50150B

# C# Programming in the .NET Framework

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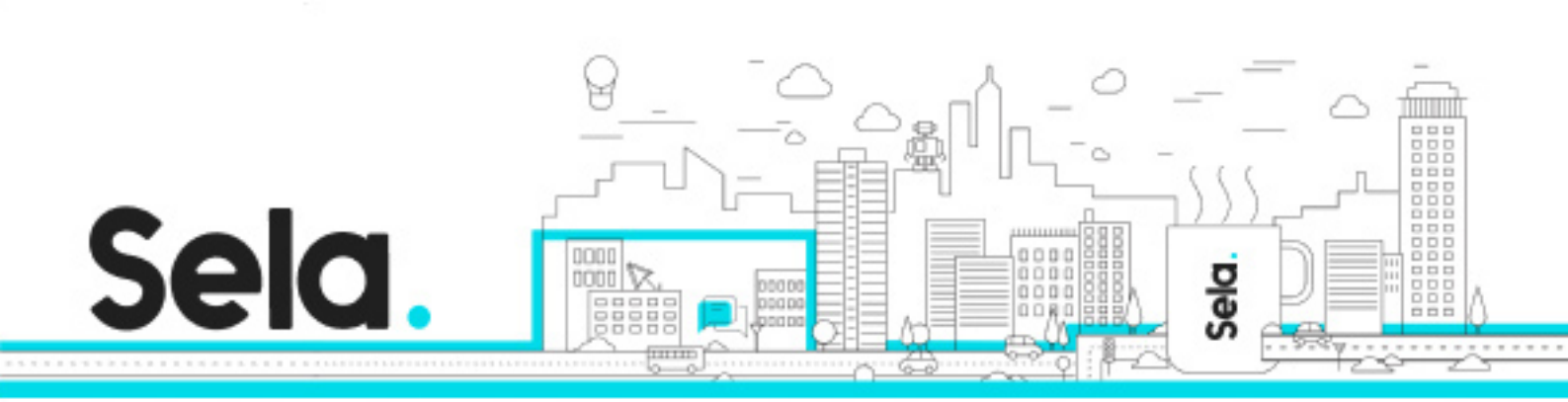



# C# Programming in the .NET Framework

50150B - Version: 2.3

6 days Course

## Description:

This six-day instructor-led course provides students with the knowledge and skills to develop applications in the .NET Framework using the C# programming language. C# is one of the most popular programming languages in existence, and the recent revisions introduce new productivity, performance, and convenience features into the language. This course features an overview of all language-related features, as well as an introduction to general .NET Framework features such as garbage collection, assembly loading, Reflection, Language-Integrated Query (LINQ), Asynchronous prgramming and many others.

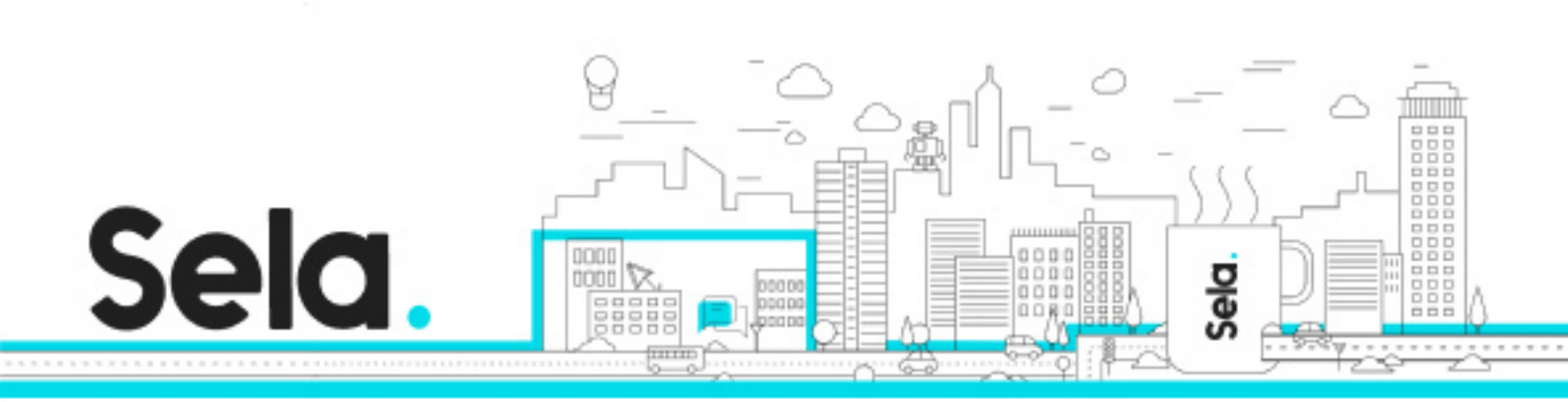
## Intended audience:

