Data Structure

Lab 5. Polynomial Long Division

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May 5, 2020

Lab 5 - Submission & Evaluation

- Submission deadline: 9 PM, May 11 (Mon)
- Online test: http://34.64.144.206 Session ID: 3kLlAp1
- Evaluation: 10 points x 1 problem (total 10 points)
  - 10 points: succeed on time (before the deadline)
  - 7 points: succeed by 9 PM, May 13 (Wed)
  - ≤ 5 points: submit a report by 9 PM, May 14 (Thur)
- Note
  - You must fill out blank parts (indicated as TODO) in the baseline code, and you must not modify the other given parts https://github.com/hongshin/DataStructure/blob/lab5/polydiv.c

Polynomial Long Division (1/2)

- Complete `polydiv.c` by adding polynomial long division operation to our linked list-based polynomial representation
  - You are asked to write the following four functions with `TODO`:
    - `linkedlist_clone`: receive an existing linked list and create a new linked list to have the same elements (i.e., clone)
    - `polynomial_create`: return a polynomial of the given string whose formatting is the same as `polynomial_print`
    - `polynomial_subt`: return the subtraction result of two given polynomials
    - `polynimal_div`: receive dividend and divisor polynomials and then return the quotient and the remainder polynomials
  - You must not change the other functions (except the four with `TODO`)
    - Note that the `main` function is given and you cannot change it

Polynomial Long Division (2/2)

- Polynomial long division is to find the quotient *Q* and the remainder *R* of the division of a dividend *A* by a divisor *B*
  - *A* = *Q* x *B* + *R* where *R* has a lower degree than *B*
  - Example

$$
\begin{array}{rl}
 & x^2 + x + 3 \quad \leftarrow \text{quotient} \\
\text{divisor} \rightarrow x - 3 & \overline{)\, x^3 - 2x^2 + 0x - 4} \quad \leftarrow \text{dividend} \\
 & \underline{x^3 - 3x^2} \\
 & \quad +x^2 + 0x \\
 & \quad \underline{+x^2 - 3x} \\
 & \quad\quad +3x - 4 \\
 & \quad\quad \underline{+3x - 9} \\
 & \quad\quad\quad +5 \quad \leftarrow \text{remainder}
\end{array}
$$

  - c.f., https://en.wikipedia.org/wiki/Polynomial_long_division

Input and Output

- Input
  - Given from the standard input
  - First line represents the dividend and second line represents the divisor. Each line has no more than 255 characters.
  - Dividend and divisor are represented as follows:

(c_1) x^d_1 + (c_2) x^d_2 + ⋯ (c_n) x^d_n

where c_i is a non-zero integer and
d_i is a non-negative integer and $d_i > d_{i+1}$

  - For divisor, the coefficient of the highest degree term is 1

- Output
  - Print the quotient at first line and the remainder at second line
  - Make sure to put newline ('\n') at the end

Examples

- Ex. 1. $(x^2 + 3x + 2) / (x + 2)$

```
(1) x^2 + (3) x^1 + (2) x^0
(1) x^1 + (2) x^0
```

<Input 1>

```
(1) x^1 + (1) x^0

```

<Output 1>

- Ex. 2. $(2x^2 - 5x - 1) / (x - 3)$

```
(2) x^2 + (-5) x^1 + (-1) x^0
(1) x^1 + (-3) x^0
```

<Input 2>

```
(2) x^1 + (1) x^0
(2) x^0
```

<Output 2>