**Answer to Question: 1**

Q1. One of the major difficulties of handling medical data is its „double nature“, having to collect and integrate in the same record heterogeneous elements related to high and low level processes, such as i) lab tests, ii) images, iii) genetic data, iv) family's medical history and v) appraisals of emotional states. Please indicate the data types and/or representation formats that you would use for each of the above five information elements.

It is important to separate the way the data is stored, from the way it is represented. It’s clear that the interface design should take top priority. Nonetheless it is necessary to clarify some points on the best way to organize the data in terms of computer science.

The typical computer design answer involving object oriented design must be disregarded forthwith. Since we’re dealing with very complex types of data it appears to make sense, that the we should split something like a lab test or a patient’s family medical history into a class/subclass and to create methods that would then tweak the representation of data. In a perfect world this would be the optimal solution, whoever we must consider that medicine is both a constantly evolving subject and that not every hospital uses the same system. To an American system programmed in *python*, a Finnish patients *C++* object might as well be gibberish.

Hence the solution to the problem usually revolve around markup languages, such as XML or HL7.

This type of approach provides us with many advantages, these types of documents are generally very light, easily encryptable quickly parsable and very flexible.

Let’s consider one of the five examples given in this question namely lab tests. It is easy to see how to translate these to a markup language, one would start by defining the test with some sort of identifying tab followed by the various attributes that describe the results of the test. A new type of test would require nothing but a new document, and more attributes or a different way to describe attributes (Standard Kg vs English Stone) can be easily added without making old test results obsolete. Even images can be implemented with a markup language by simply describing the way they are encoded, for example:

<jpeg-base64> adsauda…….0ud88iuj8 </jpeg-base64>

In computer science data is nothing more than an organized collection of strings, ultimately the far more important and difficult task revolves around representing that data in a way that the user can benefit from.

To that lengthy and complex topic we can only regard with certainty that there is no single way display medical data. This is due to the fact that we are dealing with an excessively diverse use cases, from elderly computer illiterate patients to medical researchers, nurses and pharmacists. This is an area of study that must be dealt case by case, dividing each of the major areas of the use cases as much as possible and designing separate interfaces from there.

**Answer to Question: 2**

Q2. Given the imprecision of many medical terms, why do you think that serious instances of miscommunication among health care professionals are not more common? Explain also, in your own words, why is greater standardization of terminology necessary if computers rather than humans are to manipulate patient data?

The lack of major communications problems can the thanked in large part to the history of health care.

“Increasingly over the latter half of the 20th century, English became the Lingua Franca of medicine, in both international and intra-national communication.” – Showell, C., Cummings, E. and Turner, P. (2010)

The information age has in many ways served to further dispel miscommunication,

Q3CS. Present an Entity-Relationship (ER) model of the medication resource. Convert also the ER model to the relational model, and implement the database in a database management system of your choice (suggestion: sqlite3 ). Your answer should contain (i) the ER model, and (ii) the SQL instructions to define the relational schema of the database.

Q4CS. Write a program to populate the relational database from JSON files encoding medication resources according to the HL7-PHIR format (suggestion: use Python with the sqlite library4 ).