Programming and Data Structures with Python 2025

Assignment 2

2 Oct 2025, due 9 Oct 2025

Polynomials

Let us consider polynomials in a single variable x with integer coefficients — for instance, $3x^4-17x^2-3x+5$. Our goal is to write a Python class to represent such polynomials.

Note that any such polynomial is a collection of pairs of the form (*coefficient*,*exponent*), where no two pairs have the same second component (exponent). For instance, the polynomial above consists of the pairs $(3,4)$, $(-17,2)$, $(-3,1)$ and $(5,0)$.

Choose a suitable representation, including one for the zero polynomial, and write a class `Polynomial` with the following features.

- The constructor should take a list of (*coefficient*,*exponent*) pairs `[(c1,e1),(c2,e2),...,(cn,en)]` and create the corresponding polynomial $c_1x^{e_1} + c_2x^{e_2} + \cdots c_nx^{e_n}$. In this list, the exponents need not be distinct. If no list is provided, create the zero polynomial.
- The class should have a function `iszero()` such that `p.iszero()` returns `True` precisely when `p` represents the zero polynomial.
- Given polynomials `p` and `q`, the expressions `p+q`, `p-q` and `p*q` should return polynomials for the sum, difference and product of `p` and `q`, respectively.
- Given polynomials `p` and `q`, the comparisons `p < q`, `p <= q`, `p > q`, `p >= q`, `p == q` and `p != q` should return sensible values. To compare polynomials, use lexicographic ordering with respect to (*exponent*,*coefficient*). In other words, first compare the highest exponent. If these are equal, compare the coefficient of the highest exponent. If these are again equal, go to the next smaller terms in each polynomial and apply the same rule.
- `print(p)` should print a sensible representation of `p` without any zero coefficients. For instance, if `p` represents $3x^4 - 17x^2 - 3x + 5$, `print(p)` could produce `3x^4 - 17x^2 - 3x + 5`.

Instructions

- Submit your solution through Moodle as a single Python notebook
- Add documentation to explain at a high level what your code is doing
- Show some sample executions
