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Microcredential course in Mathematics and Computational Thinking with Python

Scope

Proposal to strengthen the training offer of the Tomar School of Technology (ESTT) of the Polytechnic of Tomar (IPT), through the microcredential course in Computational Thinking in Mathematics using the Python programming language, with a view to the operational application of the concepts. This course takes into account the new curriculum recommendations for mathematics in primary and secondary education, which call for the introduction of computational thinking in this subject, namely through the use of software, in particular Python programming. Thus, we propose a brief introduction to programming in Python, focused on mathematics. The contents are introduced progressively, and the problems are presented within the scope of current curricular programs, being analysed and solved using the code developed. In line with this, we submit this proposal to create an introductory course worth 1 ECTS, corresponding to a total of 27 hours (13 contact hours and 14 hours of self-directed work).

Context

In recent years, essential learning in primary and secondary education in Portugal has changed so that algorithmics and programming are now explicitly included in the mathematics curriculum. This gives students leaving compulsory education the opportunity to develop Computational Thinking and gain programming experience. Currently, Python programming language is recommended in new secondary school mathematics programmes. This language has all the key features needed to develop computational thinking, and is used by both computer scientists and non-computer scientists to solve everyday academic problems. It should be noted that this language is used by some of the calculators recommended for secondary education. Teachers must therefore develop skills in this language to facilitate its learning and use by students. This course aims to meet the growing demand for equipping educators and professionals with competencies in Computational Thinking applied to Mathematics through Python.

Target Audience

Mathematics teachers, or other professionals with mathematics knowledge at the 12th-grade level, who wish to develop skills in analysis, algorithm development, and coding in the Python programming language, applied to problem-solving within the context of mathematics learning.

Student Places

The maximum number of places is twenty (20).

Course Structure

The training will cover the following subject content:

1. Basics of Python programming

1.1.   Introduction
1.2.   Variables and basic data types
1.3.   Expressions and operators (arithmetic, logical and relational)
1.4.   Conditional and cyclic instructions
1.5.   Break, continue and pass commands
1.6.   Data collections (lists, tuples and dictionaries)

2. Functions and graphics
2.1.   General concepts
2.2.   Functions and modules
2.3.   Importing functions and modules
2.4.   Parameters
2.5.   Create graphical windows and function representations

3. Solving equations, systems of equations, and inequalities with Python

4. Trigonometry and Python

<u>Methodology</u>

This course is based on a pedagogical model designed for hybrid teaching, i.e. face-to-face with the option of live videoconference streaming. After a brief introduction to Python programming, algorithms will be developed and codes produced to solve problems related to learning mathematics. The course includes 13 hours of instructor-led sessions, followed by 14 hours of self-directed learning.

<u>Assessment Method</u>

Practical project focused on knowledge-based problem solving 100%).