This course is intended for developers with good knowledge of object-oriented principles and practical experience of at least 6 months with an object-oriented programming language (C++ preferred).

## Prerequisites:

good knowledge of object-oriented principles and practical experience of at least 6 months with an object-oriented programming language (C++ preferred)
For student who has experience with non-object oriented programming language must take the 1 day course introduction to object oriented, usually this day course preformed before this course in few days

## Objectives:




Develop applications using the C# 5.0 language in the .NET Framework 4.5
Use generic types and implement generic algorithms to improve application performance and reliability.
Apply object-oriented architecture and design principles to .NET applications written in C#, and combine them with functional programming fundamentals.
Use attributes and reflection for metadata-driven or aspect-oriented software development.
Employ Language-Integrated Query (LINQ) syntax and classes to declaratively implement data-driven applications.
Deploy, version, configure and register .NET assemblies and applications.

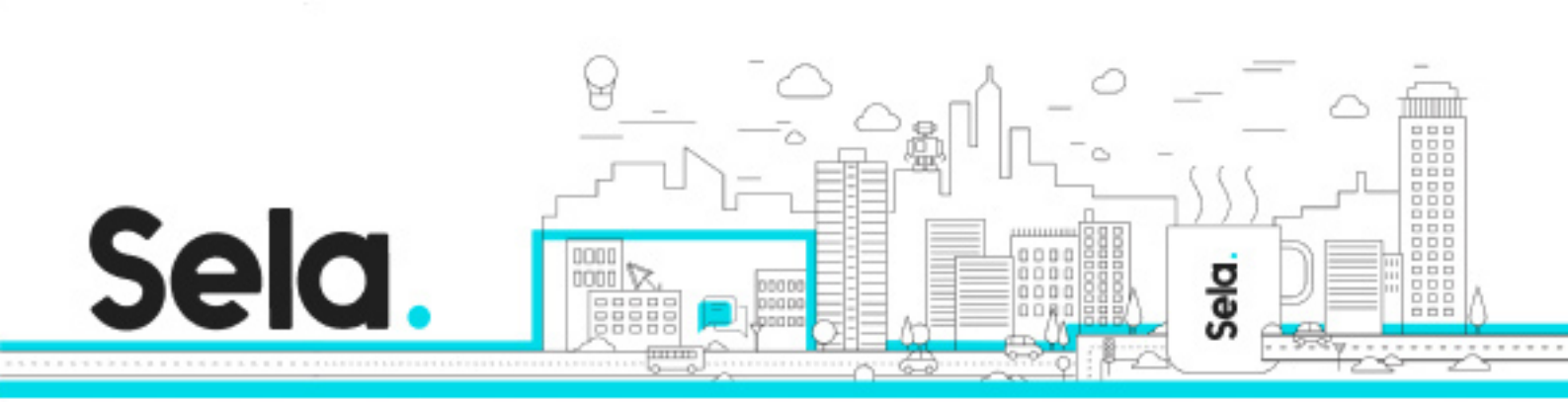
## Topics:

### Module 1: Introduction to the .NET Framework

- Introduction to the .NET Framework
- Common Language Runtime Components – Garbage collector (GC), Common Type System (CTS), Just-in-Time compiler (JIT)
- An Overview of Managed Languages
- Microsoft Intermediate Language (IL)
- Native Image Generator (NGEN)
- An Overview of the Framework Class Library (FCL)
- .NET Version Evolution – from .NET 1.0 to .NET 4.5

