ALGORITHMS & DATA STRUCTURES - PROBLEM SOLVING

1) Write a program to given input Check whether Even or odd.
2) Write a program to Generate Even and Odd Number less than N and Generate ‘N’ Even and Odd Numbers.
3) Write a program to decide given N is Prime or not.
4) Write a program to subtract two integers without using Minus (-) operator
5) Write a program to find remainder of two numbers without using modulus (%) operator
6) Write a program to generate Prime Numbers less than N and Generate ‘N’ Prime Numbers/in given range.
7) Write a program that prints the numbers from 1 to 100 and for multiples of '3' print "Fizz" instead of the number and for the multiples of '5' print "Buzz". https://www.geeksforgeeks.org/fizz-buzz-implementation/
8) Write a program to find GCD (Greatest Common Divisor) or HCF (Highest Common Factor) of two numbers is the largest number that divides both of them using recursion.
9) Write a program find GCD of the array elements given an array of numbers,
10) Write a program given an array of ‘N’ numbers, find LCM of it.
11) Write a program to find the Sum of Array Elements.
12) Write a program for swapping of two arrays

13) Write a program to find the maximum number in an array using function

14) Write a program to find Median of the given Array?

15) Write a program to find the highest and the lowest number in array

16) Write a program to find Mean of given Array Elements?

17) Write a program to find whether given number is an Armstrong number or not? ** (Narcissistic number or Pluperfect digital invariant (PPDI) or a Plus perfect number)

18) Write a program to find whether given number is an Perfect number or not

19) Write a program to check whether given character is vowel or consonant

20) Write a program to find the largest number among three numbers

21) Write a program to find the roots of a quadratic equation

22) Write a program to Check Whether the given year is a leap year or not

23) Write a program to check whether a number is a positive number or negative number?

24) Write a program to Program to calculate the Combinations and Permutations!

Combination means way of selecting a things or particular item into group or sets.

nCr=n!/r!(n-r)!.

Permutations means possible way of rearranging in the group or set in the particular order.

nPr=n!/(n-r)!

25) Write a program to find power of a number using recursion

26) Write a program check whether given character is an alphabet or not

27) Write a program to classify the triangle as equilateral, isosceles and scalene to the given sides of triangle.(HINT: Solve using semi-perimeter and area)

28) Write a program to find area and circumference of circle

29) Write a program to remove duplicate element in an array

30) Write a program to check if the given string is palindrome or not

31) Write a program to add and subtract of given (NXN) Matrices

32) Write a program to multiply given 2 (NXN) matrices

33) Write a program to sort the matrix rows and columns

34) Write a Program to add all Elements in Matrix

35) Write a Program to accept two matrices and check if they are equal

36) Write a Program to check if a given matrix is an identity matrix

37) Write a Program to check the frequency(count) of odd numbers and even numbers in matrix

38) Write a program to find the trace of given matrix

39) Write a Program to find the Inverse of the Matrix

40) Write a program to find given a matrix, check whether it's magic square or not.

(HINT:A Magic square is whose sum of elements diagonally,vertically,horizontally are equal)

41) Write a Program to display transpose of a matrix

42) Write a program to accept a matrix and determine whether it is a sparse matrix or not?. A sparse matrix is a matrix, which has more zero elements than nonzero elements.

43) Write An Algorithm using Javascript to swap two numbers using temporary variables, using arithmetic operators, using logical operators?(Swapping should be done using 5 methods)

44) Write a program to Convert Decimal to Binary and Binary to Decimal

45) Write a program to Convert Negative Decimal Number to Binary (2's Complement)

46) Write a program using Left Shift Operator (6<<i = 6*2^i) and Derive the General Formula

47) Write a program using Right Shift Operator (6>>i = 6/2**i) and Derive the General Formula

48) Write An Algorithm in Javascript to find the Power Function with Left Shift(1<<N) and without Left Shift, M^N Power Function.

