

Code responsibly with generative AI in C# (desktop applications) (CRWGAIC)

ID CRWGAIC **Prix CHF 2 250,– (Hors Taxe)** **Durée** 3 jours

A qui s'adresse cette formation

C# developers using Copilot or other GenAI tools

Pré-requis

General C# development

Objectifs

- Understanding the essentials of responsible AI
- Getting familiar with essential cyber security concepts
- Input validation approaches and principles
- Identify vulnerabilities and their consequences
- Learn the security best practices in C#
- Correctly implementing various security features
- Managing vulnerabilities in third party components
- Understanding how cryptography supports security
- Learning how to use cryptographic APIs correctly in C#
- All this put into the context of GitHub Copilot

Contenu

Day 1

Coding responsibly with GenAI

- What is responsible AI?
- What is security?
- Threat and risk
- Cyber security threat types – the CIA triad
- Consequences of insecure software
- Security and responsible AI in software development
- GenAI tools in coding: Copilot, Codeium and others
- Input validation
 - Input validation principles
 - Denylists and allowlists
 - What to validate – the attack surface
 - Where to validate – defense in depth
 - When to validate – validation vs transformations

- Injection
 - Code injection
 - OS command injection
 - Lab – Command injection
 - OS command injection best practices
 - Avoiding command injection with the right APIs
 - Lab – Command injection best practices
 - Lab – Experimenting with command injection in Copilot
 - Case study – Command injection in Ruckus
- Integer handling problems
 - Representing signed numbers
 - Integer visualization
 - Integer overflow
 - Lab – Integer overflow
 - Signed / unsigned confusion
 - Case study – The Stockholm Stock Exchange
 - Lab – Signed / unsigned confusion
 - Lab – Experimenting with signed / unsigned confusion in Copilot
 - Integer truncation
 - Best practices
 - Upcasting
 - Precondition testing
 - Postcondition testing
 - Integer handling in C#
 - Lab – Checked arithmetics
 - Lab – Experimenting with integer overflow in Copilot
- Files and streams
 - Path traversal
 - Lab – Path traversal
 - Additional challenges in Windows
 - Case study – File spoofing in WinRAR
 - Path traversal best practices
 - Lab – Path canonicalization
 - Lab – Experimenting with path traversal in Copilot

Day 2

Input validation

- Unsafe reflection
 - Reflection without validation
 - Lab – Unsafe reflection
 - Lab – Experimenting with unsafe reflection in

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Copilot

- Unsafe native code
 - Native code dependence
 - Lab – Unsafe native code
 - Best practices for dealing with native code
- Security features
 - Authentication
 - Authentication basics
 - Multi-factor authentication (MFA)
 - Case study – The InfinityGauntlet attack
 - Time-based One Time Passwords (TOTP)
 - Password management
 - Inbound password management
 - Storing account passwords
 - Password in transit
 - Lab – Is just hashing passwords enough?
 - Dictionary attacks and brute forcing
 - Salting
 - Adaptive hash functions for password storage
 - Lab – Using adaptive hash functions in C#
 - Lab – Using adaptive hash functions in Copilot
 - Case study – Veeam missing authentication and cleartext password storage
 - Password policy
 - NIST authenticator requirements for memorized secrets
 - Password database migration
 - Hard coded passwords
 - Best practices
 - Lab – Hardcoded password
 - Protecting sensitive information in memory
 - Challenges in protecting memory
 - Case study – Microsoft secret key theft via dump files
 - Storing sensitive data in memory
 - Case study – KeePass password leakage via strings
 - Information exposure
 - Exposure through extracted data and aggregation
 - Case study – Strava data exposure
 - Platform security
 - .NET platform security
 - Protecting .NET code and applications
 - Code signing
 - Denial of service
 - Flooding
 - Resource exhaustion
 - Algorithmic complexity issues
 - Regular expression denial of service (ReDoS)
 - Lab – ReDoS

- Lab – Experimenting with ReDoS in Copilot
- Dealing with ReDoS
- Using vulnerable components
 - Case study – The Polyfill.io supply chain attack
 - Vulnerability management
 - Lab – Finding vulnerabilities in third-party components
- Security of AI generated code
 - Practical attacks against code generation tools
 - Dependency hallucination via generative AI
 - Case study – A history of GitHub Copilot weaknesses (up to mid 2024)

Day 3

Cryptography for developers

- Cryptography basics
- Crypto APIs in C#
- Elementary algorithms
- Hashing
 - Hashing basics
 - Hashing in C#
 - Lab – Hashing in C# (exploring with Copilot)
- Random number generation
 - Pseudo random number generators (PRNGs)
 - Cryptographically secure PRNGs
 - Weak and strong PRNGs
 - Using random numbers in C#
 - Lab – Using random numbers in C# (exploring with Copilot)
 - Case study – Equifax credit account freeze
- Confidentiality protection
 - Symmetric encryption
 - Block ciphers
 - Modes of operation
 - Modes of operation and IV – best practices
 - Symmetric encryption in C#
 - Symmetric encryption in C# with streams
 - Lab – Symmetric encryption in C# (exploring with Copilot)
 - Case study – Padding oracle used in RCE against Citrix ShareFile
 - Asymmetric encryption
 - The RSA algorithm
 - RSA in C#
 - Combining symmetric and asymmetric algorithms
 - Key exchange and agreement
 - Key exchange

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- Diffie-Hellman key agreement algorithm
- Key exchange pitfalls and best practices
- Integrity protection
 - Message Authentication Code (MAC)
 - Calculating HMAC in C#
 - Lab – Calculating MAC in C#
 - Digital signature
 - Digital signature with RSA
 - Elliptic Curve Cryptography
 - ECC basics
 - Digital signature with ECC
 - Digital signature in C#
 - Lab – Digital signature with ECDSA in C#
- Common software security weaknesses
 - Code quality
 - Code quality and security
 - Data handling
 - Initialization and cleanup
 - Class initialization cycles
 - Lab – Initialization cycles (exploring with Copilot)
 - Object oriented programming pitfalls
 - Inheritance and overriding
 - Mutability
 - Lab – Mutable object (exploring with Copilot)
 - Serialization
 - Serialization and deserialization challenges
 - Integrity – deserializing untrusted streams
 - Integrity – deserialization best practices
 - Look ahead deserialization
 - Property Oriented Programming (POP)
 - Creating a POP payload
 - Lab – Creating a POP payload
 - Lab – Using the POP payload
 - Case study – Deserialization RCE in Veeam
- Wrap up
 - Secure coding principles
 - Principles of robust programming by Matt Bishop
 - Secure design principles of Saltzer and Schroeder
 - And now what?
 - Software security sources and further reading
 - .NET and C# resources

Centres de formation dans le monde entier



Fast Lane Institute for Knowledge Transfer (Switzerland) AG

Husacherstrasse 3
CH-8304 Wallisellen
Tel. +41 44 832 50 80

info@flane.ch, <https://www.flane.ch>