Programming Assignment 2 (CS142)

In this assignment we will implement polynomial arithmetic. That is, given two polynomials, how do you add them, compute the product and so on. In the first part, we will restrict ourselves to univariate polynomials. In the second part, we extend this for multivariate polynomials.

Part I:

You will write a class implementing the structure and methods for polynomial arithmetic operations. For this part, we will consider only univariate polynomials (polynomials of a single variable) such as $p(x) = 2x^3 + 5x^2 + 1$. The input for a such a polynomial will be given as follows. The number of terms in the polynomial along with the coefficient and the degree of the variable of each term will be provided. For example, the input for polynomial $x^5 - 2x^3 + x$ will be provided as the number of terms being 3, and the coefficient and degree values for the three terms are $1, 5,\ -2, 3$ and $1, 1$, respectively.

Let's assume all the coefficients are integers. One implementation option is to use the number of terms as a data attribute, and store the coefficients and the degrees in a list.

Define a class and write a method to multiply two input polynomials and output the product polynomial.

Expected Input/Output behaviour:
- Two polynomials will be provided as input.
- Output the product polynomial.

Note: For input polynomials $(x + 1)$ and $(x + 1)$, you should output $x^2 + 2x + 1$ instead of $x^2 + x + x + 1$.

Part II:

In this part, we extend this to implement multivariate polynomial arithmetic. An example of a 2-variate polynomial in variables x and y is $p(x, y) = 2x^2y^2 + 3x^2y - 2y + 5$. The input for such a polynomial will be provided as follows. We are given the number of terms of the polynomial along with the coefficients and degrees for each of the variables in each term of the polynomial. For polynomial $p(x, y) = 2x^2y^2 + 3x^2y - 2y + 5$, the number of terms is 4 and the coefficients and degrees of the terms are $2, 2, 2,\ 3, 2, 1,\ -2, 0, 1$ and $5, 0, 0$, respectively.

Define a class and write a method to multiply two input polynomials and output the product polynomial.

Expected Input/Output behaviour:
- Two polynomials will be provided as input.
- Output the product polynomial.

Note: For input polynomials $(x+y)$ and $(x+y)$, you should output $x^2+2xy+y^2$ instead of $x^2+xy+xy+y^2$.

Submission: Write both parts in a single python file. Ask user whether they want to do univariate polynomial arithmetic or multivariate polynomial arithmetic. Name your submission as RollNo.py and upload on Google classroom.