Introduction to Java Programming

Course Number: Java Programming

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Course Objectives

This course will benefit the students who are looking for ways to quickly build robust, cross-platform applications are increasingly turning to Java programming. Java's unique architecture permits programmers to develop a single application that can run across multiple platforms seamlessly and reliably. This course provides extensive experience with Java and its object-oriented features. The students will be able to use Java 2 to create both applications and Applets, including intuitive GUIs.

The students will learn how to

- Write, compile and execute Java programs using Java 2
- Build robust applications using Java's object-oriented features
- Create applications and Applets using Java class libraries
- Develop platform-independent GUIs
- Read and write data using Java streams
- Solve browser compatibility problems with Java Plug-In

Books/Resources:

Required and provided: Just Java 2, by Peter van der Linden
ISBN 0130320722

Course Requirements

Attendance and participation in class sessions - whether face-to-face or virtual - is mandatory, including participation in peer reviews of on-going work, as discussions and shared experience are important parts of the course.

Class Activities

This course will utilize a combination of lectures, media, demonstrations, hands-on experience, and homework assignments.

Assessment

Because of the nature of the course offering, this course will not be graded on a pass or fail standard. Certification will be based on completion.

Course Schedule

The course will be 15 days for 43 hours.

Course Topics and Schedule

(Subject to change)

Class 1 – Thursday, March 14, 2002 6:30PM - 9:30PM

Lecture Topics - Java Language intro and overview

- Language features
- The Java programming model
  - Reusing existing classes
  - Extending existing classes

- The Java runtime model
  - VM concepts
  - Garbage collection
  - Bytecode
  - Interpreters
  - Compilers
  - JIT/Hotspot

- History & Evolution of the language

- Java Tools
  - JDK Tools
  - IDEs

Materials:
Resource list
Syllabus
OO Concepts worksheet

Assignment:
Complete OO Worksheet
Enter, build & run "HelloGalaxy" application

Class 2 – Tuesday, March 19, 2002 6:30PM - 9:30PM

Lecture Topics – Java Application Architecture

- Language module elements
  - Structure of a class
  - Source files
  - Members
  - Local variables
  - Formal arguments/Parameters
  - Return values
  - Exceptions

- Packages

    - The motivation for packages
    - Type and member visibility levels

- Architecture of an application
    - "Main" classes
    - Main methods

- Architecture of an Applet
    - Lifecycle of an Applet
    - Callback methods

- Introduction to the UML
    - History and purpose of the UML
    - Data definition/ER diagrams
    - Flowcharts
    - Static modeling in detail

Materials:
UML "Cheat Sheet"
HelloGalaxy application class diagram
Package hierarchy diagram

Assignment:
Code & build HelloGalaxy classes from diagram.

Class 3 – Thursday, March 21, 2002 6:30PM - 9:30PM

Lecture Topics – Java programming constructs

- Procedural constructs
    - Sequence
    - Selection
    - Iteration

- Methods as procedures
- Methods as functions

Assignment:
Code and run “Repeater.java”
Code and run Fibonacci sequence generator

Class 4 – Thursday, March 28, 2002 6:30PM - 9:30PM

Lecture Topics – – the Object Oriented paradigm in Java

- OO Concepts and advantages
    - Encapsulation
    - Inheritance

    - Polymorphism
    - Composition

- Implementation of OO concepts
    - Parallel implementations in procedural languages
    - Java support

- Multiple Inheritance
    - Classic example of the need (HouseBoat)
    - Why Java does not include this feature
    - How Java (and proper design) responds to the need for MI

- Related concepts
    - Overloading

Class 5 – Thursday, April 4, 2002 6:30PM - 9:30PM

Lecture Topics – – Exceptions & Event Handling

- Flow of control into and from a method as part of an expression evaluation
    - Returning from a method
    - Exceptions thrown
    - Try/catch/finally

- Return values

- Throwing Exceptions
    - The throw statement
    - The throws keyword

- The Exception class hierarchy
    - Exception
    - Throwable
    - Checked and Unchecked exceptions

Class 6 – Tuesday, April 9, 2002 6:30PM - 9:30PM

Lecture Topics – – GUI concepts

- The Swing Component hierarchy
    - Swing components relationship to AWT components
    - Controls vs. Containers

- Commands
    - The Menu bar
    - Menus
    - Menu items
    - Command keys/Accelerators

