

Module description: Scientific Programming		
Module Code	w.BA.XX.3SP-WIN.XX	
ECTS Credits	3	
Language of Instruction/Examination	English	
Module Description	This module teaches the fundamentals of scientific programming. The focus is on scientific programming for data science applications. The programming language is Python. Python as an object-oriented programming language has caught up with other programming languages in terms of popularity and distribution in recent years and is thus becoming increasingly important. Students learn the most important programming paradigms. Due to the application-oriented nature of the module, students acquire the necessary knowledge that allows them to apply Python in practice.	
Organizational Unit	Institut für Wirtschaftsinformatik	
Module Coordinator	Mario Gellrich	
Deputy Module Coordinator	Elena Gavagnin	
Program and Specialization	<ul style="list-style-type: none"> • Business Information Technology - Specialization in Data Science 	
Legal Framework	Academic Regulations BSc dated 29.01.2009, for the degree programs in Business Administration, International Management, Business Information Technology, Business Law, Business Law and Applied Law, first adopted on 12.05.2009	
Module Category	Module Type Compulsory	Program Phase Main Study Period
Prerequisite Knowledge	<ul style="list-style-type: none"> • Knowledge of statistics • Basic knowledge of the Python programming language (syntax, data types, operators) • Basic knowledge of SQL 	
Contribution to Program Learning Objectives (by the concerned Module)	<ul style="list-style-type: none"> • Professional Competence • Methodological Competence • Social Competence • Self-Competence 	
Contribution to Program Learning Objectives	<p>Professional Competence</p> <ul style="list-style-type: none"> • Knowing and Understanding Content of Theoretical and Practical Relevance • Apply, Analyze, and Synthesize Content of Theoretical and Practical Relevance • Evaluate Content of Theoretical and Practical Relevance <p>Methodological Competence</p> <ul style="list-style-type: none"> • Problem-Solving & Critical Thinking • Scientific Methodology • Work Methods, Techniques, and Procedures • Information Literacy • Creativity & Innovation <p>Social Competence</p> <ul style="list-style-type: none"> • Written Communication • Oral Communication • Teamwork & Conflict Management • Intercultural Insight & Ability to Change Perspective <p>Self-Competence</p> <ul style="list-style-type: none"> • Self-Management & Self-Reflection • Ethical & Social Responsibility • Learning & Change 	

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Module Learning Objectives	Students... <ul style="list-style-type: none">• know the importance of scientific programming in the data science context.• know how to work with GitHub Codespaces, Visual Studio Code, and Jupyter Notebooks.• know the basics of the Python programming language (e.g., syntax, libraries, operators, functions, methods, and classes).• are able to select and use suitable Python libraries (e.g., numpy, matplotlib, and pandas).• know data formats and data structures in Python and how to work with them.• know the most important control statements and can work with them (e.g., if, else, break, for- & while-loops, ...).• know what procedural programming and object-oriented programming is and can develop their own programs.• can program simulation models like cellular automata and agent-based models.• can program a simple AI-enhanced web application.• are able to identify and evaluate programming solutions for real-world problems in the field of data science.• are able to automate data analysis processes with foundation models.• are able to visualize data using Python libraries like matplotlib, seaborn and folium.																															
Module Content	<ul style="list-style-type: none">• Introduction to scientific programming• The Python programming language: basics & overview• Input & output, formatting of strings & dates• Data manipulation & analysis with pandas• Data visualization with Python• Automating data analysis with foundation models• Conditional statements, loops, loop control statements• Procedural programming• Object-oriented programming• Introduction to modeling & simulation• Cellular automata & agent-based modeling• Developing AI-enhanced web applications																															
Links to other modules	This module is linked to the following modules:																															
Digital Learning Resources	<ul style="list-style-type: none">• Teaching Materials• Case Studies (with Key)																															
Methods of Instruction	<ul style="list-style-type: none">• Lecture• Literature Review• Project Work• Exercises		Social Settings Used: <ul style="list-style-type: none">• Group Work• Individual Work																													
Type of Instruction	<table><tr><th></th><th>Classroom Instruction</th><th>Guided Self-Study</th><th>Autonomous Self-Study</th></tr><tr><td>Large Class</td><td>28 h</td><td>-</td><td></td></tr><tr><td>Small Class</td><td>-</td><td>28 h</td><td></td></tr><tr><td>Group Instruction</td><td>-</td><td>-</td><td></td></tr><tr><td>Practical Work</td><td>-</td><td>-</td><td></td></tr><tr><td>Seminar</td><td>-</td><td>-</td><td></td></tr><tr><td>Total</td><td>28 h</td><td>28 h</td><td>34 h</td></tr></table>					Classroom Instruction	Guided Self-Study	Autonomous Self-Study	Large Class	28 h	-		Small Class	-	28 h		Group Instruction	-	-		Practical Work	-	-		Seminar	-	-		Total	28 h	28 h	34 h
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Performance Assessment	End-of-module exam		Form	Length (min.)	Weighting
	Written exam		open book	60	70.00
	Permitted Resources		Spec. calculator acc. to leaflet "Utilities"	With dictionary	
	Others	Assessment	Format	Length (min.)	Weighting
	Project work	Grade	Gruppenarbeit	20	30.00
Classroom Attendance Requirement	None While attendance is not compulsory, it is highly recommended owing to the complexity of the subject matter.				
Compulsory Reading	<ul style="list-style-type: none">• The literature issued in class or made available on the teaching platform is compulsory reading.				
Recommended Reading	<ul style="list-style-type: none">• -				
Comments	<ul style="list-style-type: none">• Students need a laptop for this module as well as the rights to install programs on it.• Students need a GitHub account which uses their ZHAW email address.				