

Information Systems Analysis & Design (M8748)

Tutorial 18 Answer

1. Give one example each of a persistent and a transient object.

Transient – any object that is used as a temporary value, for example created for a calculation, or a string object that is created temporarily, for example for an error message, or something as large as the calculator object that is used as an example in the chapter.

Persistent – any object that is stored in an information system, e.g. customer, order, product, line, line fault, etc.

2. Explain the difference between different types of file organization and file access.

This is explained in detail in Section 18.3.

3. Of the different kinds of record type listed in Section 18.3.1 suggest which would be most appropriate for storing complex nested objects. Explain the reasons for your choice.

Tagged data, with a tag for the class of each object and the attribute of each value within each object. This way, it is possible to reconstruct any object from the data in the file without having to hard code the structure of every possible complex object. (This is the approach used by the Java `ObjectOutputStream` and `ObjectInputStream` classes and by XML and SOAP.)

4. Outline the advantages and disadvantages of using a database management system over developing an application using files.

Students given this exercise should be clear that we are asking for the advantages of using a DBMS and not just of using computers to store data. (We often find that students asked to give the benefits of using a database management system give the benefits of having a computerized information system, which they think of as ‘a database’.)

The use of a conceptual schema can eliminate unnecessary duplication of data.

Data integrity can be ensured by the use of integrity constraints and transaction management techniques.

Changes to the conceptual schema, the logical model, should not affect the application programs, provided the external schema used by the application programs does not have to be changed.

Changes to the internal schema, the physical storage of the data, have no impact on the conceptual schema and should not affect the application programs, except perhaps

positively in enabling them to access data more efficiently. Compromises may have to be made between the needs of different application programs.

Tools are available for tuning the performance of the database.

Facilities are provided for the back-up and recovery of data.

Security and access to data by multiple simultaneous users can be controlled.

5. What is the key difference between a relational DBMS and an object DBMS?

Two possible key differences:

1) For objects to be stored in a relational database they must be converted to flat two-dimensional rows of data. Complex objects can be stored as they are in an object database.

2) Object databases provide persistence mechanisms that are effectively transparent. For example, using ObjectStore, persistent objects only need to be created and amended within a transaction for them to be stored automatically. To store objects in a relational database, special calls must be made to software to handle the storage.

(Note that with Container Managed Persistence for Entity Java Beans, it is becoming easier to build systems with components that are persisted into a relational database. However, the J2EE Container is having to do a lot of work to provide this. It also requires the overhead of the J2EE Container or Application Server.)

6. List in your own words the three steps used in going from an unnormalized relation to a relation in third normal form.

1) Remove repeating groups. Ensure all row column intersections contain only atomic values.

2) Make sure every attribute is dependent on the whole primary key. Create a separate table for part-key dependencies.

3) Ensure every attribute is dependent on the primary key and not on another non-key attribute. Create a separate table for non-key dependencies.

7. What are the three ways of mapping the classes in an inheritance hierarchy to tables?

1) Only implement the superclass as a table. Attributes of subclasses become attributes of this class and nulls are used to fill these values when they are not used.

2) Only implement the subclasses as tables. Hold the attributes of the superclass in each table.

3) Implement each class as a table. To retrieve the full set of attributes, data from the superclass table and one of the subclass tables must be retrieved.

8. What is meant by OML and ODL?

Object Manipulation Language and Object Definition Language.

9. What is the difference between ODBC and CORBA as ways of connecting to databases?
- ODBC works specifically with relational databases. SQL statements are issued to a server, and the results are passed back as rows of data. The recipient of the SQL statements is not an object, but a program running on the database server that handles requests for data, and passes it back to the client. The client then has to make use of it, for example to instantiate an object locally.
- CORBA provides a means for objects on different machines to send messages to one another transparently (as if they were on the same machine). It uses an interface definition language to define the operations of each class that are available to other objects. Messages are passed from machine to machine by objects called ORBS (object request brokers), using an inter-ORB protocol.

10. Explain what is meant by (i) a broker and (ii) a proxy.

In the context of data storage, a broker is responsible for the storage and retrieval of instances of a class. It provides a way of separating the data management component of the system from the business classes. There will usually be only one instance of a broker for any one class on a particular machine.

In the context of data storage, a proxy is an object that can be created in memory as a placeholder for another object. Only when one of that object's operations is invoked, does it need to instantiate that object from persistent storage. The proxy holds the object identifier of the real object and arranges for it to be retrieved from storage (possibly in collaboration with a broker) when it is needed.