49) Write An Algorithm using Javascript finding Perfect Square Root of a Number without using Built in Function

50) Write An Algorithm using Javascript to Reverse Array Elements without using Built in Function, **with** using temp array?

51) Write An Algorithm using Javascript to check if a given number is in the following series:

4,16,64,256,1024,4096,16384.,……., 4^N

52) Write a program to find the minimum and maximum values that can be calculated by summing exactly four of the five integers. Then print the respective minimum and maximum values as a single line of two space-separated long integers.

Example, Input: [1, 2, 3, 4, 5]

Output; [10, 14]

Explanation

Our initial numbers are 1, 2, 3, 4, and 5. We can calculate the following sums using four of the five integers:

1. If we sum everything except 1, our sum is $2 + 3 + 4 + 5 = 14$.
2. If we sum everything except 2, our sum is $1 + 3 + 4 + 5 = 13$.
3. If we sum everything except 3, our sum is $1 + 2 + 4 + 5 = 12$.
4. If we sum everything except 4, our sum is $1 + 2 + 3 + 5 = 11$.
5. If we sum everything except 5, our sum is $1 + 2 + 3 + 4 = 10$.

53) Write a program in the Tower of Hanoi consists of three pegs or towers with n disks placed one over the other. The objective of the puzzle is to move the stack to another peg following these simple rules.

1. Only one disk can be moved at a time.
2. No disk can be placed on top of the smaller disk.

54) Write a program to generate N fibonacci series, generate fibonacci series upto N. With recursion, with iteration. Which approach is more efficient?

55) Write a program to calculate factorial of any given number N. With recursion, without recursion.

Which approach is more efficient?

56) Write a program that prints all interleavings of the given two strings,given two strings str1 and str2 .

You may assume that all characters in both strings are different

Input: str1 = "AB", str2 = "CD"

Output:

ABCD

ACBD

ACDB

CABD

CADB

CDAB

PRINTING PATTERNS:

57-87) Write the algorithm to produce as shown below patterns

12345
1234
123
12
1

12345
2345
345
45
5

54321
4321
321
21
1

54321
5432
543
54
5

1
12
123
1234
12345

5
45
345
2345
12345

```
12344321
123**321
12****21
1******1
```

```
    1
  2 3 4
5 6 7 8 9
```

```
1   2   3   4   5   6   7   8   9   10
36  37  38  39  40  41  42  43  44  11
35  64  65  66  67  68  69  70  45  12
34  63  84  85  86  87  88  71  46  13
33  62  83  96  97  98  89  72  47  14
32  61  82  95  100 99  90  73  48  15
31  60  81  94  93  92  91  74  49  16
30  59  80  79  78  77  76  75  50  17
29  58  57  56  55  54  53  52  51  18
28  27  26  25  24  23  22  21  20  19
```

```
11111
2222
333
22
1
```

```
5432*
543*1
54*21
5*321
*4321
```

1
21
321
4321
54321

5
54
543
5432
54321

1
22
333
4444
55555

5
44
333
2222
11111

55555
4444
333
22
1

11111
2222
333
44
5

```
    *
   ***
  *****
 *******
*********
```

```
*********
 *******
  *****
   ***
    *
```

```
**********
****  ****
***    ***
**      **
*        *
**      **
***    ***
****  ****
**********
```

```
    *
   ***
  *****
 *******
*********
 *******
  *****
   ***
    *
```

```
*
**
***
****
*****
```

```
*****
****
***
**
*
```

A
AB
ABC
ABCD
ABCDE

E
DE
CDE
BCDE
ABCDE

A
BA
CBA
DCBA
EDCBA

E
ED
EDC
EDCB
EDCBA

ABCDE
ABCD
ABC
AB
A

ABCDE
BCDE
CDE
DE
E

EDCBA
DCBA
CBA
BA
A

EDCBA
EDCB
EDC
ED
E

Write a program to print Pascal triangle as shown below for given N input lines:

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1

Write a program to print Floyd's triangle as shown below for given N lines:

1

2 3

4 5 6

7 8 9 10

11 12 13 14 15

16 17 18 19 20 21

88)Write a program to produce the sum of integers upto given input n

1 + 2 + 3 + 4 + 5 + ... + n.

