

Programming in C# Jump Start

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05 | Advanced C#, Part 1

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Module Overview

- Type and Value Validation
- Encryption Techniques

Type and Value Validation

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What is Data Validation?

- Data validation is testing values introduced to an app (via a service, file, or data entry) against expected values and ranges.
 - Prevent overflow
 - Prevent incorrect results
 - Prevent undesirable side-effects
 - Provide guidance to systems or users
 - Prevent security intrusions

Data Validation (023)

- The compiler validates that the object type is correct
 - It does not validate the object's value
- Debug / Trace Assert() methods alert the developer or the user
- Raise an Exception:
 - System.ArgumentException
 - System.ArgumentOutOfRangeException
 - System.ArgumentNullException

```
public override void SetName(string value)
{
    // validate empty
    if (string.IsNullOrEmpty(value))
        throw new ArgumentNullException("value");

    // validate conflict
    if (value == this.Name)
        throw new ArgumentException("value is duplicate");

    // validate size
    if (value.Length > 10)
        throw new ArgumentException("value is too long");

    this.Name = value;
}
```

```
Animal cat = new Cat();  
Animal dog = new Dog();  
  
if (cat is Dog)  
    throw new NotSupportedException("Dogs only!");  
  
if (cat == dog)  
    throw new Exception("Not the same");  
  
if (cat.Equals(dog))  
    throw new Exception("Not equal");
```


Data Contracts (023)

- “Design by Contract” from the Eiffel programming language
- Code contracts are a unified system that can replace all other approaches to data validation
- Code contracts have
 - Preconditions (Requires)
 - Post-conditions (Ensures)
- A contract assertion can be “evaluated” statically
- A contract assertion can be “enforced” at runtime

```
public string Name { get; protected set; }
public void SetName(string value)
{
    // validate input
    Contract.Requires(!string.IsNullOrEmpty(value), "value is empty");
    this.Name = value;
}

public string GetName()
{
    // validate output
    Contract.Ensures(!string.IsNullOrEmpty(Contract.Result<string>()));
    return this.Name;
}
```

What is an Unhandled Exception? (022)

- An exception thrown by your code or the runtime outside of a try block
- The runtime handles all exceptions protecting the system, not your app
 - Causes Instability
 - Causes Termination
- Try / Catch
- Try / Catch / Finally
- Try / Finally

```
try
{
    Process();
}
catch (DivideByZeroException ex)
{
    // specific exception
}
catch (Exception ex)
{
    // generic exception
}
finally
{
    // this will always occur
}
```

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Data Validation (023)

Encryption

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What is encryption? (024)

- An encryption algorithm makes data unreadable to any person or system until the associated decryption algorithm is applied.
 - Encryption does not hide data; it makes it unreadable
 - Encryption is not the same as compression
- **Types of encryption**
 - File Encryption
 - Windows Data Protection
 - Hashing, used for signing and validating
 - Symmetric and Asymmetric

Simple Encryption Methods

- **File Encryption**
 - Encrypts and decrypts files
 - Fast to encrypt/decrypt
 - Based on user credentials
- **Windows Data Protection**
 - Encrypts and decrypts byte[]
 - Fast to encrypt/decrypt
 - Based on user credentials

Hashing

- One-way encryption
- Common algorithms:
 - MD5 (generates a 16 character hash than can be stored in a Guid)
 - SHA (SHA1, SHA256, SHA384, SHA512)
- Fast (depending on chosen algorithm)
- Used for storing passwords, comparing files, data corruption/tamper checking
 - Use SHA256 or greater for passwords or other sensitive data

Symmetric Encryption

- One key is used for both encryption and decryption
- Faster than asymmetric encryption
- Cryptography namespace includes five symmetric algorithms:
 - Aes (recommended)
 - DES
 - RC2
 - Rijndael
 - TripleDES

Asymmetric (or Public Key) Encryption

- One key is used for encryption and another key for decryption
- Commonly used for digital signatures
- Cryptography namespace includes four asymmetric algorithms:
 - DSA
 - ECDiffieHellman
 - ECDSA
 - RSA (most popular)

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Encryption (024)

Module Recap

- Type and Value Validation
- Design by Contract
- Handling Exceptions
- Encryption Techniques



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