### Module 2: Introduction to C#

- C# 5.0: Overview and Design Goals
- The Visual Studio Integrated Development Environment
- "Hello World" in C#
- Namespaces and References – Importing types, multi-targeting support, target platform
- Console Operations



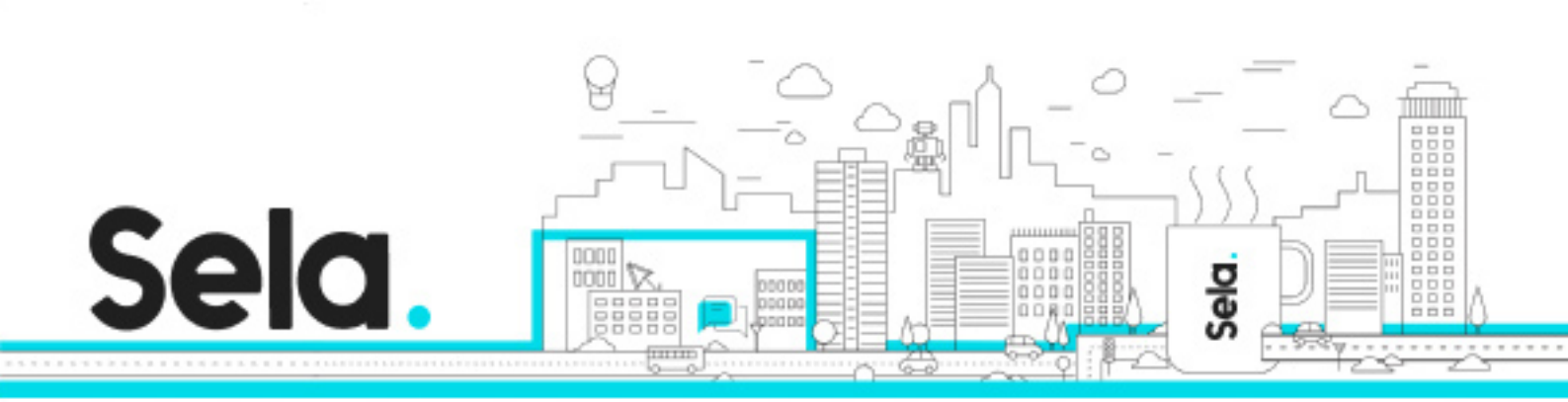

- String Formatting
- Disassembling .NET – ILDASM, .NET Reflector
- Lab 1: Basic Operations
  - º Simple console operations
  - º String output formatting

## Module 3: The .NET Type System

- The Common Type System
- The Common Language Specification
- Primitives and Built-in Types
- Value Types and Reference Types
- Boxing and Unboxing
- System.Object Class Members
- Type Conversions
- Lab 2: Reviewing Reference Types and Value Types
  - º Class exercise – comparing operations on value types and reference types
- Lab 3: Reviewing Object Equality
  - º Class exercises – comparing equality operations on value types and reference types

## Module 4: C# Classes

- Class Members
- Access Modifiers
- Nested Types
- Fields
- Constructors and Static Constructors
- Constants and Readonly Fields
- Properties and Automatic Properties
- Object Initializer Syntax




- Methods and Static Methods
- Optional and Named Parameters
- Static Classes
- Extension Methods
- Partial Types and Partial Methods
- The new Operator
- Parameter Modifiers
- Variable Parameter Lists
- The Entry Point and its Parameters
- Destructors
- Lab 4: Basic Class
    - º Rectangle class – methods, static methods, fields, properties
    - º Linked list, partial methods and extension methods
    - º Using optional and named parameters in a Microsoft Word interop scenario