89) Write a program to produce the sum of squares upto given n value

(1*1) + (2*2) + (3*3) + (4*4) + (5*5) + ... + (n*n)

90) Write a program to produce the sum as below

(1) + (1+2) + (1+2+3) + (1+2+3+4) + ... + (1+2+3+4+...+n)

91) Write a program to produce the sum of series as below

1! + 2! + 3! + 4! + 5! + ... + n!

92) Write a program to produce the sum of series as below

(1^1) + (2^2) + (3^3) + (4^4) + (5^5) + ... + (n^n)

93) Write a program to produce the sum of series as below

(1!/1) + (2!/2) + (3!/3) + (4!/4) + (5!/5) + ... + (n!/n)

94) Write a program to produce the sum of series as below

[(1^1)/1] + [(2^2)/2] + [(3^3)/3] + [(4^4)/4] + [(5^5)/5] + ... + [(n^n)/n]

95) Write a program to produce the sum of series as below

[(1^1)/1!] + [(2^2)/2!] + [(3^3)/3!] + [(4^4)/4!] + [(5^5)/5!] + ... + [(n^n)/n!]

96) Write a program to produce the sum of series as below

1/2 - 2/3 + 3/4 - 4/5 + 5/6 - ..... n

97)Write a program to produce the series as below

1 2 3 6 9 18 27 54...

Hint : http://www.edugoog.com/details/1-2-3-6-9-18-54-number-series.html

98)Write a program to produce the series as of below

2 15 41 80 132 197 275 366 470 587

Hint:http://cbasicprogram.blogspot.com/2013/01/series-program-11.html

99) Write a program to produce the series as of below

1 3 8 15 27 50 92 169 311

HInt:http://cbasicprogram.blogspot.com/2013/01/series-program-12.html

BIT MANIPULATION ALGORITHMS:

100) Write a program for given array where every element occurs three times, except one element which occurs only once. Find the element that occurs once.

101)Write a program to Multiply given input with number 10 without using addition and multiplication operator (Hint : Left Shift)

102)Write a function that returns true if the signs of given integers are different, otherwise false

Given two signed integers,.

For example, the function should return true -1 and +100, and should return false for -100 and -200.

The function should not use any of the arithmetic operators.

103) Write a program to add one to a given number. The use of operators like '+', '-', '*', '/', '++', '–' …etc are not allowed.

104) Given a integer x, Write a function that multiplies x with 3.5 and returns the integer result.

You are not allowed to use %, /, *.

Input: 5

Output: 17 (Ignore the digits after decimal point)

105) Write a program Given an integer to find whether it is a power of 4 or not.

106) Write a program to rotate the bits of a number.

Bit Rotation: A rotation (or circular shift) is an operation similar to shift except that the bits that fall off at one end are put back to the other end.

In left rotation, the bits that fall off at left end are put back at right end.

In right rotation, the bits that fall off at right end are put back at left end.

```
Left Rotation of 16 by 2 is 64
Right Rotation of 16 by 2 is 4
```

107) Write a program to find number which occurs odd number of times when given an array of positive integers all numbers occur even number of times except one

108) Count SET BITS in an integer.

Write an efficient program to count number of 1s in binary representation of an integer.

Solve all the problems in this URL :

https://www.geeksforgeeks.org/bitwise-algorithms/

https://www.hackerearth.com/practice/notes/bit-manipulation/

https://www.hackerrank.com/domains/algorithms/bit-manipulation

https://www.hackerearth.com/practice/basic-programming/bit-manipulation/basics-of-bit-manipulation/tutorial/

RECURSION PROBLEMS:

109) Write a program to print the Fibonacci sequence using recursion

110)Write a program to print the factorial of a given number using recursion

111)Write a program to solve Tower of Hanoi using recursion

Recursion Additional Problems:

**** https://www.geeksforgeeks.org/recursion-practice-problems-solutions/

https://www.geeksforgeeks.org/category/algorithm/recursion/

https://www.hackerrank.com/domains/fp/fp-recursion

PROBLEMS ON STRINGS :

https://www.geeksforgeeks.org/string-data-structure/

PROBLEMS ON PERMUTATIONS AND COMBINATIONS:

112) Write a program to generate and print all possible combinations of r elements in given an array of size n.

