

## ECE 3331 Computer Problem 7 Spring 2019 (due 11:59pm 5/1/19)

A common way to represent a polynomial expression (e.g.  $3x^5 - 2.2x^3 + 4x - 1.713$ ) is with linked structures that have three members:

- a) A member to represent the coefficient (3)
- b) A member to represent the exponent (5)
- c) A pointer to the next term in the expression

Write a program that does the following:

- 1) Write a function `input_poly(ptr1)` that reads in two polynomials at a time with coefficient and exponent from a file `cp7_in.txt`. The file will contain 2n polynomials, where n is an integer that is 10 or less. Space for the polynomial will be allocated in run time and there is no limit to the size of the polynomial, e.g. the first two lines of the file is  
 $3\ 5\ -2.2\ 3\ 4\ 1\ 1.713\ 0$   
 $3\ 100\ -2.2\ 3\ 14\ 55\ 3.1\ 101$   
 (Note the terms may be in any order)  
 Then, two polynomials will be created  
 $3x^5 - 2.2x^3 + 4x - 1.713$  and  
 $3.1x^{101} + 3x^{100} + 14x^{55} - 2.2x^3$
- 2) Write a function `add_poly(ptr1, ptr2)` that expects pointers `ptr1` and `ptr2` to two lists that represent polynomials and returns a pointer to a third list that represents the sum of polynomials. You will find the sum of every pair of polynomials.
- 3) Write a function `mult_poly(ptr1, ptr2)` that expects pointers `ptr1` and `ptr2` to two lists that represent polynomials and returns a pointer to a third list that represents the product of polynomials. You will find the product of every pair of polynomials.
- 4) Write a function `print_poly(ptr1)` that prints the polynomial pointed to by `ptr1` to a file, `cp7.out`. The terms must be printed in descending order of exponent. That is to say, e.g.  $3x^5 - 2.2x^3 + 4x - 1.713$  is correct but e.g.  $-2.2x^3 + 3x^5 + 4x - 1.713$  is not.

From the function `main()`, you may call the function `print_poly(ptr1)` to print out the following to `cp7.out`:

The sum of polynomials::

$$3x^5 - 2.2x^3 + 4x - 1.713$$

$$3.1x^{101} + 3x^{100} + 14x^{55} - 2.2x^3$$

is

$$3.1x^{101} + 3x^{100} + 14x^{55} + 3x^5 - 4.4x^3 + 4x - 1.713$$

The product of polynomials::

$$3x^5 - 2.2x^3 + 4x - 1.713$$

$$3.1x^{101} + 3x^{100} + 14x^{55} - 2.2x^3$$

is

$$9.3x^{106} + 9x^{105} - 6.82x^{104} - 6.6x^{103} + 12.4x^{102} + 6.6897x^{101} - 5.139x^{100} + 42x^{60} - 30.8x^{58} +$$


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$$56x^{56} - 23.982x^{55} - 6.6x^8 + 4.84x^6 - 8.8x^4 + 3.7686x^3$$

Precision up to 3 digits after the decimal is enough. Do not need more and **do not print more (think printf format).**

You will not be given points for documenting your code, but points will be docked if you do not, with a maximum penalty of -20 points. Again, you must document what each function does and what the different parameters are for, and critical sections of the code, including how you convert decimal to binary for both decimal integers and floating point numbers. **You are to do this alone, not with anyone else. No teams of two.**

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You may develop your program in Visual Studio or any other IDE of your choice but you must use standard C.

Some of the more common errors when you move from a C++ system to standard C are:

- (1) using C++ style comments (`//`this is not standard C89)
- (2) placing variable declarations AFTER executable statements (works in C++ but not standard C89)

(3) using .C or .cpp as the file extension for the source file rather than .c

Remember that your grade will depend not only on getting the right answers but also on program documentation (comments). Be sure you include the specified initial comments, describe each variable, and in the body describe each logical block.

Your entire source program must be in a single file, of type .c, which you must begin with your cougarnet username followed by the letters cp7 (no spaces, all lowercase). Turn it in to Engineering Blackboard e.g. my cougarnet name is brsheth and so the file I will turn in is: brshethcp7.c