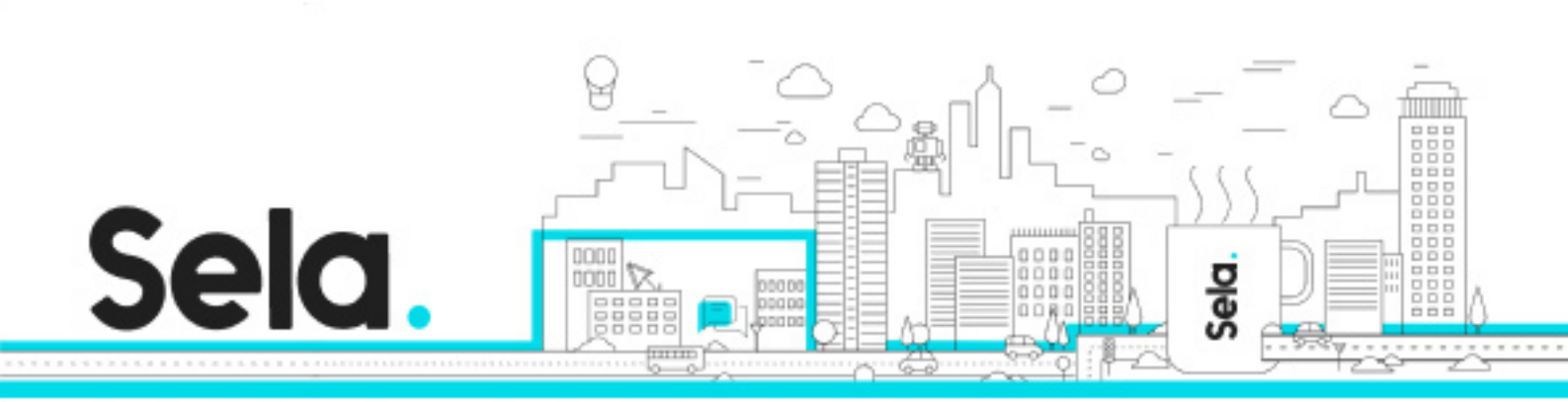
## Module 5: Garbage Collection

- Destructor and Finalization
- Tracing Garbage Collection
- Interacting with the Garbage Collector
- Generations
- Weak References

## Module 6: XML Documentation

- XML Overview
- XML Documentation in Comments
- Auxiliary Tools – Sandcastle, DocumentX!

## Module 7: Arrays and Strings




- Array Definition and Usage – Multi-dimensional, jagged, System.Array
- Casting and Enumerating Arrays
- String Class Members
- String Immutability
- StringBuilder
- String Literals
- Lab 5: Name Processing
    - Reading, sorting and writing strings and files

## Module 8: Object Oriented Programming in C#

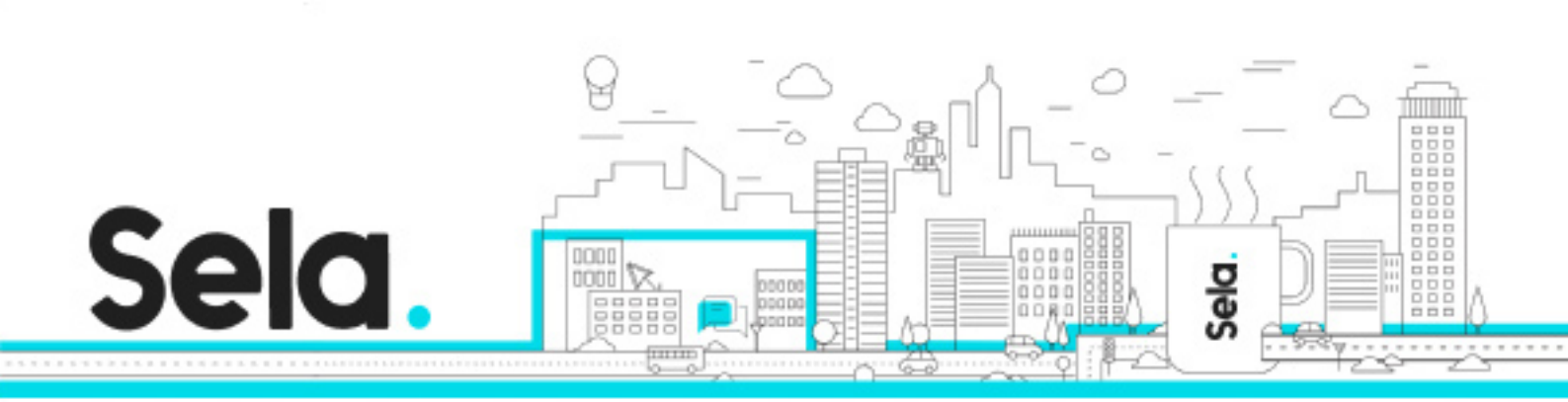
- Inheritance and Polymorphism
- Up Casts and Down Casts
- Inheritance and Overriding Subtleties
- Lab 6: Shapes
    - Shape inheritance hierarchy
    - Extending the hierarchy – a compound shape (Composite design pattern)