For example, if input array is {1, 2, 3, 4} and r is 2, then output should be {1, 2}, {1, 3}, {1, 4}, {2, 3}, {2, 4} and {3, 4}.

https://www.geeksforgeeks.org/print-all-possible-combinations-of-r-elements-in-a-given-array-of-size-n/

https://www.geeksforgeeks.org/combinations-from-n-arrays-picking-one-element-from-each-array/

#Write a program to Program to calculate the Combinations and Permutations!

Combination means way of selecting a things or particular item into group or sets.

nCr=n!/r!(n-r)!.

Permutations means possible way of rearranging in the group or set in the particular order.

nPr=n!/(n-r)!

113) Write a program to print all permutations of a given string

SORTING ALGORITHMS :

BUBBLE SORT:

https://www.geeksforgeeks.org/bubble-sort/

https://www.hackerrank.com/contests/problem1/challenges/bubble-sort-

https://www.hackerearth.com/practice/algorithms/sorting/bubble-sort/practice-problems/

INSERTION SORT:

https://www.geeksforgeeks.org/insertion-sort/

https://www.hackerearth.com/practice/algorithms/sorting/insertion-sort/practice-problems/

https://www.hackerrank.com/challenges/insertionsort1/problem

https://www.hackerrank.com/challenges/insertionsort2/problem

https://brilliant.org/practice/insertion-sort/

SELECTION SORT:

https://www.geeksforgeeks.org/selection-sort/

https://www.hackerearth.com/practice/algorithms/sorting/selection-sort/practice-problems/algorithm/selection-sort-problem/

https://practice.geeksforgeeks.org/problems/selection-sort/1

MERGE SORT:

https://www.geeksforgeeks.org/merge-sort/

https://www.hackerearth.com/practice/algorithms/sorting/merge-sort/practice-problems/

https://www.hackerrank.com/contests/hw1/challenges/merge-sort

QUICK SORT:

https://www.geeksforgeeks.org/quick-sort/

https://www.hackerearth.com/practice/algorithms/sorting/quick-sort/practice-problems/

https://www.hackerrank.com/challenges/quicksort1/problem

https://www.hackerrank.com/challenges/quicksort2/problem

https://www.hackerrank.com/challenges/quicksort3/problem

https://www.hackerrank.com/challenges/quicksort4/problem

RADIX SORT:

https://www.geeksforgeeks.org/radix-sort/

https://www.hackerearth.com/practice/algorithms/sorting/radix-sort/tutorial/

https://brilliant.org/wiki/radix-sort/

HEAP SORT:

https://www.geeksforgeeks.org/heap-sort/

https://www.hackerearth.com/practice/algorithms/sorting/heap-sort/tutorial/

https://www.programiz.com/dsa/heap-sort

https://www.toptal.com/developers/sorting-algorithms/heap-sort

COUNTING SORT:

https://www.geeksforgeeks.org/counting-sort/

https://www.hackerearth.com/practice/algorithms/sorting/counting-sort/practice-problems/

https://www.hackerrank.com/challenges/countingsort1/problem

https://www.hackerrank.com/challenges/countingsort2/problem

https://www.hackerrank.com/challenges/countingsort3/problem

https://www.hackerrank.com/challenges/countingsort4/problem

https://brilliant.org/practice/counting-sort/

SEARCHING ALGORITHMS:

https://www.hackerrank.com/domains/algorithms/search

http://www.geeksforgeeks.org/search-in-row-wise-and-column-wise-sorted-matrix/

http://www.spoj.com/problems/TEST/
http://www.spoj.com/problems/AGGRCOW/
http://www.spoj.com/problems/SUMFOUR

