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**EECS 560**

**Project 1**

**Results from running on test input file given:**

**(Note 1: if a polynomial is empty, and it is asked to print, I print 0 rather than nothing)**

**(Note 2: After 'Q' is read, the polynomials are just printed, no line breaks in between)**

**12x^3**

**-3**

**-9**

**5.2x^25 + 18x^18 + 3x^7 + 2x^3 - 4x - 3**

**130x^24 + 324x^17 + 21x^6 + 6x^2 - 4**

**6x^3 - 5x^2 - 3x - 1**

**1.5x^4 - 1.66667x^3 - 1.5x^2 - x**

**96**

**5**

**x^4 + x^3 + x^2 + x + 1**

**0**

**6x^8 - 5x^7 - 3x^6 - x^5 - 6x^3 + 5x^2 + 3x + 1**

**6x^3 + 5x^2 + 3x + 1**

**6x^3 - 5x^2 - 3x - 1**

**5.2x^25 + 18x^18 + 3x^7 + 2x^3 - 4x - 3**

**130x^24 + 324x^17 + 21x^6 + 6x^2 - 4**

**6x^8 - 5x^7 - 3x^6 - x^5 - 6x^3 + 5x^2 + 3x + 1**

**1.5x^4 - 1.66667x^3 - 1.5x^2 - x**

**x^5 - 1**

**x - 1**

**Q. A report in which you describe and discuss another method of doing the project i.e. using a data structure other than the linked lists described above. Identify the advantages and disadvantages of your alternative method. Input must be read from a file exactly as described above. That is, you may not use a buffer to hold the data until you figure out how much space you need.**

**One alternative data structure for holding the polynomial would be a structure similar to the standard library vector class where all data is guaranteed to be contiguous (like an array). The main advantages of having contiguous data is that random accessing of elements is faster since the address of the element can be calculated as base\_addr + ( sizeof( node ) \* elem\_num ) and that contiguous data is more amicable to caching algorithms so data can be accessed significantly quicker. The downside of using contiguous data is that if an element is removed then all elements behind the removed element must be shifted down, and insertion of elements suffers from the same problem.**

**Another alternative data structure for holding the polynomial would be a binary tree. The exponent would be used to sort the tree. If the tree was structured to place the highest exponents on the left, then the structure could be traversed in depth first order to print the polynomial. Insertion of elements in the tree would be as fast (if it degraded to a linked list) or faster than the linked list. The speed of removing elements depends on if the tree is self-balancing or not. One disadvantages is that since the tree will be traversed in depth first order, unless an iterative algorithm is used (significantly increasing the complexity of writing the code), traversal will be a recursive function, which consumes a lot of memory in stack frames.**