# Birla Institute of Technology and Science, Pilani Hyd Campus
# BITS F232: Foundations of Data Structures and Algorithms
## 1st Semester 2022-23
## Programming Assignment-1, Max Marks: 07
## Date of Submission: 30th Sept 2022

**Q.1** Give C++ code for performing add(e) and remove(i) functions for game entries stored in an array A, as discussed in the class "Scores", except this time, don't maintain the game entries in order. Assume that we still need to keep 'n' entries stored in indices 0 to n − 1. Try to implement the add and remove functions without using any loops, so that the number of steps they perform does not depend on 'n'.

**Q.2** Write a C++ program using Arrays to implement the following using the topics that have been covered till lecture no: 8.
Amish wants to complete as much questions as possible. The time it takes to complete each question is given in the form of an array containing n elements. You are given the total amount of time Amish has. Help him by telling him the maximum number of questions he can do in the given time.

INPUT FORMAT (input arrives from the terminal / stdin):
Each input consists of a pair of lines. The first line of each pair contains N and K. N represents the total questions and K represents the total time Amish have. The second line contains a1, a2, a3, . . ., an, which represents the time it takes for each question to complete. Values of N might differ in each test case.

OUTPUT FORMAT (print output to the terminal / stdout):
Print a single integer, which is the answer to the problem.

**SAMPLE INPUT 1:**
4 5
1 5 4 3

**SAMPLE OUTPUT 1:**
2

Explanation- He can accomplish 1st and 3rd/4th task at max.

**SAMPLE INPUT 2:**
4 8
1 5 4 3

**SAMPLE OUTPUT 2:**
3

Explanation- He can accomplish 1st and 3rd and 4th task at max.

**Q.3** You are given a positive integer 'n'. You need to print all the valid parenthesis of length 2*n. A sequence of brackets is called balanced if one can turn it into a valid math expression by adding characters «+» and «1». For example, sequences ( ( ) ) ( ), ( ) and ( ( ) ( ( ) ) ) are balanced, while ) ( , ( ( ) and ( ( ) ) ) are not. Write a C++ program using **Recursion** to implement this.

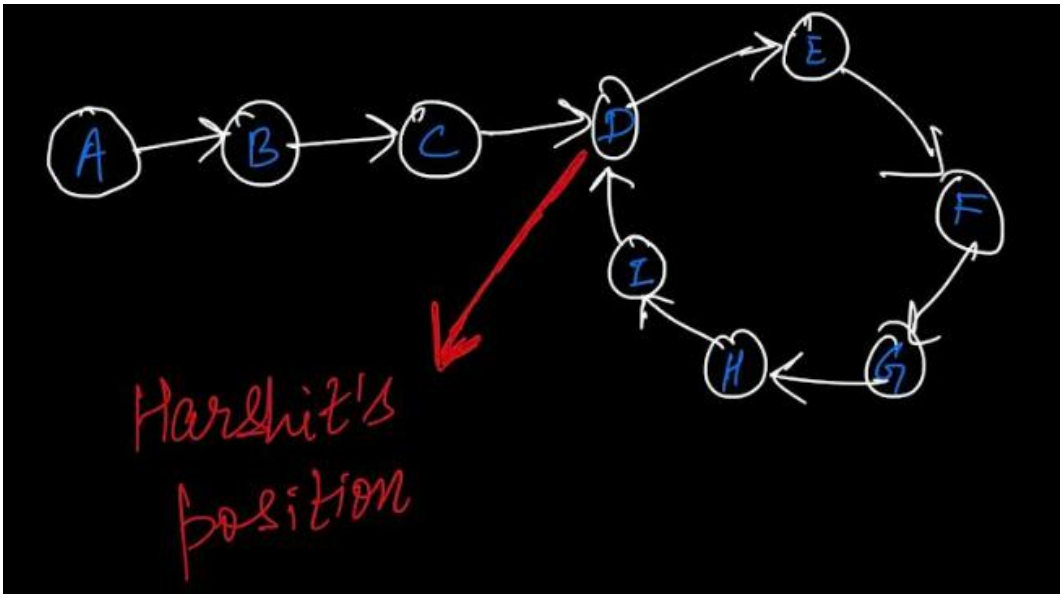
INPUT FORMAT (input arrives from the terminal / stdin):
A single integer N.

OUTPUT FORMAT (print output to the terminal / stdout):
All valid parentheses of length 2*n.

**SAMPLE INPUT 1**:
1
**SAMPLE OUTPUT 1**:
( )

**SAMPLE INPUT 2**:
2
**SAMPLE OUTPUT 2**:
( ( ) )
( ) ( )

**Q.4** Owing to the "You pay now, I'll pay you later! "Culture of BITS, Harshit who is contesting for Vyas Hostel Representative owes money to 2 of his friends, while all other friends owe only to a single person. You have to make your own linked list. Imagine each person as a node whose next pointer points to a friend who has to pay him money (the current node).
You are required to find the node to which Harshit corresponds to, so that he can clear his debts and gets maximum votes. Write a C++ code to implement this. You are free to make any assumptions needed.
(Hint: You might have to check if there exists a Cycle using the two pointers concept discussed in the class)
**Explanation:**



**Q.5** You are given an array containing n distinct elements.
You can perform the following operation any number of times, which is as follows:

a. Choose 2 indexes i,j ($i \geq 0$, $i<n$, $j \geq 0$, $j<n$).
b. Swap a[i],a[j].

The final goal is to make an array such that $a[i]>a[i+1]$ ($i \geq 0$, $i<n-1$). But the twist is that you need to use minimum number of operations in order to achieve the goal.

INPUT FORMAT (input arrives from the terminal / stdin):
Each input consists of a pair of lines. The first line of each pair contains N. N represents the total number of elements. The second line contains a1, a2,a3, . . . , an , which represents the array elements. Values of N might differ in each test case.

OUTPUT FORMAT (print output to the terminal / stdout):
Print a single integer, which is the answer to the problem.

**SAMPLE INPUT:**
4
1 5 4 3

**SAMPLE OUTPUT:**
3

Explanation- Swap 1st & 2nd element; then 2nd & 3rd; and at last 3rd & 4th element.

## Submission Instructions:

You can form your own group of two students. This grouping is allowed only for allowing peer learning. However, you need to solve yourself all the questions. There will be a demo or viva for these assignments at a later date. You should submit your exe file, and source files putting all of those into a tar file/ zip file, and upload it into google class before the submission deadline i.e. midnight, 30th Sept 2022. Submission details will be announced soon through google class. Your code should also run on Ubuntu systems (like in the lab) for evaluation purposes. You should also keep a copy of your code. Any doubts or queries regarding the questions can be emailed to f20200065@hyderabad.bits-pilani.ac.in.

**I/C**
**(C R Hota)**

**Date given: 24th Sept 2022**

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