B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT - A

MODEL PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO:_____   **TOTAL MARKS (100) :**_____

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SET 1

1. Find the M-th maximum number and Nth minimum number in an array and then find the sum and difference of it.

	Test cases:	output –
a.	{16, 16, 16 16, 16}, M = 0, N = 1	(illegal input)
b.	{0, 0, 0, 0}, M = 1, N = 2	0
c.	{-12, -78, -35, -42, -85}, M = 3 , N = 3	-7
d.	{15, 19, 34, 56, 12}, M = 6 , N = -3	(illegal input)
e.	{85, 45, 65, 75, 95}, M = 5 , N = 2	-20

2.   Given an array of integers nums which is sorted in ascending order, and an integer target, write a function to search target in nums. If target exists, then return its index. Otherwise, return -1.integer target. Write a program to search a number in a list using binary search and estimate time complexity

Test cases:

    Input : (45, 4, 23, -11, 20, 5, 10, 50)   Key element 5
    Output   Found in the position 2

    Input : (8,-2, 11, 8, 6, 3 10,0)   Key element 2
    Output   Not found

3.   Write a program to find the reverse of a given number. Find and write the time complexity

   Input / Output

        1234   -   4321
        67894   - 49876
        45a34   -   Illegal input

4.   Write a program to compute Binomial coefficient for n=8, k=8 using dynamic programming

   Using condition such as

        I   nCk =1   if k=0 or n=k

        II nCk – (n-1)Ck-1 + (n-1)Ck   for n>k>0

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT - A

MODEL PRACTICAL EXAMINATIONS

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SET 2

1.   Write a program to perform sum of subsets problem using backtracking and find the time complexity.

Input / Output

Input : Set (s) = (6, 2,8,1,5)   sum is 9   Set (s) = (6, -4, 7, -1, 5, 2,8,1,)   sum is 10

Output : Subset is (6,2,1)   (2,8,1)   Subset is (6,-4, 8)   (2,8)

2. Write a program to check the given number is Armstrong or not.

The k-digit number N is an Armstrong number if and only if the k-th power of

each digit sums to N.

 Given a positive integer N, return true if and only if it is an Armstrong number.

Input : 153   Input : 419

Output : True   Output : False

3. Write a program to perform Strassen's Matrix Multiplication for the 2*2 matrix elements.

 Find its time complexity.

        Example:

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \times \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae + bg & af + bh \\ ce + dg & cf + dh \end{bmatrix}$$

A, B and C are square metrices of size N x N
a, b, c and d are submatrices of A, of size N/2 x N/2
e, f, g and h are submatrices of B, of size N/2 x N/2

4. Write a program to find the Factorial of a number using recursive method and write its time complexity.

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT - A

MODEL PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO _____ **SET 3**   **TOTAL MARKS (100) :** _____

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1. Given an array of integers nums which is sorted in ascending order, and an integer target, write a function to search target in nums. If target exists, then return its index. Otherwise, return -1. You must write an algorithm with O(log n) runtime complexity.

2. Write a program to find the GCD of two numbers. Find time complexity if recursion is

    used Perform the test cases for the given set of no's

    A.   (36,48)   2
    B.   (156, 90)   6
    C.   (-56,88)   Illegal input

3. Find Max and Min value in the list using divide and conquer find its time complexity.

    Testing Condition – Count the number of times in Comparison to find Min_Max value

    in a list n for the given set of elements.

    A.   (23,45,6,8,-9,44,7,8)   Min val = -9, Max Value = 45
    B.   (8,-5,7,2,6,0,1,9)   Min val = -5, Max Value = 9
    C.   (45, y, 9, 8,4, 7,11, 22,16)   Illegal input

4. Generate a program for Pascal triangle.

    Estimate the time complexity for the row=5

                          1

                      1   1

                  1   2   1

              1   3   3   1

          1   4   6   4   1

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT - A

MODEL PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO:_____   **TOTAL MARKS (100) :**_____

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SET 4

1.　　　　　Write a program to find the sum of digits. You are given a **0-indexed** array nums consisting of **positive** integers. You can choose two indices i and j, such that i != j, and the sum of digits of the number nums[i] is equal to that of nums[j]. Return *the* **maximum** *value of* nums[i] + nums[j] *that you can obtain over all possible indices* i *and* j *that satisfy the conditions.*

2.　　　　　Consider a two integer arrays nums1 and nums2, sorted in non-increasing order and two integers m and n, representing the number of elements in nums1 and nums2 respectively. Write a program to Merge them into a single array using Merge Sort. Derive time complexity of merge sort