## Module 9: Structures and Enumerations

- User-Defined Value Types
- Field Initialization
- Nullable Types
- Enumerations and Flags

## Module 10: Indexers

- Indexers
- Consuming Indexers from Other .NET Languages
- Lab 7: Receptionist Scheduling




- Indexer access to classes
- Multi-parameter indexers

## Module 11: Exception Handling

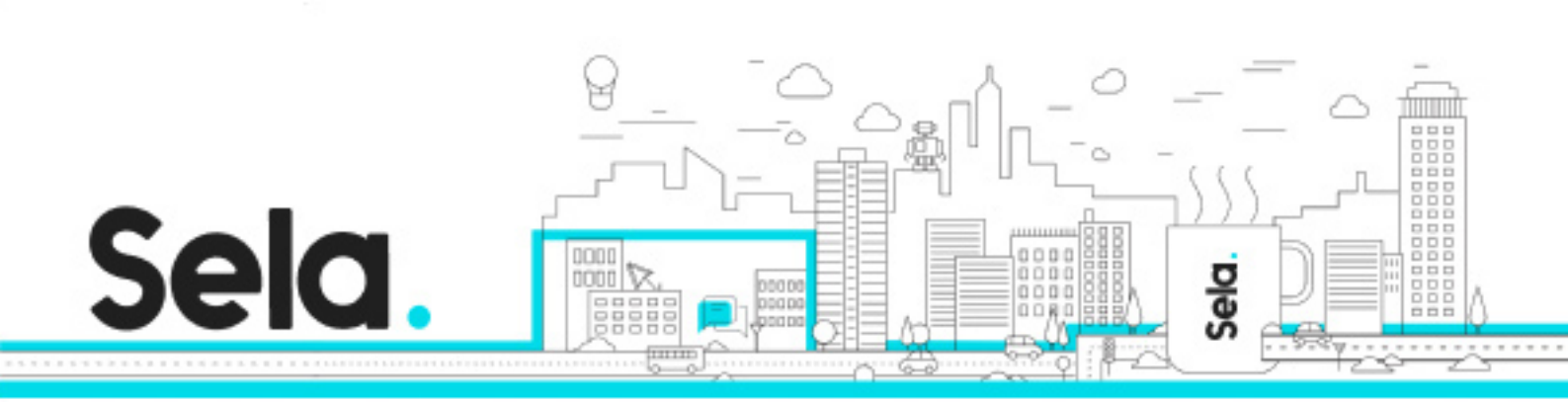
- Error Reporting Alternatives
- Throwing and Catching Exceptions
- Exception Types and Objects
- Inner Exceptions
- User-Defined Exceptions
- Resource Management
- Checked and Unchecked Arithmetic
- Exception Design Guidelines and Performance
- Lab 8: Incorporating Exception Handling
  - Adding exception handling to Lab 4

## Module 12: Interfaces

- Interface Declaration and Implementation
- Explicit Interface Implementation
- System Interfaces
- Extending Interfaces using Extension Methods
- Lab 9: Enumeration Capabilities
  - Providing enumeration via foreach to the class from Lab 7
  - Providing find (with a comparer) capabilities to the class from Lab 4

