CSCI 716 – Software Design

– Textbook and Topics that will be part of the comprehensive exam


Chapter 1: Introduction to Software Engineering Design

- What is software engineering design?
- Why study software engineering design?
  - Reasons for studying software design in product development
  - Reasons for studying software design in project management
- Software Design Challenges:
  - Requirements volatility, process, technology, ethical and professional practices, managing design influences
- Software Design Process
  - Software Architecture
  - Detailed Design
    - Interface design
    - Component design
  - Construction Design
  - HCI Design
- Software Design Fundamentals
  - Software Design Principles
    - Modularization, Abstraction, Encapsulation, Coupling, Cohesion, Separation of Interface and Implementation, Completeness and Sufficiency
  - Practical Design Considerations
    - Design for Minimizing Complexity
    - Design for Change
  - Software Design Strategies
    - Structured Design
    - OO Design

Chapter 2: Software Design with Unified Modeling Language

- UML Fundamentals
- Structured Modeling
- Component Diagrams
  - Logical vs Physical Components
- Class Diagrams
- Deployment Diagrams
- Behavioral Modeling
- Use Case Diagrams
- Interaction Diagrams
  - Communication and Sequence Diagrams
Chapter 3: Principles of Software Architecture

- What is Software Architecture
- Key Tasks in Architectural Design
- Problem Solving in Software Architecture
- Software Architecture Process
- Understand and Evaluate Requirements
  - Elicitation, Analysis, Specification and Validation
- Designing the Architecture
  - The 4 + 1 View Model
  - Components and Connectors
- Evaluating the Architecture

Chapter 4: Patterns and Styles in Software Architecture

- Architectural Styles and Patterns
- Data Centered Systems
  - Blackboard Pattern
- Data Flow System
  - Pipe and Filter Pattern
- Distributed Systems
  - Client – Server Pattern
  - Broker Pattern
- Interactive Systems
  - MVC Patterns
- Hierarchical Systems
  - Main Program and Subroutine
  - Layered Pattern

Chapter 5: Principles of Detailed Design

- What is Detailed Design?
- Key Tasks in Detailed Design
- Detailed Design Process
- Understanding the Architecture and Requirements
- Creating Detailed Designs
  - Interface Design – Internal, External and GUI Design
  - Designing Internal Structure of Components – Classes, Interfaces, Types, Subtypes, Dynamic binding and Polymorphism, Objects
  - Design Principles for Internal Component Design
    - Open-Close Principles
    - Liskov Substitution Principle
    - Interface Segregation Principle
  - Programming Styles in Detailed Design
  - Modeling Internal Behavior of Components
  - Design Components Using Design Patterns
- Architectural vs. Design Patterns
- Classification of Design Patterns
- Documenting Design Patterns
  - Document the Software Design

**Chapter 6: Creational Design Patterns in Detailed Design**

- Abstract Factory
- Factory Method
- Builder
- Prototype
- Singleton

**Chapter 7: Structural and Behavioral Patterns in Detailed Design**

- Structural Design Patterns
  - Adapter
  - Composite
  - Façade
- Behavioral Design Patterns
  - Iterator
  - Observer

**Chapter 8: Principles of Construction Design**

- What is Construction Design?
- Behavioral Construction Design
  - Flow-Based Designs
  - State-Based Designs
  - Table-Based Designs