CS3323 Homework 5: Scheme Project

Bivariate Polynomial Arithmetic in Scheme

A bivariate polynomial in x and y can be viewed as a polynomial in y with coefficients that are polynomials in x. This allows us to represent a bivariate as a list of lists of numbers. We will put terms in a degree-increasing order. For example the bivariate

$$1 + xy + xy^3 + x^3y = 1 + (x + x^3)y + xy^3$$

can be represented by the list

```
'( (1) (0 1 0 1) () (0 1))
```

Input: lists which represent bivariates.

Output: Polynomial addition, subtraction, partial derivative w.r.t. x , and multiplication

Note:

1. Please name your functions as `poly_add, poly_derx, poly_sub, poly_mul`. Please copy-and-paste your source code into a text file, and submit to Canvas. The grader will load your program using DrRacket, then run

   ```
   (poly_mul apol bpol)
   (poly_add apol bpol)
   (poly_sub apol bpol)
   (poly_derx apol)
   ```

   to test it, where apol and bpol are lists representing polynomials. For subtraction, output should be $apol - bpol$.

2. You may use, with clear citations, functions which we developed in class.

3. You should only use the pure functional features of Scheme.

4. Leading coefficients of output polynomials (in x or y) can not be zero. Use the empty list to represent the zero polynomial.

5. You may assume that input polynomials have integer coefficients.

6. The full credit for this homework is 20points.

Examples:

```
(poly_add '( (1 -1) (1 2 3) () (3))  '((-1 1) (-1 2) (3)))
---> '(() (0 4 3) (3) (3))
```

```
(poly_mul  '( (1) (1 2 3) () (3))  '((-1) (-1 2) (3)))
---> '((-1) (-2 0 -3) (2 0 1 6) (0 6 9) (-3 6) (9))

(poly_derx  '( (1) (1 2 3) () (3)))
---> '( () ( 2 6))
```