AG Heterogene Informationssysteme

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Recent Developments for Data Models – Exercise 5

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1) XML Data Modelling

XML Schema allows defining and describing a class of XML documents by using schema components to constrain and document the meaning, usage and relationships of their constituent parts: data types, elements and their content, and attributes and their values.

Figure 1: Hospital scenario

Consider the following scenario[1]: Hospitals have a name and an address. A hospital consists of several wards with a unique name and a number of beds. Each ward is

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[1] This exercise is based on *Wolfgang Lehner, Harald Schöning: XQuery – Grundlagen und fortge-schrittene Methoden, dpunkt.verlag, 2004*

headed by a nurse. The hospital is used by different kinds of persons. First, there are patients. Second, there are staff members that can be distinguished into doctors, nurses, and clerks. Doctors are specialists in surgery, anesthesia, oncology, otology, or orthopedics. Doctors are provided with pagers. Each person has a unique identifier, a name consisting of one or more first names and a single last name, a date of birth, and a phone number. For staff members the employee number, the email address, and the date of hire are also relevant. Doctors and nurses work in one of the hospital's wards. When patients stay in the hospital, they are assigned to a ward and provided with a bed. For the time of the stay one of the doctors is responsible for the patient. The start date, the duration, and the reason for the stay are documented. An overview of the scenario is provided by Figure 1.

Specify an XML Schema file based on the hospital scenario!

a. Declare restricted derived types for international phone numbers and email addresses.

b. Declare a complex type for a postal address.

c. Declare a type hierarchy for persons, staff members, clerks, nurses, and doctors. Note that the types for persons and staff members will not be instantiated directly.

d. Declare elements for the staff member type hierarchy. Note that the staff member element should be substitutable by its sub-elements.

e. Declare a derived type for patients and elements for the remaining entities. What alternatives do you see to model relationships between different entities?

2) XQuery

Specify XQuery expressions based on the XML schema defined in 1) to produce the following results.

a. All doctor elements enclosed in a root element called `listOfDoctors`.

b. The first and last name of all doctors living in "Berlin" enclosed in a root element called `doctorsFromBerlin` in alphabetical order.

c. The name of each ward together with the last and first name of its head nurse.

d. The name of each ward together with the names of all associated nurses.

e. The name of each ward together with the *number* of associated nurses.

f. The name of each ward together with a sequence number indicating its position in the XML document.

g. The names of all employees ordered by the data of hire starting with the most recent one. Missing values should appear at the end of the list.

h. The city names in alphabetical order with the names of all residents.

i. All patients together with a list of doctors living in the same city.

j. The average length each patient stood in the hospital.

k. The number of doctors that are specialist for "surgery", "anesthesia", "oncology".

l. A numbered list of staff members ordered by date of birth. Staff members with an unspecified date of birth shall appear at the end of the list.

m. A list of specializations. Doctors shall be nested within their respective specialization.

n. Retrieve the date of birth of the youngest and the oldest staff member for each group (clerks, doctors, and nurses).

o. All patients that have been treated at the emergency ward.

p. All patients that have been treated at the emergency ward only and have not been to any other ward.

q. Patients that have been treated in two or more wards.