INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Object Oriented Programming			Field of study	Computer Science								
Bachelor in	Management Informatics			School	School of Technology and Management								
Academic Year	2023/2024	Year of study	1	Level	1-1	ECTS credits	6.0						
Type	Semestral	Semester	2	Code	9186-709-1204-00-23								
Workload (hours)	162	Contact hours	T -	TP 60	PL -	TC -	S -	E -	OT -	O -			

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s): Luís Manuel Alves, Maria João Tinoco Varanda Pereira

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Identify the guiding principles of object-oriented programming;
2. Modeling the solution of a problem by constructing UML class and communication diagrams;
3. Define classes, objects, interfaces, attributes and methods using Java language, identifying and defining the needed constructors to the correct instance initialization;
4. Understand and implement the cloning and comparison of Java objects;
5. Distinguish aggregation and simple associations and accomplish their implementation conveniently;
6. Identify and implement inheritance between classes and establish class hierarchies;
7. Understand and implement the concept of polymorphism;
8. Understand the concept of interface and abstract class as a mean to impose operations in the derived classes.

Prerequisites

Before the course unit the learner is expected to be able to:
1. Be able to make logical reasoning to solve problems;
2. Create programs using the procedural paradigm.

Course contents

Object Oriented Programming definition. Principles of Object Oriented Programming. Concepts of Object Oriented Modeling. Class Definition in Java. Cloning and Comparison of Java Objects. Class Hierarchy and Inheritance. Abstract Classes and Polymorphism. Java Collections Framework (JCF).

Course contents (extended version)

1. Object Oriented Programming definition:
   - Motivation;
   - Basic concepts.
2. Principles of Object Oriented Programming:
   - Encapsulation;
   - Inheritance;
   - Polymorphism.
3. Concepts of object oriented modeling:
   - UML class diagrams;
   - UML communication diagrams;
   - Associations between classes: simple, aggregation and composition;
   - Inheritance: overriding and adding new features, abstract classes, multiple inheritance.
4. Class definition in Java:
   - Class definition;
   - Class creation;
   - Simple classes, objects and behavior;
   - Class methods and variables;
   - Non-instantiable classes;
   - Wrapper classes.
5. Cloning and comparing Java objects:
   - Composition in the definition of classes;
   - The methods get (), set () and encapsulation;
   - Encapsulation and clone;
   - The toString(), equals() and clone() methods;
6. Class Hierarchy and Inheritance:
   - Class hierarchy;
   - Inheritance mechanisms;
   - Class creation via inheritance;
   - Compatibility between classes and subclasses;
   - Generic programming via polymorphism;
   - Implementation of inheritance and polymorphism.
7. Abstract classes and polymorphism:
   - Introduction to abstract classes;
   - Use of abstract classes;
   - Abstract classes and instance variables;
8. Java Collections Framework (JCF):
   - Generic types;
   - Iterable and Iterator interfaces;
   - The classes and interfaces architecture of JCF;
   - List, Set, Map and Queue interfaces;
   - The ordination of the JCF concrete collections;
   - Comparable and Comparator interfaces.

Recommended reading

1. F. Mário Martins, “Java 8 – Poo + Construções Funcionais”, Tecnologias de Informação, FCA, 2017.
2. Pedro Coelho, “Programação em Java”, Curso Completo, FCA, 2016.
3. J. L. M. Borges, J. F. Cunha e T. G. Dia, "Modelação de Dados em UML - Uma abordagem por problemas", FCA, 2015
4. Herbert Schildt, “Java the Complete Reference”, 11th Ed. , McGraw-Hill Education, 2019.
5. Paul Deitel, Harvey Deitel, “Java How to Program, Late Objects”, 11th Edition, Pearson, 2020.

Teaching and learning methods

Lecture classes of theoretical concepts followed by practical discussion of model examples. Concept application through small problem solving. Practical experience is developed with the resolution of a larger problem. Execution of a final project assignment.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
   - Intermediate Written Test - 25%
   - Practical Work - 25%
   - Final Written Exam - 50% (Component with a minimum grade of 7 out of 20.)
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 100% (Includes supplementary exercises designed to replace the Intermediate Test and Practical Work.)

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Luís Manuel Alves, Maria João Tinoco Varanda Pereira	Tiago Miguel Ferreira Guimaraes Pedrosa	José Carlos Rufino Amaro	Nuno Adriano Baptista Ribeiro
29-02-2024	14-03-2024	16-03-2024	17-04-2024