**Institute for Advancing Intelligence, TCG CREST**
(TCG Centres for Research and Education in Science and Technology)

Introduction to Programming and Data Structures
Ph.D. Coursework: First year, First Semester (Session: 2024-25)
**Assignment #06**

Full Marks: 200 — Instructor: Dr. Laltu Sardar
Clarification Deadline: **2024-Nov-14** — Submission Deadline: **2024-Nov-17**

## Instructions

1. Errors must be handled in all possible functions used, whether from libraries or written by yourself
2. Function names and variable names should clearly describe their purpose.
3. Write the program in such a way, that program does not fails.
4. Take input from files only

# Problem #0601: Polynomial Operations

### Problem statement

Write a C program to perform various polynomial operations. Here is the function prototypes.

```
typedef struct polynomial_t {
    int n; //degree
    float * cf; //coefficient array
} Poly;

Poly create_polynomial(int n);
void display_polynomial(const Poly A);
Poly add_polynomials(const Poly A,const  Poly B);
Poly subtract_polynomials(const Poly A,const  Poly B);
Poly multiply_polynomials(const Poly A,const  Poly B);
float evaluate_polynomial(const Poly A, const  int x);
void free_polynomial(const Poly A);
void divide_polynomials(const Poly A, const  Poly B, Poly * Q, Poly * R);
```

### Sample Input and Output

Take input from file `input_polynomials.txt` and output to file `output_polynomials.txt`

**Input:**

```
Number of test cases (say 2)
operation_1
Number of terms in the 1st polynomial (say 3)
1st_coeff 1st_exp
2nd_coeff 2nd_exp
3rd_coeff 3rd_exp
```

```
Number of terms in the 2nd polynomial (say 2)
1st_coeff 1st_exp
2nd_coeff 2nd_exp

operation_2
Number of terms in the 4st polynomial (say 2)
1st_coeff 1st_exp
2nd_coeff 2nd_exp

Number of terms in the 4st polynomial (say 3)
1st_coeff 1st_exp
2nd_coeff 2nd_exp
3rd_coeff 3rd_exp
```

**Output:**

At first, output the result polynomials, in the same format to the output file. Then display on the terminal.

```
First Polynomial: 3x^2 + 5x + 6
Second Polynomial: 4x^3 + 2x^2 - 3x

Addition Result: 4x^3 + 5x^2 + 2x + 6
Subtraction Result: -4x^3 + x^2 + 8x + 6
Multiplication Result: 12x^5 + 26x^4 + 11x^3 - 9x^2 - 15x
Evaluation of First Polynomial at x = 2: 28
```

### Testing

Write a function to test if the output are correct. Use modular programming and divide source and header accordingly.

[150]

# Problem #0602

Write a program to read student data from a file into an array of student structures. Each student has the following attributes: - Name (string), Marks (integer), ID (fixed-size string), and age (int)

1. Implement a function to read the student data from a file and store it in an array of structures.
2. Implement a single sorting functions to sort the students by:
   - Marks (in ascending or descending order)
   - Names (in lexicographical order)
3. Input: Take student data from a file.
4. Output: Display the sorted list of students based on each criterion (marks and names).

[50]