## Module 13: Operator Overloading

- Overloading Operators
- Operator Names in the CLS




- User-Defined Conversions – Implicit and explicit, sequence of conversions

## Module 14: Delegates and Events

- Delegate Definition and Usage
- Delegate Implementation
- Multi-cast Delegates
- Anonymous Methods
- Lambda Functions
- Events
- Event Design Patterns
- Lab 10: Sorting with Delegates
    - º Sort criteria implementation using delegates
- Lab 11: Event-Based Chat System
    - º Client and server event-based chat

## Module 15: Preprocessor Directives

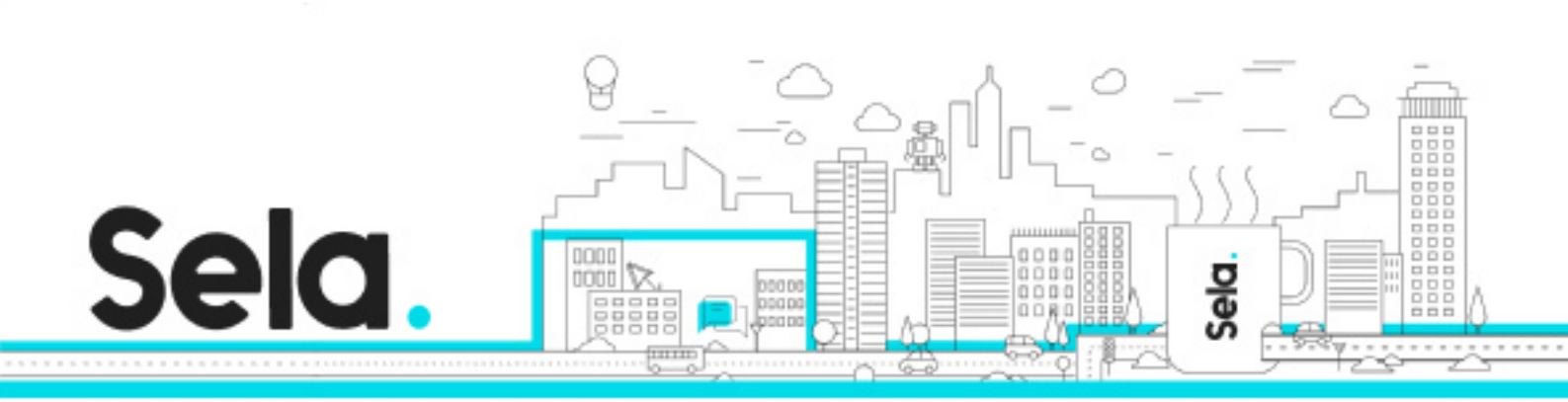
- Preprocessing Directives
- Defining and Undefining Preprocessor Directives

## Module 16: Improved C++

- Control Flow Statements
- Switch Blocks

## Module 17: Metadata and Reflection

- Metadata Tables
- Reflection Types




- System.Activator
- Lab 12: Self-Registration with Interfaces
    - Self-registered singleton repository using a marker interface

