

Training: Capstone Courseware  
106 Advanced Java Programming

FORM OF TRAINING	MATERIALS	PRICE	DURATION
Traditional	Hardcopy	1150 EUR	5 days
Traditional	CTAB Tablet	1250 EUR	5 days
Distance learning	Hardcopy	1150 EUR	5 days
Distance learning	CTAB Tablet	1150 EUR	5 days

## LOCATIONS

Krakow - 5 Tatarska Street, II floor, hours: 9:00 am - 4:00 pm

Warsaw - 17 Bielska Street, hours: 9:00 am - 4:00 pm

## TRAINING GOALS:

Version 8.0

This course provides advanced training in developing software using the **Java Platform, Standard Edition**, or **Java SE**. It is intended for students with solid experience in structured and object-oriented Java programming, including use of the Collections API and exception handling. Generic types should be understood, at least at a basic level; the course does begin with a refresher and then a more advanced treatment of generic types.

After a quick introduction to the Java Time API, students get familiar with the I/O streams model, file handling, and object serialization, and learn to use streams to communicate over network sockets. A two-chapter unit covers multi-threaded programming and concurrency techniques. We look at dynamic typing in Java, in the Reflection API and with dynamic proxies, and understand the underpinnings of source-code annotations.

Finally, several chapters at the end of the course introduce unit-testing and test-driven-development practices. Here for the first time we introduce external libraries -- **JUnit**, and the **Mockito** dynamic-mocking library -- and the study is not entirely about technology but leans more into design and good practice.

## Learning Objectives

- Make effective use of Java generic types.
- Understand the structure of streams in Java, and learn how to use streams to manage file I/O.
- Learn how to use Java Serialization to internalize and externalize potentially complex graphs of objects.
- Communicate between processes using network sockets.

- Write multi-threaded Java applications that safely manage concurrent access to application state.
- Use the Reflection API and dynamic proxies for highly generic tasks, discovery, or code-generation.
- Use standard annotations and develop custom annotations to express meta-data in Java source files.
- Build unit tests for Java classes using JUnit.
- Write effective tests, and design classes for testability.
- Understand test-driven development (TDD) and use dynamic mocking to support isolated testing.

## CONSPECT:

- Generics
  - Using Generics
  - Type Erasure
  - Type Boundaries
  - Wildcards
  - Generic Methods
  - Strengths and Weaknesses of Generics
  - Legacy Code and Generics
- The Time API
  - A History of Time ... in Java
  - Limitations of Date and Calendar
  - The Time API
  - Temporal Types
  - Accessors and Adjusters
  - Formatting
  - Decomposition Into Fields
  - Date Arithmetic
  - Managing Precision
  - Duration and Period
  - Time Zones and Offsets
  - Converting Between Time Zones
- The Java Streams Model
  - Delegation-Based Stream Model
  - InputStream and OutputStream

- Media-Based Streams
- Filtering Streams
- Readers and Writers
- Byte-Array Streams
- String Readers and Writers
- Closing Streams, Readers and Writers
- Working with Files
  - The File Class
  - Modeling Files and Directories
  - File Streams
  - Working with File Systems
  - The Path Interface
  - The Paths and Files Utilities
  - Processing with `java.util.stream.Streams`
- Delegating Streams
  - Buffering
  - Data Streams
  - Push-Back Parsing
  - Byte-Array Streams and String Readers and Writers
- Java Serialization
  - The Challenge of Object Serialization
  - Serialization API
  - Serializable Interface
  - `ObjectInputStream` and `ObjectOutputStream`
  - The Serialization Engine
  - Transient Fields
  - `readObject` and `writeObject`
  - Externalizable Interface
- Sockets
  - The OSI Reference Model
  - Network Protocols
  - The Socket Class
  - The `ServerSocket` Class
  - Connecting Through URL Objects
  - HTTP and Other TCP Servers
  - Datagram Clients and Servers

- Non-Blocking Sockets
- Threads
  - Java Thread Model
  - Creating and Running Threads
  - Manipulating Thread State
  - Thread Synchronization
  - Synchronized Blocks and Methods
  - wait and notify
  - join and sleep
  - Multi-Threading in Servers
- Concurrency
  - The Concurrency API
  - Semaphore and Other Synchronizers
  - Concurrent Collections
  - Atomic Operations
  - Executor and ExecutorService
  - Thread Pools
  - Parallel Processing
- Reflection
  - Uses for Meta-Data
  - The Reflection API
  - The ClassClass
  - The java.lang.reflect Package
  - Reading Type Information
  - Navigating Inheritance Trees
  - Dynamic Instantiation
  - Dynamic Invocation
  - Reflecting on Generics
- Dynamic Proxies
  - The Proxy Pattern
  - Dynamic Proxies in Java
  - Use Cases
  - The InvocationHandler Interface
  - Proxy Classes
- Annotations
  - Aspect-Oriented Programming and Java

- The Annotations Model
- Annotation Types and Annotations
- Built-In Annotations
- Annotations vs. Descriptors (XML)
- Automated Unit Testing with JUnit
  - Automated Testing
  - JUnit and Related Tools
  - The @Test Annotation
  - The Assert Class Utility
  - Test Runners
  - Lifecycle Methods
  - Expecting Exceptions
  - Test Suites
- Writing Tests
  - Test Granularity
  - Reusing Test Logic
  - Recording and Comparing Output
  - Test Isolation
  - Controlling the Test Environment
  - Managing Dependencies
  - Non-Invasive Testing
  - Designing for Testability
  - Factories
  - Testing and Threads
- Test-Driven Development
  - Writing the Test First
  - The TDD Cycle
  - Advantages of TDD
  - Resistance to TDD
  - A Case Study
- Mocking
  - Mock Objects in Testing
  - Mock Objects in Test-Driven Development
  - Static vs. Dynamic Mocks
  - Stubbing
  - Verifying

- Matching and Capturing
- Using a Spy
- Partial Mocking

## REQUIREMENTS:

Solid **Java programming** experience is essential -- especially object-oriented use of the language. Language features and techniques that are integral to some lab exercises include interfaces and abstract classes, threading, generics and collections, and recursive methods. Course 103, "[Java Programming](#)," is excellent preparation.

## Difficulty level



## CERTIFICATE:

The participants will obtain certificates signed by Capstone Courseware.

## TRAINER:

Authorized Capstone Courseware Trainer.