

EBU5602 Database Tutorial 1

Q1.

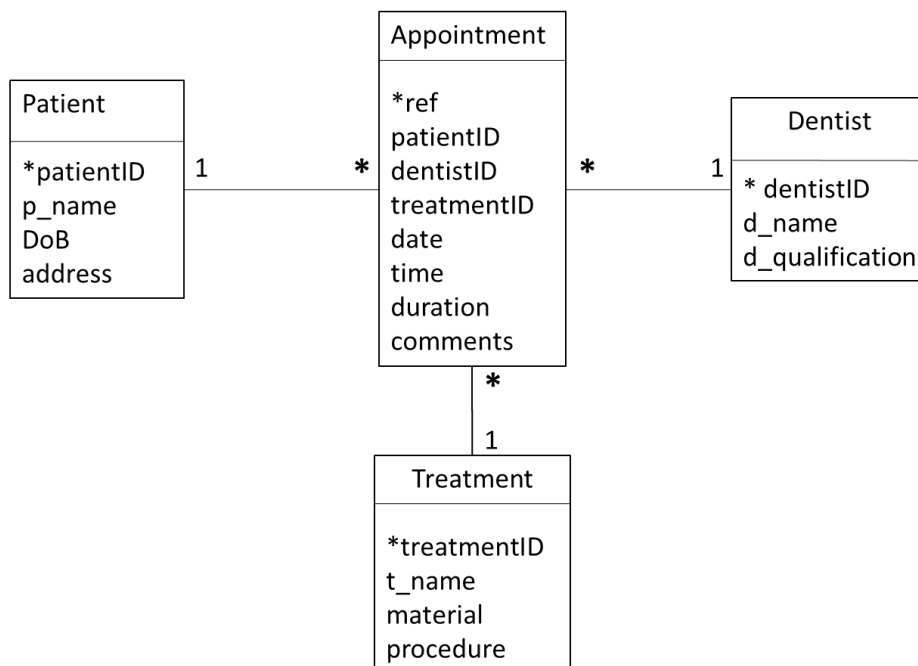
You are asked to design a relational database for a dental clinic, and the following information is given by the clinic:

- There are a number of dentists working in the clinic, and the database needs to store their ID, name, qualification details.
- There are a number of registered dental patients, and the database needs to store their patient ID (which uniquely identifies a patient), name, address, date of birth and some other personal information.
- There are a number of dental treatments (e.g. filling, root canal treatment, dental implant etc). Each treatment has a treatment ID, name, required materials, procedure etc.
- Patients can book appointments with dentists to receive treatments, and the database needs to store the date, time and duration of the appointment. Dentists can also record comments for the appointment, e.g. examination results, etc.

Draw an *Entity-Relationship(ER) model* for the dental clinic database. Your ER diagram must include details of the entities, attributes and relationships and **label** them clearly. Clearly **state the assumptions** if you make any.

Solution:

The ER diagram is below:



Appointment is a ternary relationship among Patient, Dentist and Treatment. One patient can book with one dentist for many treatments, one dentist can perform one treatment on many patients, and one patient can receive one treatment from many different dentists, hence the multiplicity of the relationship is m:m on all three relations.

Q2.

The following tables form part of a database held in a Relational Database Management System:

Employee (empNo, eName, salary, position)

Aircraft (aircraftNo, aName, aModel, flyingRange)

Flight (flightNo, aircraftNo, from, to, flightDistance, departTime, arriveTime)

Certified (empNo, aircraftNo)

Where Employee contains details of all employees (pilots and non-pilots) and empNo is the key.

AirCRAFT contains details of aircraft and aircraftNo is the key.

Flight contains details of the flights and flightNo is the key.

And Certified contains details of the staff who are certified to fly an aircraft, and empNo/aircraftNo form the key.

Formulate the following queries in *relational algebra*:

i) List the details of all Boeing aircraft. (Boeing is the aircraft name)

$\sigma_{aName = \text{"Boeing"}} (\text{Aircraft})$

ii) List all Boeing 737 aircraft. (737 is the aircraft model)

$\sigma_{aName = \text{"Boeing"} \wedge aModel = \text{"737"}} (\text{Aircraft})$

iii) List the employee number of pilots who is certified to fly Boeing aircrafts.

$\pi_{empNo} (\sigma_{aName = \text{"Boeing"}} (\text{Aircraft} \bowtie \text{Certified}))$

iv) List the aircraftNo of aircrafts that can fly nonstop from London to New York (flyingRange > flightDistance).

$\pi_{aircraftNo} (\sigma_{from = \text{"London"} \wedge to = \text{"New York"} \wedge flyingRange > flightDistance} (\text{Aircraft} \bowtie \text{Flight}))$

v) List the employee number of pilots who are certified to fly **all** aircrafts that Hugh Jackman is certified to fly.

$A = \pi_{aircraftNo} (\sigma_{eName = \text{"Hugh Jackman"}} (\text{Employee} \bowtie \text{Flight}))$

Final result: $\text{Certified} \div A$