1. **. Explain why design conflicts might arise when designing an architecture for which both availability and security requirements are the most important non-functional requirements**.

Fundamentally, to provide availability, you need to have (a) replicated components in the architecture so that in the event of one component failing, you can switch immediately to a backup component.

You also need to have several copies of the data that is being processed. Security requires minimizing the number of copies of the data and, wherever possible, adopting an architecture where each component only knows as much as it needs to, to do its job. This reduces the chance of intruders accessing the data.

Therefore, there is a fundamental architectural conflict between availability (replication, several copies) and security (specialization, minimal copies). The system architect has to find the best compromise between these fundamentally opposing requirements.

2. Giving reasons for your answer based on the type of system being developed, suggest the most appropriate generic software process model that might be used as a basis for managing the development of the following systems:

a) A system to control anti-lock braking in a car

b) A virtual reality system to support software maintenance

c) A university accounting system that replaces an existing system

d) An interactive travel planning system that helps users plan journey with the lowest environment impact

a**) Anti-lock braking system** This is a safety-critical system so requires a lot of up-front analysis before implementation. It certainly needs a plan-driven approach to development with the requirements carefully analyzed. A waterfall model is therefore the most appropriate approach to use, perhaps with formal transformations between the different development stages.

b**) Virtual reality system** This is a system where the requirements will change and there will be an extensive user interface components. Incremental development with, perhaps, some UI prototyping is the most appropriate model. An agile process may be used.

c) University accounting system This is a system whose requirements are fairly well-known and which will be used in an environment in conjunction with lots of other systems such as a research grant management system. Therefore, a reuse-based approach is likely to be appropriate for this.

d) Interactive travel planning system with a complex user interface but which must be stable and reliable. An incremental development approach is the most appropriate as the system requirements will change as real user experience with the system is gained.

Why are iterations usually limited when the waterfall model is used?

The waterfall model is a document-driven model with documents produced at the end of each phase. Because of the cost of producing and approving documents, iterations and costly and involve significant rework. Hence, they are limited.

Outline and explain 5 different types of software application. Give an example software application system of each type

- **Stand-alone applications** These are application systems that run on a local computer, such as a PC. They include all necessary functionality and do not need to be connected to a network. Examples of such applications are office applications on a PC,
- **Interactive transaction-based applications** These are applications that execute on a remote computer and that are accessed by users from their own PCs or terminals. Examples is e-commerce application
- **Batch processing systems:** These are business systems that are designed to process data in large batches. They process large numbers of individual inputs to create corresponding outputs. Examples of batch systems phone billing systems, and salary payment systems.
- **Embedded control systems**: These are software control systems that control and manage hardware devices. Numerically, there are probably more embedded systems than any other type of system. Examples of embedded systems include the software in a mobile (cell) phone, software that controls anti-lock braking in a car, and software in a microwave oven to control the cooking process.
- **Entertainment systems** These are systems that are primarily for personal use and which are intended to entertain the user. Most of these systems are games of one kind or another.

Distinguish between the waterfall model and incremental model and give an example each of suitable software application that each might be used to develop type?

The waterfall model is a document-driven model with documents produced at the end of each phase. This takes the fundamental process activities of specification, development, validation, and evolution and represents them as separate process phases such as requirements specification, software design, implementation, testing, and so on. Example of software suitable is anti-lock braking system. While Incremental model approach interleaves the activities of specification, development, and validation. The system is developed as a series of versions (increments), with each version adding functionality to the previous version. Example of suitable software is the virtual reality system.

Briefly explain the principal stages of the requirements engineering process with a suitable diagram?