makes	A Doctor makes a Visit to a Patient	• Doctor, (0,N); • Patient, (0,N); • Visit, (1,1).	-
Yields	An exam is made to yield some specific result	• Exam, (0,1); • Result, (1,1).	-
Follows	The results for an exam follow a certain from	• Result, (1,1); • Form, (0,N).	-
Reports	A patient's Medical History is reported during a Visit	• Medical History, (1,1); • Visit, (0,1).	-
Has	Medical History is inserted via a form	• Medical History, (1,1); • Form, (0,N).	-
Uses	A document has a certain form	• Document, (1,1); • Form, (0,N).	-
Suffers	A patient can have one	• Patient, (0,N);	-

	or more allergies	• Allergy, (0,N).	
Discovers	A disease contraction can be discovered/suspected during a visit	• Visit, (0,N); • Disease Contraction, (1,1).	-
Regards	A disease contraction is regarding a specific disease	• Disease Contraction, (1,1); • Disease, (0,N).	-
Gets	A patient can get one or more vaccinations, and each vaccination is performed at a specific call	• Patient, (0,N); • Call, (1,N); • Vaccination, (0,N).	• Date, the date when the vaccination is performed, date; • Deadline, the deadline date for the vaccination, date.
Undergoes	A patient undergoes a treatment in a certain structure	• Patient, (0,N); • Treatment, (1,N); • Structure, (0,N).	• Date, date on which the patient undergoes the treatment, date.
Is Relative	A patient is relative to another patient	• Patient, (0,N); • Patient, (0,N).	• Kinship, the degree of relationship connecting the two patients, text.
Prescribes	A prescription can prescribe a specific exam type	• Prescription, (0,N); • Exam Type, (0,N).	• Cause, the reason why the exam or the drug object of the prescription is prescribed, text.
Comes After	An exam can come after a medical prescription, and the doctor needs to have this information stored	• Prescription, (0,N); • Exam, (0,1).	-
Takes	A patient takes an exam in a certain structure	• Patient, (0,N); • Exam, (0,1); • Structure, (0,N).	• Date, date on which the patient takes the exam.
Belongs	An exam belongs to a specific exam Type	• Exam, (1,1); • Exam Type (0,N).	-
Is about	An exam type can be about a certain disease	• Exam Type, (0,N); • Disease, (0,N).	-
Authorizes	A prescription is about one or more drugs	• Prescription, (0,N); • Drug, (0,N).	• Dosage, the dosage of the drug to be

			taken by the patient, text; • Cause, the reason why the exam or the drug object of the prescription is prescribed, text.
Made of	A form is made of several fields	• Form, (0,N); • Field, (1,1).	-
Releases	A medical document is released during a visit	• Document, (1,1); • Visit, (0,N).	• Date, the date on which the document is released, text; • Deadline, the date up to which the document is valid, text.

External Constraints

External constraints for the above defined schema are:

- Doctors can access and modify the data only after logging in to the system via personal password.
- Hospitalization records have to be composed by the collection of received treatments and exams in the same structure.
- Patient History has to be the collection of Medical Histories and all the past diseases, treatments, exams, prescriptions, vaccinations, certificates, exemptions and allergies of the patient.
- Prescription History, on the patient side, has to be the collection of all the exam and drug prescriptions related to that single person, while on the doctor side has to be the collection of all the prescription made by that specific physician.

Functional Requirements Satisfaction Check

The DBMS has to guarantee the following functions:

- Patient records fields: the fields to be contained are: name, surname, fiscal Code, birth date and place of birth, telephone number, emails, ULSS, date of taking under care, vaccinations, allergies, diseases, hospitalizations, received prescriptions, prescription history, medical history, exemptions, certificates. They all are entities or entity attributes and can thus be accessed by means of queries and displayed to the final user, who can also modify them.

- Information on doctors: The following fields are available as attributes of doctor entity: name, surname, birth date and place of birth, telephone number, email.
- Doctors have a personal password stored with their data: Hashed password is one of the mandatory attributes of doctor entities.
- Information about patient health conditions and exams: Vaccination (and relative Call), Disease Contraction, Exam and Allergy entities allow users (the doctors) to store the relative information about every single patient via the relationships with the Patient entity. Disease Contraction entity has been introduced to take into account the subsequent occurrences of a specific disease: once an instance is created it is forced to participate in relationships with visit and disease by (1,1) cardinalities. Analogous motivations lead to the introduction of the distinct Exam and Exam Type entity, the former being introduced to take into account subsequent occurrences of the same exam typology. All the other relationships between the aforementioned entities and the patient one are optional, thus a patient record can be created without initializing it with any medical condition.
- Medical document creation: A medical document, (i.e. prescription, exemption, certificate) can be created by the doctor during a visit, thus uniquely linking it with a patient, by filling specific fields in a form. Visits can have no documents associated to them because of the (0,N) cardinalities, but every time a document is created it must be associated to a visit because of the (1,1) cardinality on its side.
- Patient-Doctor-Visit relationship: this relationship has been introduced to keep track in which occasion a disease is diagnosed or when medical documents, like prescriptions for drugs/exams, are released.
- Actions performed by the doctor: the entities inserted in the above ER scheme allow doctors to insert and modify patient records, store information about medical visits, vaccination, diseases and allergies, filling forms about medical documents (exemptions, prescriptions, certificates), store results about exams.