.Input　Set[],　A = (3,8,1,9)　　　　Set[],　B = (4,-2, 0,7)

Output　A * B = (-2,0,1,3,4,7,9)

3.　　　　　Write a program to find all pairs shortest path using Floyd's technique and to estimate its time complexity.

	A	B	C	D
A	0	8	7	8
B	9	0	11	12
C	10	9	0	11
D	8	10	11	0

4.　　　　　Write a program to perform linear search and estimate time complexity. Compute the amount of time for completion.

　　　Input/ Output series

A = (56,89,7,13,75, 23, 8, 12)　　Key element 75　　　Element found in position 4

B = (89,45 -23,45,0, 44, 2)　　Key element 0　　　Element found in position 5

C = (45,67,56,A,34,-2,100)　　Key element 90　　　 Not Found

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT - A

UNIVERSITY PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO: **TOTAL MARKS (100) :**

`   **SET 5**

1.   Write a program to compute Binomial coefficient for n=8, k=8 using dynamic programming Using condition such as

   I   nCk =1   if k=0 or n=k

   II   nCk – (n-1)Ck-1 + (n-1)Ck   for n>k>0

2.   Write a program to find the factorial (fact)of a number and to estimate time complexity.

   Conditions such as i. n=0, return 1   otherwise fact (n-1) * n

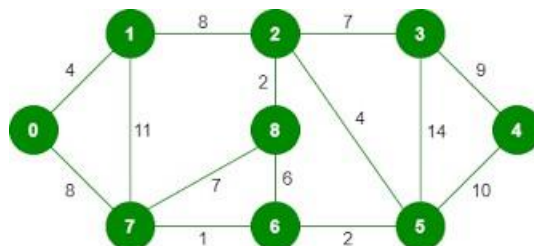   Testing condition

         a.   4   Value is 24
         b.   -3   No negative value
         c.   6   Value is 720

3.   Write a program to perform Knapsack problem using dynamic programming for the following set of object values.,

            Knapsack weight = 100

item	Weight	Profit
1	40	80
2	30	70
3	20	50
4	30	80

   .

4.   Write a program to find a minimum spanning tree using prims technique for the given graph.

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2023 SLOT - A

MODEL PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

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SET 6

1. Write a program to print the first n perfect numbers. (Hint Perfect number means **a positive** integer that is equal to the sum of its proper divisors)

    > Sample Input:
    > N = 3
    > Sample Output:
    > First 3 perfect numbers are: 6 , 28 , 496
    > Test Cases:
    > 1.   N = 0
    > 2.   N = 5
    > 3.   N = -2
    > 4.   N = -5
    > 5.   N = 0.2

2. Write a Program to find even Sum of Fibonacci Series Till number N?

    > Sample Input: n = 4
    > Sample Output: 33
    >   (N = 4, So here the Fibonacci series will be produced from 0th term till 8th term: 0, 1, 1, 2, 3, 5, 8, 13, 21
    > Sum of numbers at even indexes = 0 + 1 + 3 + 8 + 21 = 33)

3.   Write a program to perform Selection sort and estimate time Complexity

    Estimate the time iteration for the following set of numbers.

Input	Output
A. (10,5, 80,-2, 15,23, 45)	(-2, 5, 10, 15, 23, 45, 80)
B. (12, 3, 0, 34, -11, 2, 8)	(-11, 0, 3, 8, 12, 22, 34

4. A **perfect number** is a **positive integer** that is equal to the sum of its **positive divisors**, excluding the number itself. A **divisor** of an integer x is an integer that can divide x evenly.
    Given an integer n, return true *if* n *is a perfect number, otherwise return* false.

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT - A

MODEL PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO: **TOTAL MARKS (100) :**

`   **SET 7**

. 1.   Write a program to check for the following cases and find its time complexity

        Case 1: Given string is palindrome or not
        Case 2: Given number is palindrome or not
        Sample Input:
        Case = 1
        String = MADAM
        Sample Output:
        Palindrome
        Test cases:
        1. MONEY
   2. 5678765
        3. MALAY12321ALAM
        4. MALAYALAM
        5. 1234.4321

2.   Write a program to insert a number in a list
        Testing Condition
        i.   Insert at the beginning
        ii. Insert in the middle
        iii. Insert at the last
        iv. Not Available position in a list

