

# Introduction to Programming 1

## Lab 7

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- 1) Write a program in C to find the transpose of a square matrix. (The size of the matrix should be given by the user)
- 2) Write a program that fills a five-by-five matrix as follows:
  - Upper left triangle with +1s.
  - Lower right triangle with -1s.
  - Right to left diagonal with 0s.Display the content of the matrix.
- 3) Given, two one dimensional arrays **A** and **B** which are sorted in ascending order. Write a program to merge them into a sorted array **C** that contains every item from array **A** and **B**, in ascending order.
- 4) Given below is the list of marks obtained by a class of 50 students in an annual examination.

43, 65, 51, 27, 79, 11, 56, 61, 82, 09

25, 36, 07, 49, 55, 63, 74, 81, 49, 37

40, 49, 16, 75, 87, 91, 33, 24, 58, 78

65, 56, 76, 67, 45, 54, 36, 63, 12, 21

73, 49, 51, 19, 39, 49, 68, 93, 85, 59.

Write a program to count the number of students belonging to each of the following groups of marks:

0-9, 10-19, ..... , 90-99, 100.

- 5) Write a program to search for an element in an array using linear search.
- 6) Write a program that inserts an element in an array at a specified index by moving elements to the right.
- 7) Write a program to check whether a square matrix is symmetric or not.
- 8) Write a program to reverse a portion of an array.
- 9) Write a program that will find the number of occurrences of a character in a string.
- 10) Write a program to count number of words in a string and print each word in a separate line.
- 11) Write a program to read a string and out put the frequency of each character in that string.
- 12) Write a program to convert a string in to uppercase.
- 13) Write a program to accept a string and count the number of vowels present in the string.
- 14) Write a program to test whether a string is palindrome or not.
- 15) Write a program to multiply two 2D matrices.
- 16) Write a function *isPrime*, which takes a number as an input and returns 1 if the number is prime or 0 otherwise.
- 17) Write a function that inputs two numbers and print all prime numbers between those numbers.

18) The Fibonacci numbers are defined recursively as follows:

$$\begin{aligned}f_1 &= 1 \\f_2 &= 1 \\f_n &= f_{n-1} + f_{n-2}\end{aligned}$$

Write a function that will generate and print the first  $n$  Fibonacci numbers.

19) Use a recursive function call to evaluate the following expression

$$f(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

20) Given a list of elements. Write a program to find the maximum of those elements using recursion.

21) Write a recursive program to solve Tower of Hanoi problem. Check the time taken by your solution for different number of discs.

[ Function Prototype: TOH(int n, int tower1, int tower2, int tower3) ]

where n= no of Discs. tower1, tower2, tower3 are integer values representing the source, middle and destination towers respectively.

A Sample call to the program from main function: TOH(3, 1, 2, 3) solves the problem for 3 discs, and source, middle and destination towers are represented by numbers 1, 2, and 3 respectively.

*Sample Output of this call may look like:*

Move the top disc from tower1 to tower3  
Move the top disc from tower1 to tower2  
Move the top disc from tower3 to tower2  
Move the top disc from tower1 to tower3  
Move the top disc from tower2 to tower1  
Move the top disc from tower2 to tower3  
Move the top disc from tower1 to tower3

22) A number is called perfect if sum of proper divisors of that number is equal to the number. For example 28 is a perfect number since  $1+2+4+7+14 = 28$ . Write a function to print all the perfect numbers in a given range.

23) Two different numbers are called amicable numbers if sum of proper divisors of one is equal to the other number. For example 220 and 284 are amicable numbers.

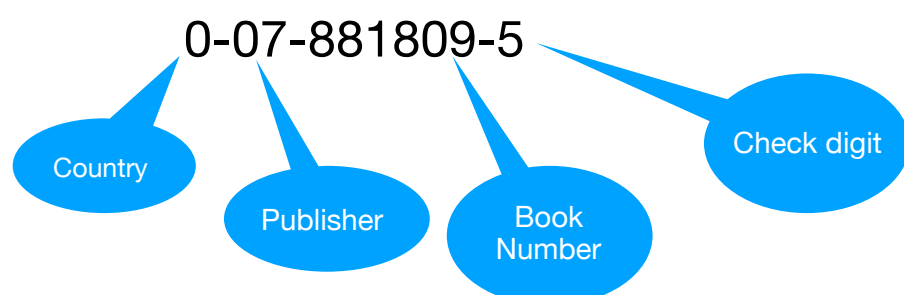
Since, Sum of proper divisors of 220 is  $1 + 2 + 4 + 5 + 10 + 11 + 20 + 22 + 44 + 55 + 110 = 284$  Sum of proper divisors of 284 is  $1 + 2 + 4 + 71 + 142 = 220$

Write a function to print pairs of amicable numbers in a given range.

- 24) Write a function that inputs a number and prints the multiplication table of that number.
- 25) Write a function **cubesum( ... )** that accepts an integer and returns the sum of the cubes of individual digits of that number.
- 26) Write a function that converts a decimal number to binary number.
- 27) Write a function that inputs a binary or octal number and converts to decimal number.
- 28) Write a function to print twin primes less than the number 'n'.
- 29) Write a function that accepts a character, if the character is a lower case alphabet its upper case equivalent is returned otherwise the unchanged character is returned.
- 30) Write a function to multiply two integers 'a' and 'b' using recursion.
- 31) Given two arrays A and B of 10 integers each. Write a function that tests if every element of array A is equal to the corresponding element in array B. The function will return true if all elements are equal and false if at least one element is not equal.
- 32) The Pascal triangle can be used to compute the coefficients of the terms in the expansion of  $(a + b)^n$ . Write a function that creates a 2D matrix representing the Pascal triangle. A Pascal triangle of size 7 is shown as below.

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

- 33) An International Standard Book Number (ISBN) is used to uniquely identify a book. It is made of 10 digits. Write a function to that test an ISBN to see if it's valid. For an ISBN number to be valid, the weighted sum of the 10 digits must be evenly divisible by 11. The tenth digit may be  $x$  which indicates 10. To determine the weighted sum, the value of each position is multiplied by its relative position, starting from the right, and the sum of the products is determined. The calculation of the weighted sum for the following ISBN is shown below.



Code	Weight	Weighted Value
0	10	0
0	9	0
7	8	56
8	7	56
8	6	48
1	5	5
8	4	32
0	3	0
9	2	18
5	1	5
	Weighted Sum	220

Since the (weighted sum) % 11 is zero, the ISBN number is a valid number. Test your function with the example given above. Also test the result with another ISBN as:  
**0-08-781809-5**