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

Homework Assignment – 3

1. Write a C program to achieve the following. When the user inputs any number, show that in words.
   Note: User input range 0 – 9999

   Input:
   Enter a number <0 – 9999>.
   5435
   Output:
   Five Thousand Four Hundred and Thirty Five

2. A Soundex code is the phonetic code of the word. If the Soundex codes of two words are same, that means they are pronounced same way.
   For more details refer:
   http://creativyst.com/Doc/Articles/SoundEx1/SoundEx1.htm#SoundExConverter

   Write a C program to print those lines of a file that contain a word that sounds like a given word.

   Input:
   test.txt (input a file name)
   ball (input a word)
   Output:
   He addressed every class in a terrifying **bawl**.
   Your father will **bawl** you out when he sees this mess.

3. Random numbers are needed for many different purposes in engineering and computer science, i.e., to run simulations, to generate random passwords, etc. Around 1946 John von Neumann came up with the "**middle square method**" for generating random numbers.
   For example: if the starting number is 1234, the next seed will be middle digits of the square of 1234 which is 5227 (because square of (1234) = 01522756)
   Note: for even digit number: if the square of the initial or any seed in the process has odd no. of digits then zeros are padded to the left so that the next seed can be extracted. The same procedure has to be followed for odd number extraction.

   Input:
   Enter initial seed.
   222
   Enter no. of random numbers that have to be generated.
   5

Output:
5 random numbers with the initial seed 222 are:
928
611
733
372
383

4. Write a program to read a number n and print the numbers from 1 to n^2 pattern in a spiral order. You have to use a square matrix. And it should be dynamically allocated using **malloc**().

for ex. n = 4 , output is :

```
 1  2  3  4
12 13 14  5
11 16 15  6
10  9  8  7
```

5. You have to read a square matrix **a** of size n x n. Find the maximum sum of a sub-matrix which is also a square matrix of size m X m where $1 \leq m \leq n$ & $1 \leq n \leq 100$ & $-100 < a[i][j] < 100$.
Input Format :
n

n row's having n numbers separated by spaces.

Sample Input:
3
1 2 3
4 5 6
7 8 9
Output:
45

6. You have to read a sorted array and an element x. You have to find out how many times x is present in the array in **O(logn)** time complexity.
Input Format :
n x
n number's separated by spaces

Output Format :
Number of times element x is present.

Sample Input :
13 7
4 6 7 7 7 7 10 14 14 14 15 16 20

Sample Output :
4

7. Long back people used key based phones which had ten digits on the keypad. If you have to type characters from 'a'-'z' you have to press keys in a certain sequence to get the desired character. The letters are mapped onto the digits as shown in figure below. For instance to type the character 'n' you have to press "66" and to type two characters in sequence from the same key, the user must pause before pressing the key a second time. The space character ' ' indicate a pause. For example, "6 6" indicates "mm" whereas "66" indicates "n".

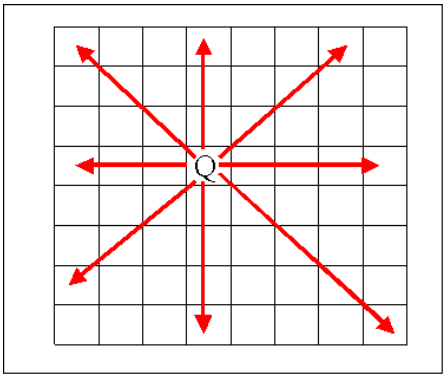
Now your job is to read a line of string which have only lowercase characters ‘a’–‘z’ and space and output the sequence of key presses(which can have pauses also).

Sample Input-1:
hello
Sample Output-1:
4433555 555666

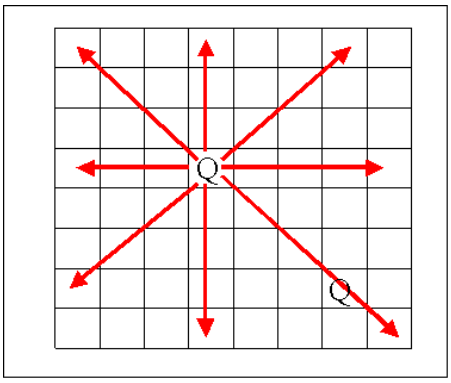
Sample Input-2:
dsa is cool
Sample Output-2:
37777204447777022266 6 666555

8. You are given a chess board(8 X 8 board) where some queens ranging from 2 to 8 are placed on it .In chess a queen may move any number of spaces straight up, down, left, right, or along any of the 4 diagonals shown in Fig. 1. Any two queen can attack each others position. Queens are said to be in attacking or not safe position when no two queens are in the same row, column, or diagonal Fig. 2 depicts that two queens are attacking each other(same diagonal). Fig 3 represents two queens in non-attacking or safe position. You will be given a 2D integer array of dimension 8 X 8 containing 0s and 1s where 1 represent the presence of queen and 0 represent open spaces. You need to check if all queen's are placed in non-attacking position i.e. safe position. If safe

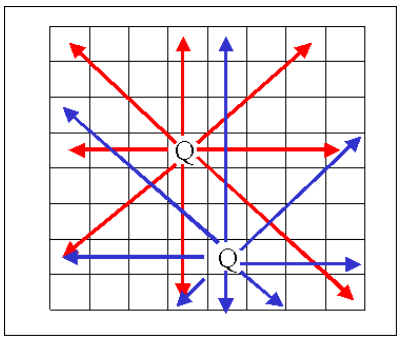
output YES otherwise NO



(Fig.1)



(Fig. 2)



(Fig. 3)

Input Format : 8 line of input, each line contains eight numbers separated by spaces.
Output Format :YES or NO

Sample Input-1
0 0 0 0 0 0 0 0
0 0 0 0 0 0 1 0
0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0
0 0 0 1 0 0 0 0
0 0 0 0 0 0 0 0
1 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0
Sample Output-1
NO
Explanation
There exist pairs of queen which are attacking each other one pair is { Queen placed at cell (3,0) , Queen placed at (6,0) } both are in same column. and other pair is { Queen placed at cell (1,6) , Queen placed at (4, 3) } both are in same diagonal

Sample Input-2
0 0 0 1 0 0 0 0
1 0 0 0 0 0 0 0
0 0 0 0 1 0 0 0
0 0 0 0 0 0 0 1
0 1 0 0 0 0 0 0
0 0 0 0 0 0 1 0
0 0 1 0 0 0 0 0
0 0 0 0 0 1 0 0
Sample Output-2
YES
Explanation
All the queens are non-attacking hence YES

9. Write a program to count and display the number of lines, words, and characters in a text file (similar to Unix wc program). You have to use file handling to solve this problem.

10. You are given three sorted arrays of integers (in ascending order). Write a program to find a triplet (one element from each array) such that distance is minimum.

    If a[i], b[j], and c[k] are three elements, then distance is calculated as triangular distance.
    Distance = diff(a[i]-b[j]) + diff(b[j]-c[k]) + diff(c[k]-a[i])
    Solve it using O(n) complexity algorithm.