Information Systems Analysis & Design (M8748)

<u>Tutorial 14 Answer</u>

1. What levels of visibility may be assigned to an attribute or an operation?
    An attribute or operation may be assigned one of three levels of visibility i.e. public (+), private (-), protected (#) or package (~).

2. Why should attributes be private?
    Attributes should be designated private to enforce encapsulation.

3. How does the application of the concepts of coupling and cohesion help to produce object-oriented designs?
    The application of coupling and cohesion produces coherent, focused classes that are loosely coupled and more amenable to reuse.

4. What are the advantages and disadvantages of applying the Liskov Substitution Principle?
    The advantages of applying the Liskov Substitution Principle (LSP) include the following points.
    *   The production of inheritance structures that exhibit high levels of inheritance coupling.
    *   The resulting classes in the inheritance structure are cohesive.
    *   There is no anomalous behavior when base class operations are applied to derived class objects and as a result the program code is much safer.
    The disadvantages include the following points.
    *   The resulting inheritance hierarchy may not map precisely onto problem domain objects. (It is a moot point whether this is a disadvantage or not though it does complicate traceability from the problem domain to the implementation to some extent.)
    *   If base classes are not chosen carefully extending an inheritance hierarchy may require its complete restructuring to ensure Liskov compliance and this may be result in significant changes to programme code. For this reason it may not always be cost effective to apply LSP (again a debatable point) but when LSP is not enforced the resulting structures are likely to be less safe. Many developers take a pragmatic view to applying LSP because of this contention between the perception that development and maintenance costs are higher and the development of systems that are safe because maintaining the integrity of derived classes is easier with LSP.

5. How can collection classes be used when designing associations?

Collection classes can be used to hold the object identifiers of the linked objects at the many end of an association. Collection classes provide collection specific behavior for manipulating the collection. Typically the collection class would provide collection management operations like getFirst(), getNext() and so on.

6. Under what circumstances should a collection of object references be included in a class?

A collection class of object identifiers (references) should be included in a class if it is not used by another class and it does not increase the complexity of the class unduly.

7. How can referential integrity be enforced in an object-oriented system?

Referential integrity is maintained by including appropriate checks in object constructors and destructors. These checks would ensure that object references were either null (if the multiplicity constraints permitted this) or that the object reference refers to an object that exists.

8. Under what circumstances is normalization useful during object-oriented design?

Normalization can be useful when decomposing complex objects or when implementing the system with a relational database management.