## Module 18: Attributes

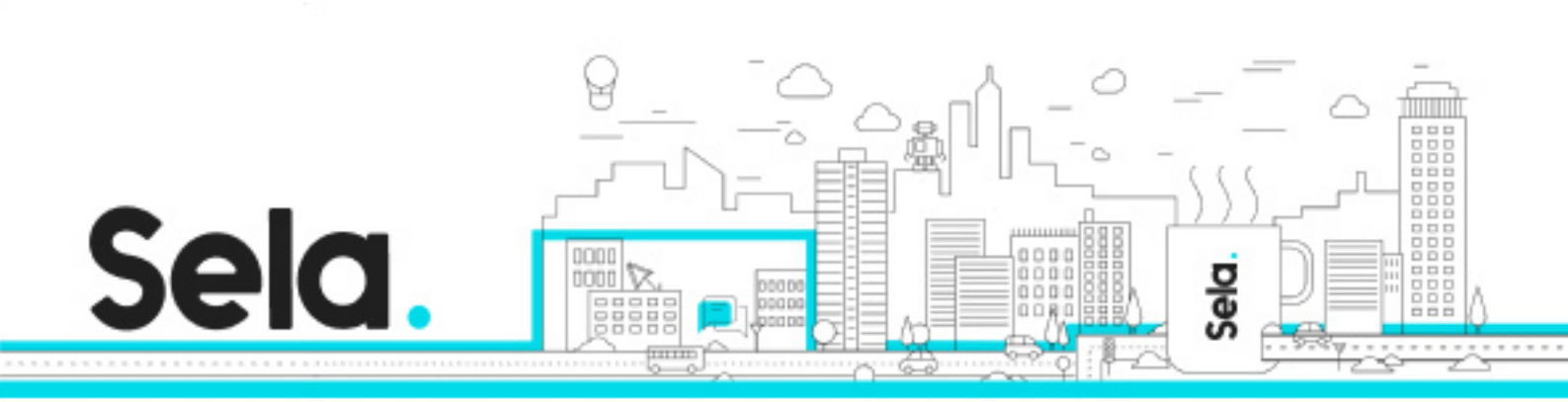
- Attribute Class
- Attribute Examples
- Applying Attributes
- User-Defined Attributes and Attribute Usage
- Querying Attributes with Reflection
- Lab 13: Logging with Attributes
    - Primitive object serialization for logging purposes
- Lab 14: Self-Registration with Attributes
    - Self-registration (see Lab 12) with attributes instead of a marker interface

## Module 19: Generics

- Motivation for Generics
- Generic Constraints
- Generic Interfaces, Methods and Delegates
- .NET Generics vs. C++ Templates
- Generics and Reflection

## Module 20: Generic Collections

- Built-in Generic Collections
- Generic System Interfaces
- Collection Initializers
- Lab 15: Implementing a Generic Collection




- Implementing IList<T> on the collection from Lab 4

## Module 21: Deployment, Versioning and Configuration

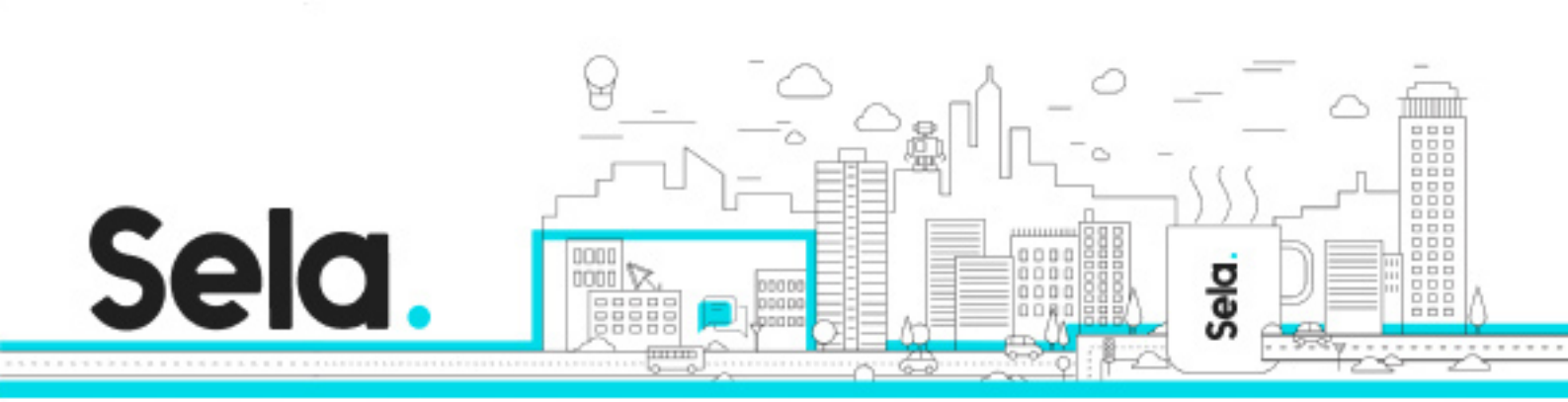
- Deployment and Versioning of .NET Assemblies
- Private and Shared Assemblies – The Global Assembly Cache (GAC)
- Application Configuration Files
- Versioning Policies
- Friend Assemblies
- Multi-Module Assemblies
- Lab 16: Creating and Registering Assemblies
  - Creating a privately deployed assembly
  - Using probing configuration to access an assembly at a sub-directory
  - Registering a shared assembly in the GAC
  - Controlling versioning (binding) policy using application configuration

