

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
HYDERABAD
CAMPUS,
Data Structures and Algorithms
CS F211 / IS F211
Homework Assignment – 10

1. You are given an algebraic expression representing some math arithmetic example $((a+b)*c)$. Such expressions are difficult for computers to consume. Hence such expressions are transformed into RPN(Reverse Polish Notation) form which can easily be processed by computers. Along with algebraic expression you are also given the binary operator precedence order from highest to lowest $() , ^ , / , * , - , +$. Lowercase letters a, b, c, ... z represent your operands. Also input will be given such that there is unique RPN equivalent. Your job is to convert such expressions to RPN form.

Input :

$(a+(b*c))$

Output :

abc*+

2. Olympics will be held in Brazil. In an sporting event there are N groups and each group has M teams in it. Points table is stored as 2D array of N X M size where N rows represents N groups and M elements in a row represents points scored by each team in that group. At the end of this event you are given the 2D array(Points table) where each row is in decreasing order. You have to print the final standing of teams showing score and index positions(row and column) where team scoring highest point will appear first. You have to solve this problem using heap. And the space complexity of it should be $O(n)$.

Example: $N = 3, M = 2$

Input:

```
pointsTable[3][2] = { {40, 30},
                      {35, 25},
                      {27, 26}
                    };
```

Output:

Final Ranking list :

```
40 0 0
35 1 0
30 0 1
27 2 0
26 2 1
25 1 1
```

3. You are given an array A of positive integers and an integer X. You have to carry out some steps to make the array in increasing sequence i.e. $A[0] < A[1] < A[2] \dots < A[n-1]$. In each step, you can add X to any element of the array. Find the minimum steps required by you.

Input:

$N=4 \ X=2$

$A[] = \{ 1, 3, 3, 2 \}$

Output:

3

4. You are given a string s . Now if it is not a palindrome you have to split it in to palindromes in such a way that their concatenation gives s . Also Splitting has to be done in such a way that minimum number of palindromes are formed.

Input-1:

MALAYALAM

Output:

1, MALAYALAM

Input-2:

WHAATRAALOL

Output:

7, W, H, AA, T, R, AA, LOL

Explanation:

Splitting strings are $W + H + AA + T + R + AA + LOL = WHAATRAALOL$

5. You are given a rectangular map of Japan. This map is stored in 2D array of $M \times N$ where each cell contains 'L' or 'W'. 'L' represents land and 'W' represents water. 2 cells are adjacent to each other, if they share a side. So there can be at the most 4 neighbours for any cell (Up, Down, Left, Right). Now, an island is a piece of connected land. You have to find the number of islands present.

Input:

3 4

WWWL

LLWL

LWWL

Output:

2

6. Given a matrix of size $M \times N$, find the maximum sum of a sub-matrix in $O(M + N)$ time

Input:

3 3

-11 32 46

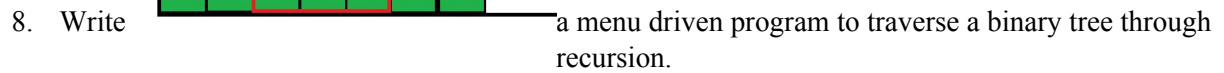
73 -39 -56

94 -25 20

Output:

167

7. You have been given a histogram and you want to find the largest area in it. Example refer to figure below. Consider the following histogram with 7 bars of heights $\{6, 2, 5, 4, 5, 2, 6\}$. The maximum area rectangle is highlighted in red). The largest area here is $4 \times 3 = 12$ (given that width of each block is 1.) You have to read an array storing the heights of histogram and assume the width to be 1 unit. You have to solve this problem through stack data structure.



- Note :** You should create dummy tree with integer data.

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