**Lab 1 – Arrays and Modular Design**

**CSC 241**

**Fall 2017**

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| **Date Assigned:** | Thursday, 31 August | **Date Due:** | Tuesday, 12 September |
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| **Introduction:** | Array and classes are useful in many applications. Sometimes it is useful to build an object with reference types inside (either another class object or and array). You are to build a program that stores information of a polynomial in a class object. This program is a modified version of the exercise 3 on page 133 of the book. | | |
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| **Description:** | A polynomial is an algebraic expression consisting of multiple terms, usually containing different powers for a given variable summed together. This expression takes the form:  *p(x) = c0 + c1x + c2x2 + … + cnxn,*  where ci, i = 0, 1 , …, n, are integers, and is the coefficient before the exponential term. You must construct a program that creates an ADT (abstract data type) that can create a polynomial up to the *nth* degree. | | |
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| **Program:** | Your program should handle the above requirements in a modular fashion according to good software design. In particular you will need:  A data structure to hold a polynomial.  A function to display the polynomial as a string. Any term with a coefficient of 0 should not be shown. Any negative term should be shown as a subtraction (not an addition of a negative). An exponent of 1 should be shown as just the x term without the exponent. Example: 1x3+ -2x2 + 1x1 + 0 should be displayed as 1x^3 – 2x^2 + 1x  A function to evaluate the polynomial for a given value of x.  A function to display the derivative of the polynomial.  Write a program that reads in coefficient values from a data file. Using the values you need to create a polynomial object from these values and be able to perform the above described functions. You program should ask the user to input options for what action to perform (evaluate, derivative, or quit). While quit is not selected you should keep performing the given actions requested by the user. **You must perform error checking to make sure all inputs are valid for their given intent**. | | |
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| **Input:** | The input data (**p1.dat**) will be a stream of integers that represent values for the coefficients in the polynomial. The order they appear in also corresponds to the exponent of the x value they are associated with. For example the data file might have the following numbers: 1,2,-5,1 and it corresponds to the following polynomial: 1 + 2x – 5x2 + x3.  You must also get user input for the actions to perform on the polynomial as well as the value for x if chosen to evaluate. | | |

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| **Output:** | Your program should first display what the polynomial looks like after it has been created. You must keep looping asking for tasks until a quit option is entered. Remember to make sure you have correct corresponding input for the actions.  Your polynomial is: -1x^5+3x^4-4x^3+3x+2  Enter Option:  (E/e) Evaluate the Polynomial for a value of x  (D/d) Get Derivative of the polynomial  (Q/q) Quit  e  Enter a value for x  2  -8.0  Enter Option:  (E/e) Evaluate the Polynomial for a value of x  (D/d) Get Derivative of the polynomial  (Q/q) Quit  d  p'(x) = -5x^4+12x^3-12x^2+3  Enter Option:  (E/e) Evaluate the Polynomial for a value of x  (D/d) Get Derivative of the polynomial  (Q/q) Quit  q |
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| **Hints:** | Use appropriate software design techniques, and implement the class methods with Java constructs for I/O, declarations, and calculations.  Build your program in steps (i.e., get the input and output working, then add the functions, etc.). Emphasize functionality first, then add the advanced features. Work on this program over time, DO NOT wait until the last minute (i.e., the day before it is due) to start! |
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| **Data:** | On the server, you will need to use the following absolute path and append the filename to it. "/home/courses/cs2411/ProgramFiles/"  Remember that you must pass the data file name in as a command line argument. |
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1. Make test file and get file input working
2. Build polynomial class and be able to print out polynomial in correct format
3. Build up other functions such as evaluate and derivative