3.   The n-queens puzzle is the problem of placing n queens on an n x n chessboard such that no two queens attack each other. Given an integer n, return all distinct solutions to the n-queens puzzle. You may return the answer in any order. Write a program for the same.
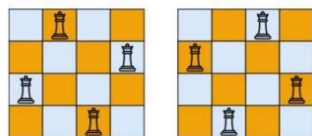
4.   Write a Program to find even Sum of Fibonacci Series Till number N?
        Sample Input: n = 4
        Sample Output: 33
           (N = 4, So here the Fibonacci series will be produced from 0th term till 8th term: 0, 1, 1, 2, 3, 5, 8, 13, 21
        Sum of numbers at even indexes = 0 + 1 + 3 + 8 + 21 = 33)

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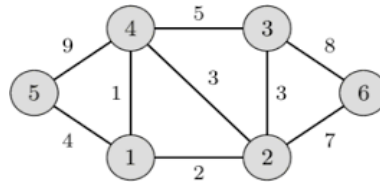
MODEL PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO:_____   **TOTAL MARKS (100) :**_____

` **SET 8**

1. Write a program to perform Minimum spanning tree using greedy techniques and estimate time complexity for the given set of values.

2.   Write a program to perform Knapsack problem using greedy approach for the following set of object values.,

Knapsack weight = 100

item	Weight	Profit
1	40	80
2	30	70
3	20	50
4	30	80

3.   Write a program to perform Quick sort and estimate time complexity.

Input	Output
(10,5, 80,-2, 15,23, 45)	(-2, 5, 10, 15, 23, 45, 80)
(12, 3, 0, 34, -11, 2, 8)	(-11, 0, 3, 8, 12, 22, 34

4. Write a program to print the reverse of a string. And estimate the time complexity for the given inputs.

Test cases: output –

" as\nr5Y"   Y5rn|sa

"7yut02"   20tuy7

 "EryEq   qEyrE

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT - A

MODEL PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO:_____   **TOTAL MARKS (100) :**_____

`   **SET 9**

1.   Write a program to perform Bubble sort and estimate time Complexity for n values.

Perform test cases for the following set of numbers. Estimate the time iteration for the following set of numbers.

Input	Output
(10,5, 80,-2, 15,23, 45)	(-2, 5, 10, 15, 23, 45, 80)
(12, 3, 0, 34, -11, 2, 8)	(-11, 0, 3, 8, 12, 22, 34

2.   Given a sorted array keys[0.. n-1] of search keys and an array freq[0.. n-1] of frequency counts, where freq[i] is the number of searches to keys[i]. Construct a binary search tree of all keys such that the total cost of all the searches is as small as possible.
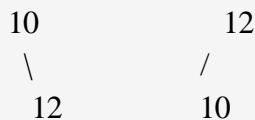
          Example

Input:
n = 2
keys = {10, 12}
freq = {34, 50}
Output: 118
Explanation:
There can be following two possible BSTs
      10   12
       \   /
        12   10
*The cost of tree I is 34*1 + 50*2 = 134*
*The cost of tree II is 50*1 + 34*2 = 118*

3.   Write a program to perform permutation of an array of integers and make all the arrangement are to be in possible sequence.

          Input a{]={1,2,3)   Output [1,2,3], [1,3,2], [2, 1, 3], [2, 3, 1], [3,1,2], [3,2,1].

4.   Write a program to print first 2 minimum values from the numbers in below list.

          Input a[]=(3, 5, -4, 1, 8, 2, 0, 4)   Output (-4, 0)

B.E./ B.Tech DEGREE EXAMINATION - FEBRUARY 2024 SLOT -

UNIVERSITY PRACTICAL EXAMINATIONS

CSA 06 - DESIGN AND ANALYSIS OF ALGORITHMS

REGISTER NO: **TOTAL MARKS (100) :**

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SET 10

1.   Write a program to check whether the given no is palindrome or not Given an integer x, return true if x is a palindrome, and false otherwise

input	out put
121	True
234	False
4554	True

2.   Write a program for the given pattern the given pattern

If n=4

```
            1
        1       2
    1       2       3
1       2       3       4
```

3. Write a program to find out Hamiltonian circuit using backtracking method. And find the time complexity for the given set of elements is

	a	b	c	d	e	f
a	0	0	1	1	1	1
b	0	0	1	0	0	1
c	1	1	0	1	1	1
d	1	0	1	0	1	0
e	1	0	0	1	0	0
f	1	1	1	0	0	0

4. Write a program to return all the possible subsets for a given integer array. Return the solution in any order.

Input nums= [1,2,3]

Output : [[], [1], [2], [3], [1,2], [1,3], [2,3], [1,2,3]]