

Introduction to Computer Programming

Mid-semester Examination

Time: 3 hours

Marks: 25

Develop C programs for the following questions. Do not use any built-in functions that were not taught in class. Marks awarded will be based on the correctness and efficiency of the programs and on how systematically the problem is tackled.

1. Let Γ denote the 2×2 matrix $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$. A matrix is said to be Γ -free if it does not contain Γ as a submatrix—i.e., it is not possible to delete some rows and columns of the matrix to obtain the matrix Γ . Write a program to check if an input matrix is Γ -free.

OR

An *Armstrong number* is a number such that the sum of the cubes of the digits in it is equal to the number itself. Write a program to print all the Armstrong numbers from 1 to n , where n is an input integer.

(5 marks)

2. Read a 10×10 matrix consisting of 1s and 0s from a text file. The matrix will have 0s at the lower left and upper right corners. Check if a token placed on the lower left corner can be moved to the upper right corner with only moves in the up, down, left, or right directions such that the token is always on a cell with a 0 in it.

OR

Write a program to read a text file and print the words in the file in the ascending order of the number of vowels in them.

(10 marks)

3. Write a program to input an array of integers (positive and negative) and find a subarray such that the sum of the integers in it is maximum among all subarrays.

OR

Write a program that uses any one of the iterative methods taught in class to approximate a root of the function $f(x) = x^3 + 4x \sin(2x) - 2$. Some helpful information: $f(-1.5) = -4.52828$ and $f(1) = 2.63719$.

(10 marks)