## Module 22: Unsafe Code and Interoperability

- .NET Interoperability Options
- Introduction to Platform Invoke (P/Invoke)
- Unsafe Code – C# Pointers
- Lab 17: Calling Exported C Functions from C#
  - Calling a custom exported C function from C#
  - Calling a Win32 API (requiring a reverse P/Invoke callback)

## Module 23: Introduction to Language-Integrated Query (LINQ)

- Anonymous Types and Implicit Variables
- Expression Trees
- Query Operators and the Query Pattern




- Language-Integrated Query Keywords and Query Translation
- LINQ to Objects
- Lab 18: Using LINQ
    - º Implementing extension methods
    - º Implementing custom query operators
    - º Implementing the query pattern
    - º Writing declarative LINQ queries against object models

## Module 24: Covariance and Contravariance

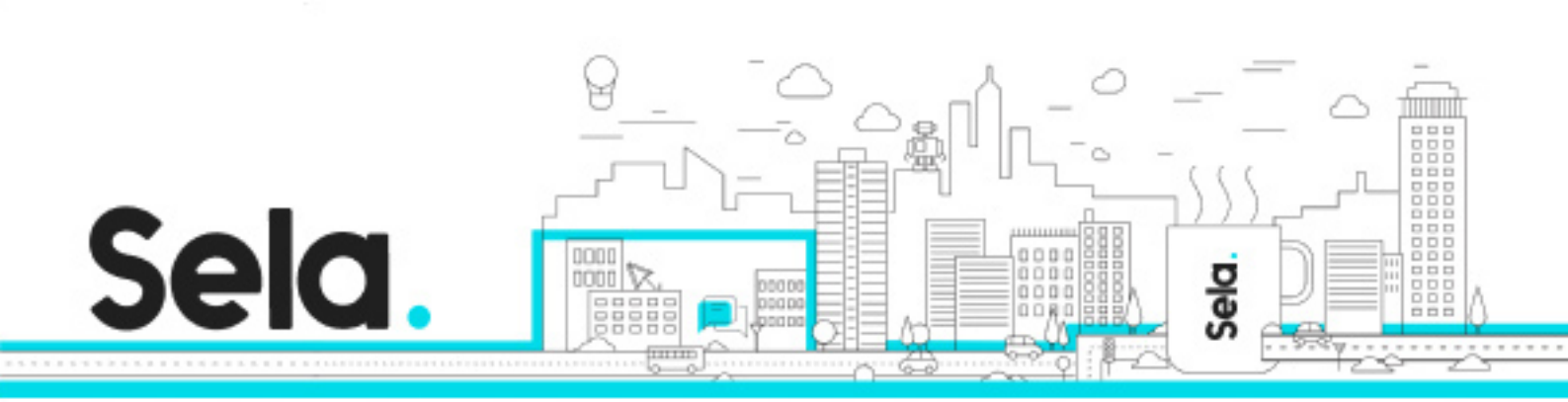
- Introduction to Covariance and Covariance
- Evolution of Covariance and Contravariance—from C# 1.0 to C# 5.0
- Covariant and Contravariant Delegates and Interfaces in C# 5.0

## Module 25: Dynamic

- Static and Dynamic Languages
- Dynamic Method Invocation
- Circumventing Generic Constraints
- Introduction to Dynamic Language Runtime
- Extending Class Definitions with DynamicObject
- Lab 19 - Dynamic
    - º Sum an array of an arbitrary type

## Module 26 - Async and Await

- History of Asynchronous Programming
- Tasks
- Tasks vs. APM
- async/await syntax




- Exceptions flow
- Limitation

## Module 27: Appendix - C#6 and C#7 Features (if time permits)

- C# 6 main features
- C# 7 main features