LINEAR SEARCH:

https://www.geeksforgeeks.org/linear-search/

https://www.hackerearth.com/practice/algorithms/searching/linear-search/tutorial/

BINARY SEARCH:

https://www.geeksforgeeks.org/binary-search/

https://www.hackerearth.com/practice/algorithms/searching/binary-search/tutorial/

https://www.interviewbit.com/courses/programming/topics/binary-search/

https://www.geeksforgeeks.org/binary-search-preferred-ternary-search/

TERNARY SEARCH:

https://www.hackerearth.com/practice/algorithms/searching/ternary-search/tutorial/

https://www.hackerrank.com/topics/ternary-search

HASHING ALGORITHMS:

1. **Hash Tables,**
2. **Hash Functions,**
3. **Complexity**
4. **Collision Resolution*****

https://www.geeksforgeeks.org/hashing-data-structure/

LINKED LISTS:

SINGLY LINKED LIST :

https://www.geeksforgeeks.org/data-structures/linked-list/singly-linked-list/

114)Write a program for the Linked List Insertion

115)Write a program for the Linked List Deletion (Deleting a given key)

116)Write a program for the Linked List Deletion (Deleting a key at given position)

117)Write a program for the find Length of a Linked List (Iterative and Recursive)

118)Write a program to Search an element in a Linked List (Iterative and Recursive)

119)Write a function to get Nth node in a Linked List

120)Write a program to get Nth node from the end of a Linked List

121)Write a program to Print the middle of a given linked list

122)Write a function that counts the number of times a given input occurs in a Linked List

123)Write a program to Detect loop in a linked list

124)Write a program to find length of loop in linked list

125)Write an Efficient program to Function to check if a singly linked list is palindrome

126)Write a program to Remove duplicates from a sorted linked list

127)Write a program to Remove duplicates from an unsorted linked list

128)Write an Efficient program to Swap nodes in a linked list without swapping data

129)Write a program to Pairwise swap elements of a given linked list

130)Write a program to Move last element to front of a given Linked List

131)Write a program to Intersection of two Sorted Linked Lists

132)Write an Efficient program to Intersection point of two Linked Lists.

133)Write a program to QuickSort on Singly Linked List

134)Write a Algorithm to Segregate even and odd nodes in a Linked List

135)Write a Algorithm Reverse a linked list

CIRCULAR LINKED LIST:

https://www.geeksforgeeks.org/tag/circular-linked-list/

136)Write a Algorithm to Traverse Circular Linked List

137)Write a Algorithm to Split a Circular Linked List into two halves

138)Write a Algorithm insert for Sorted circular linked list

139)Write a Algorithm to Check if a linked list is Circular Linked List

140)Write a Algorithm to Convert a Binary Tree to a Circular Doubly Link List

141)Write a Algorithm to Insert in Circular Singly Linked List

142)Write a Algorithm to Delete from a Circular Linked List

143)Write a Algorithm to Count nodes in Circular linked list

144)Write a Algorithm for Josephus Circle using circular linked list

145)Write a Algorithm to Convert singly linked list into circular linked list

146)Write a Algorithm to Implement Deque using circular array

147)Write a Algorithm to Exchange first and last nodes in Circular Linked List

DOUBLY LINKED LIST:

https://www.geeksforgeeks.org/data-structures/linked-list/doubly-linked-list/

148)Write a Algorithm to insert Doubly Linked List

149)Write a Algorithm to Delete a node in a Doubly Linked List

150)Write a Algorithm to Reverse a Doubly Linked List

151)Write a Algorithm to make QuickSort on Doubly Linked List

152)Write a Algorithm to Swap Kth node from beginning with Kth node from end in a Linked List

