E0 251: Programming Assignment 2
Due before 11.59 PM on 09-09-2019

Please mail the source code with a README file and 5 test cases for each problem (code and test data in separate files) to ullas@iisc.ac.in and protikpaul@iisc.ac.in. Please make a ZIP file of all the files and then mail the ZIP file. Any extra instructions regarding submission (if necessary) will be sent by Ullas and Protik.

1. [Large unsigned integer arithmetic]
You will represent an arbitrarily large unsigned integer I by a singly linked list of its "digits" d_1, d_2, ... , d_m, where d_1 is the least significant "digit" of I and d_m is the most significant "digit" of I. Assume a base of $10{,}000_{10}$. Implement each "digit" as a C *unsigned int* with "digit" values in [0, 9999].

a) Write C functions to perform the arithmetic operations addition and multiplication of large unsigned integers.
b) Write a C function to input a large unsigned integer from stdin as comma separated "digits" in decimal, ordered on decreasing significance and terminated by a $
c) Write a C function to output a large unsigned integer to stdout in the format used for input, showing each "digit" as 4 decimal digits.
d) Write a C main() which will repeatedly accept (from stdin) and evaluate, large integer infix expressions on large unsigned integer constants using the operators "+" (addition) and "*" (multiplication). An expression is terminated by "=". On encountering an "=", the value of the expression is to be printed to stdout. For simplicity, evaluate expressions from left to right.

For example, the expression

1111,0411,4111,1111,0011$ + 2222,2222$ * 0003$ =

results in output

3333,1234,2333,9999,6699$

2. [Polynomial division]
Consider polynomials with real valued coefficients. A degree n polynomial is an expression of the form

$a(x) = a_n x^n + ... + a_1 x^1 + a_0$, $a_n \neq 0$

Given polynomials $a(x)$ of degree m and $b(x)$ of degree n, where $m \geq n \geq 0$, in the division of $a(x)$ by $b(x)$, the quotient polynomial $q(x)$ and remainder polynomial $r(x)$ are defined by

$a(x) = b(x) * q(x) + r(x)$, where degree($r$) < n

You will represent the degree n polynomial a by a doubly linked list of elements (i, a_i), $a_i \neq 0$ ordered on decreasing values of i. In order to approximate real values, implement the polynomial coefficients a_i using C *float*.

a) Write a C function to perform polynomial division.
b) Write C functions to input (output) a polynomial from (to) stdin (stdout) as comma separated pairs of the form (i, a_i), $a_i \neq 0$ ordered on decreasing values of i.
c) Write a C main() which will repeatedly accept (from stdin) 2 polynomials and output the quotient polynomial and remainder polynomial resulting from the division of the first input polynomial by the second input polynomial.

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