Advanced Databases Systems

Date: Monday 21st May 2012
Time: 09:45 - 11:45

Please answer any THREE questions from the FIVE questions provided

For full marks your answers should be concise as well as accurate.
Marks will be awarded for reasoning and method as well as being correct.

This is a CLOSED book examination

The use of electronic calculators is NOT permitted
1. The following relations are from the database of a SUBWAY Restaurant, and are the setting for this question.

MenuItems (itemNum, name, flavour, price, categoryNum)
Categories (cNum, name, description);

a) Write a JDBC code fragment that is equivalent to the following PS/SQL program. You do not need to show connection to the database. State any assumptions you make.

(10 marks)

declare
cursor C1 is
select MenuItems.name, MenuItems.flavour,
Categories.name
from MenuItems, Categories
where MenuItems.categoryNum = Categories.cNum;

Name MenuItems.name%type;
Flavour MenuItems.flavour%type;
Category Categories.name%type;

begin
  open C1;
  fetch C1 into Name, Flavour, Category;
  while C1%found loop
    dbms_output.put_line('Row Number ' ||
      C1%rowcount || ' is ' ||
      Name || ' ' || Flavour || ' ' || Category);
    fetch C1 into Name, Flavour, Category;
  end loop;
end

b) Considering both the PL/SQL program shown in Part a) and your JDBC code fragment given as solution to Part a), state four reasons why you would prefer this particular program in PL/SQL to JDBC.

(4 marks)

c) Would you support the opinion that the PL/SQL program shown in Part a) would execute faster than the equivalent JDBC code given by you as solution to Part a)? Explain why or why not, using in your arguments the issues that are relevant to this claim, and illustrating your explanation with examples taken from both the program and code fragment, where possible.

(6 marks)
2. This question assumes the following tables:

\[ \text{MatchPerformance}(\text{playerId}, \text{matchId}, \text{nGoals}) \]
\[ \text{Player}(\text{playerId}, \text{name}, \text{overallNgoals}) \]

The \text{Player} table stores the identifier, the name and the overall number of goals scored by a player, taking into account all the matches played (\text{overallNgoals}). The \text{MatchPerformance} table indicates the number of goals (\text{nGoals}) scored by a player on each match.

a) Write row triggers that propagate all relevant changes made to the \text{MatchPerformance} table to the \text{Player} table, stating any assumptions you make.
   (10 marks)

b) Would you support the opinion that it would be best to implement the monitoring of table \text{MatchPerformance} and the associated reactive behaviour encoded within the triggers you wrote for Part a) on an application running on the Client, instead of triggers running on the database?

   Explain why or why not, providing five disadvantages or advantages of having this particular functionality running on the database. (10 marks)
3. a) Assuming that a JDO persistent class Book has as data members an author, a title, an ISBN and a collection (Vector) of chapters; and each chapter (from persistent class Chapter) has as data members an author, which may or may not be different from the author of the book, a title, a startPageNumber and an endPageNumber, answer the following:

i) Write a JDO program that retrieves the titles of the books to which chapters have been contributed by author A.N. Other. You do NOT need to write the statements related to database connection, and you can assume that you have access to an initialised PersistenceManager object. You DO need to include transactions and exception handling. (6 marks)

ii) The following code fragment creates two Java objects.

```java
Chapter c = new Chapter("J. Oliver", "Provence Deserts", 3, 150);
Book b = new Book("I. Garten", "French Cooking", "1234", c);
```

Provide additional code that would enable the objects to be stored on disk, assuming that each Book instance has a collection of references to Chapter instances. You do NOT need to write the statements related to database connection, and you can assume that you have access to an initialised PersistenceManager object. You DO need to include transactions and exception handling. (5 marks)

iii) Explain why or why not you have explicitly made both Chapter and Book object instances persistent in your solution to Part a.ii), mentioning any JDO concepts that may support your arguments. (2 marks)

b) Explain why or why not you have used a JDOQL query expression in your solution to Part a.i), discussing the advantages or disadvantages of a JDOQL approach to the solution over an alternative approach, such as navigation from the extent of the Book class. (7 marks)
4. The following XML Schema is relevant to this question:

```xml
<?xml version="1.0" encoding="ISO-8859-1" ?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="shiporder">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="orderperson" type="xs:string"/>
        <xs:element name="shipto">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="name" type="xs:string"/>
              <xs:element name="address" type="xs:string"/>
              <xs:element name="city" type="xs:string"/>
              <xs:element name="country" type="xs:string"/>
            </sequence>
          </complexType>
        </xs:element>
        <xs:element name="item" maxOccurs="unbounded"/>
      </sequence>
      <xs:attribute name="orderid" type="xs:string" use="required"/>
    </complexType>
  </element>
</xs:schema>
```

a) Give an example of an XML document that validates against the above schema. (5 marks)

b) Construct a relational schema that contains the same information as the above XML Schema. The schema should state keys and constraints where relevant, and types for all attributes. State any assumptions you make. (7 marks)

c) Illustrating your answer with the XML example above, state four benefits or weaknesses of the XML data representation compared with the relational model. (8 marks)
5. Consider the following schemas, independently developed for two databases that record information about properties for rent and sale, as well as contracts between property owners and clients. In all your answers, state any assumptions you make:

**Database 1:**

- PropertyForRent(propertyNo, street, city, postcode, type, rooms, rent, ownerNo)
- PropertyForSale(propertyNo, street, city, postcode, type, rooms, salePrice, ownerNo)
- PrivateOwner(ownerNo, fName, LName, address, telNo)
- Client(clientNo, fName, LName, address, telNo, prefType, maxRent)
- Lease(leaseNo, propertyNo, clientNo, rent, paymentMethod, deposit, paid, rentStart, rentFinish, duration)

**Database 2:**

- Property(prop_id, address, details_id, price, owner_id)
- Details_Property(details_id, type, rooms, features, details_furniture, view, facilities, details_area)
- Owner(owner_id, name, address, tel)
- Client(client_id, name, address, tel, constraints_id)
- Client_Constraints(constraints_id, client_id, prop_type, minPrice, maxPrice, num_rooms, carParking)
- Contract(contract_id, prop_id, client_id, rent, paymentMethod, dateStart, durationPeriod)

a) Suppose that the estate agent companies that own the above databases will merge, and, therefore, their database schemas need to be integrated. During the integration process, schema conflicts have to be reconciled.

Answer the questions below, using the following notation: `Database_i.TableName.AttributeName`, to refer to an attribute in any of the two schemas; `Database_i.TableName`, to refer to a table in any of the two schemas.

i) Describe two different one-to-one table name conflicts. (2 marks)

ii) Describe two different one-to-one table structure conflicts, one of them being the case of a missing, but implicit attribute. (2 marks)

iii) Describe one table inclusion conflict. (1 mark)

iv) Describe one many-to-many table conflict. (1 mark)

v) Describe two different many-to-many attribute conflicts. (2 marks)
b) Views are often used to bridge across independently developed schemas. They protect users from the schematic differences that may arise as a result of that independent development. You are using Oracle ManagementDB to provide a database that brings together the two state agent databases.

i) Give the two Oracle distributed database commands that would be required to link the ManagementDB with Database_1 and Database_2. Explain why you have chosen public or private, and connected user or fixed user links in your answer. (6 marks)

ii) Produce a SQL view in ManagementDB that derives a table AllPropertiesDetails(propertyNo, address, details, price, ownerNo), where attribute details include information on property type (type) and number of rooms (rooms), and which contains data derived from both Database_1 and Database_2. (6 marks)

END OF EXAMINATION