153)Write a Algorithm to Merge Sort for Doubly Linked List

154)Write a Algorithm to Create a Doubly Linked List from a Ternary Tree

155)Write a Algorithm to Find pairs with given sum in doubly linked list

156)Write a Algorithm to Insert value in sorted way in a sorted doubly linked list

157)Write a Program Delete a Doubly Linked List node at a given position

158)Write a Program to Count triplets in a sorted doubly linked list whose sum is equal to a given value x

159)Write a Program to Remove duplicates from a sorted doubly linked list

160)Write a Program to Delete all occurrences of a given key in a doubly linked list

161)Write a Program to Remove duplicates from an unsorted doubly linked list

162)Write a Program to Sort the biotonic doubly linked list

163)Write a Program to Convert a given Binary Tree to Doubly Linked List

164)Write a Program to find size of Doubly Linked List

165)Write a Program to Sort insert in a doubly linked list with head and tail pointers

166)Write a Program to find Large number arithmetic using doubly linked list

167)Write a Program to Rotate Doubly linked list by N nodes

168)Write a Program to Priority Queue using doubly linked list

169)Write a Program to Reverse a doubly linked list in groups of given size

STACKS:

https://www.geeksforgeeks.org/stack-data-structure/

Implementing Stack using Array

Implementing Stack using Linked List

https://www.hackerearth.com/practice/data-structures/stacks/basics-of-stacks/practice-problems/

https://www.hackerrank.com/domains/data-structures/stacks

QUEUE:

https://www.geeksforgeeks.org/queue-data-structure/

https://www.hackerearth.com/practice/data-structures/queues/basics-of-queues/practice-problems/

TREES:

https://www.hackerrank.com/domains/data-structures/trees

https://www.geeksforgeeks.org/binary-search-tree-data-structure/

https://www.geeksforgeeks.org/binary-tree-data-structure/
https://www.geeksforgeeks.org/tag/avl-tree/
https://practice.geeksforgeeks.org/problems/what-is-avl-tree-and-give-same-example

General Tree
Binary Trees
Binary Search Trees
Threaded Binary Tree

PRIORITY QUEUES AND HEAPS:

Implementations of Priority Queue

Applications of Priority Queue
- **Priority scheduling of processes in OS**
- **Dijkstra's Algorithm for shortest path**
- **Prim's Algorithm for minimum spanning tree**
- **Heapsort**

Implementation of Heaps
https://www.geeksforgeeks.org/heap-data-structure/

https://www.geeksforgeeks.org/priority-queue-set-1-introduction/

https://www.geeksforgeeks.org/applications-priority-queue/

Greedy Algorithms

https://www.geeksforgeeks.org/greedy-algorithms/

1. Prim's MST Algorithm

2. Dijkstra's Algorithm
3. Kruskal's MST Algorithm
4. Huffman Coding

References:
https://www.topcoder.com/community/data-science/data-science-tutorials/greedy-is-good/
http://staff.ustc.edu.cn/~csli/graduate/algorithms/book6/chap17.htm

https://www.geeksforgeeks.org/greedy-algorithms/

DYNAMIC PROGRAMMING:

http://people.csail.mit.edu/bdean/6.046/dp/
https://www.topcoder.com/community/data-science/data-science-tutorials/dynamic-programming-from-novice-to-advanced/
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/lecture-videos/lecture-19-dynamic-programming-i-fibonacci-shortest-paths/
http://www.geeksforgeeks.org/fundamentals-of-algorithms/#DynamicProgramming

GRAPH THEORY:

Graph Representation
Graph Traversals
Topological Sort
Shortest Path Algorithms
Minimum Spanning Tree
Disjoint Set Data Structure

Shortest Path Problems:
http://www.spoj.com/problems/MICEMAZE/
http://www.spoj.com/problems/SHPATH/

http://www.spoj.com/problems/HIGHWAYS/
https://www.codechef.com/problems/HOMDEL
http://www.spoj.com/problems/BUGLIFE/ - Bipartite

Advanced Data Structure:

https://www.geeksforgeeks.org/advanced-data-structures/

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PRASHANTH