- GUI Component state management
    - The need for state management
        - Maintaining a consistent interface
        - Restricting user actions
    - Examples
    - Techniques

- Event processing
    - Asynchronous versus synchronous flow of control
    - The Java 2 Event model
    - The GUI event thread

- The MVC paradigm
    - Division of responsibility
    - Motivations

Materials:
Class diagram of the Swing component hierarchy

Assignment:
Code shell .java files for SocialOrder application
Build SocialOrder application shell

Class 7 – Thursday, April 11, 2002 6:30PM - 9:30PM

Lecture Topics – – SocialOrder application overview and creating GUIs in Java applications

- Geometry management
    - Panels
    - Layout Managers
    - Scrolling
    - Resizing

- Building a display
    - Nesting components

- Menus

- Our client application: "SocialOrder"
    - Review Application Requirements
    - Describe application class hierarchy in UML

- Assignment of roles in our application class hierarchy

Materials:
Screen mockup of SocialOrder application
Class diagram of SocialOrder application (w/o packages)

Assignment:
Build Windowed SocialOrder application
Add confirmation dialog to SocialOrder application
Add Menus to SocialOrder application

Class 8 – Tuesday, April 16, 2002 6:30PM - 9:30PM

Lecture Topics – – File IO in Java

- Types of IO
  - Directories vs. Files vs. Sockets
  - Input vs. Output
  - Buffered vs. Direct
  - Text vs. Binary

- Composition versus inheritance in the java.io package
  - Avoiding a subclass explosion

- The java.io class hierarchy

Materials:
Class diagram of the java.io classes used in text file I/O

Assignment:
Adding save and load to the SocialOrder application

Class 9 – Thursday, April 18, 2002 6:30PM - 9:30PM

Lecture Topics – – Relational database access - JDBC

- Elements of database access using JDBC
  - Statement
  - ResultSet
  - Connection

- JDBC Drivers
  - Fat drivers
  - Thin drivers

- The java.sql package

Materials:
Class diagram of java.sql classes

Assignment:
Adding JDBC access to the SocialOrder application

Class 10 – Tuesday, April 23, 2002 6:30PM - 8:30PM

Lecture Topics – – Application review (short)

- Review of application structure and functionality
- Catch-up session for file and JDBC classes

Class 11 – Thursday, April 25, 2002 6:30PM - 8:30PM

Lecture Topics – – Deploying Java applications (short)

- VM Startup
  - The ClassLoader
- The CLASSPATH
  - Class directories
  - Archive files
- Executable jar files

Assignment:
Build an executable .jar file for our SocialOrder application

Class 12 – Tuesday, April 30, 2002 6:30PM - 9:30PM

Lecture Topics – – Threading in Java applications

- Use and abuse of threads
  - Race conditions
  - Deadlocks
- Java support for threads
  - Runnable
  - Thread
  - ThreadGroup
- Java facilities for managing concurrency
  - Synchronized methods
  - Synchronized blocks
  - Lock objects
- Unexpected dangers of multithreaded threaded applications
  - Non-atomic values
  - Non-atomic operations
- Techniques of multithreaded applications
  - Thread pools

    - Anonymous inner class threads
    - Active objects

Materials:
Class diagram of multithreaded application

Assignment:
Code multithreaded application with inter-thread checkpoints

Class 13 – Tuesday, May 2, 2002 6:30PM - 9:30PM

Lecture Topics – – Networking in Java

- History of IPC
    - Files
    - Cross memory services
    - Sockets
    - RPC
    - CORBA

- Java sockets
    - Client sockets
    - Server sockets

- RMI
    - Stubs
    - Skeletons

- Common RMI Techniques
    - Proxies
    - Value Objects

- N-Tiered application architecture

Materials:
Class diagram of an (RMI) distributed application

Class 14 – Tuesday, May 7, 2002 6:30PM - 9:30PM

Lecture Topics – – Applets and browsers

- Structure of an Applet
    - HTML
    - Codebase
    - Applet tag

- Applet callbacks

- Applet security
    - Applet security restrictions
    - The Java security model
    - Signed applets

- The java.applet package

- Java plug-ins

- Compatibility issues between browsers

Assignment:
Code Refresher applet

Class 15 – Thursday, May 9, 2002 6:30PM - 9:30PM

Lecture Topics – – Java in the Database

- Architecture of an n-tiered application vs. database resident code
    - Considerations and tradeoffs

- Coding stored procedures in Java for DB2

- Executing stored procedures from Java clients