

Programming and Data Structure Lab [CS19003][Section-1]

Test-3

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1. Write a C program for the task as described below. Save the file as **Test3_Part1_Roll_Number.c**. Build and run to check your program. Upload the .c file for the assignment in MS teams.
 - (a) Define and allocate space for two $n \times n$ matrices $M1$ and $M2$ of strings, where n is read as input. The entries of $M1$ must be read in row major order as strings of length at most 19. Print $M1$ in a suitable manner row-wise. The entries of $M2$ must be strings of length at most 38. [20 Marks]
 - (b) Compute the square of $M1$ in $M2$. Print $M2$ in a suitable manner row-wise. [20 Marks]

Sample Output: If $M1$ is the 2×2 matrix

$$\begin{bmatrix} \text{Somnath} & \text{Hazra} \\ \text{Gunjan} & \text{Balde} \end{bmatrix}$$

then $M2 = M1 \times M1$ is

$$\begin{bmatrix} \text{SomnathSomnath} & \text{SomnathHazra} \\ \text{GunjanSomnath} & \text{GunjanHazra} \end{bmatrix}$$

Note: The modified **multiplication** and **addition** operations for string elements of the matrices are respectively **concatenation** (||) and **lexicographic maximization** (max). For example multiplication of the strings Gunjan and Hazra results in the product string GunjanHazra, which is lexicographically *smaller* than the product string BaldeBalde, making GunjanHazra to be the entry of $M2[1][1]$. So we obtain the entry $M2[1][1]$ by evaluating the expression:

$$\max(M1[1][0]||M1[0][1], M1[1][1]||M1[1][1]).$$

2. Write a C program for the task as described below. Save the file as **Test3_Part2_Roll_Number.c**. Build and run to check your program. Upload the .c file for the assignment in MS teams.

Alice from the planet Earth wants to send a polynomial as a string to Bob, who is residing in the Jupiter's moon Europa nowadays. Malicious Eve, who is banished from earth, eavesdrops on their communication from Mars and introduces **ERROR** inside the polynomial. You have to help Bob to write a c code for the following tasks:

- Take the erroneous polynomial as input string and write a function to find the degree of the erroneous polynomial. Print the degree of the polynomial. [12 Marks]
- Remove **ERROR** from the polynomial and sanitize it using a function. Print the sanitized polynomial. [18 Marks]
- Store the sanitized polynomial in a Linked list using a function `poly *SanPoly(char *p)`, where each node of the Linked list is structure of the form:

```
typedef struct _poly {
    unsigned int coef;
    unsigned int degree;
    struct _poly *next;
} poly;
```

Print the sanitized polynomial again by calling a function `void PrintPoly(poly *p)`. [20 Marks]

- Evaluate the polynomial on a point x given by Bob (should be an user input) by calling a function of the form `int EvalPoly(poly *p, int x)`. Print the result of evaluation. [10 Marks]

Note:

- For simplicity consider the maximum degree of the polynomial to be 9.
- All the coefficients are less than 10.
- The input polynomial must contain a constant term and a term with degree greater than 0.
- The constant term should be the first term of the polynomial.

Sample Output: Here is one sample output:

Enter the Polynomial with ERROR: $2E + 3Rx + R7Ox^7$

Degree of the polynomial: 7

Polynomial after removing ERROR: $f(x) = 2 + 3x + 7x^7$

Output of PrintPoly: $f(x) = 2 + 3x + 7x^7$

Please enter a point: 2

Result of the Evaluation: $f(2) = 904$

Have fun!

Bonus Problem: Consider the problem from part 2; Read a polynomial from the file `poly.txt` and store it in a string. Print the string. Remove the white spaces and print polynomial without white spaces. Write the resulting polynomial in a file named `result.txt`. Submit a c file with the following naming convention **Bonus_Part2_Roll_Number.c**. [16 Marks]

Sample output: Here is one sample output:

The Polynomial with white-spaces: $f(x) = 2 + 3x + 7x^2 + x^3 + 5x^9$

Polynomial after removing white-spaces: $f(x) = 2 + 3x + 7x^2 + x^3 + 5x^9$

Note: You can score at most 100 in the exam. Consider the Bonus problem as an additional problem which might help to enhance your score in case you make some mistakes in the first two problems.