University of Science and Technology of Hanoi *** Mid-term Subject: Algorithms and Data Structures Sheet: 02 No of pages: 01		*Academic year*: 2025–2026 *Date*: 07/10/2024 *Time*: 45 minutes **Important instructions** *(according to lecturer's decision)* 1. No documents or communication devices are allowed. 2. Copying or using Internet will lead to heavy penalty	
Pathway coordinator		**Lecturer (or Head of Subject)**	**Dr. Đoàn Nhật Quang**
Student name		**Student's ID**	

Question 1 (16 pts)

A Harshad number is an integer that is divisible by the sum of its digits.

Example:

- $18/(1+8) = 18/9 = 2$, 18 is divisible by 2 → Harshad number.
- $21/(2+1) = 21/3 = 7$, divisible → Harshad number.
- $19/(1+9) = 19/10 = 1.919$, not divisible → not a Harshad number.
- $274/(2+7+4) = 274/13 = 21.07$, not divisible → not a Harshad number.

■ Implement a program in C/C++ using **Iteration** to find all Harshad numbers from 1 to n (n is a natural number). (7pts)

■ Implement another **function using Recursion** to complete the above question. (7pts)

■ Calculate the complexity of your functions or algorithms. Justify the answer (*comment directly in your source files*). (2pts)

Question 2 (4 pts)

Note: *The student can answer this question in a text format. The submitted file can be either .c or .text.*

A chat app buffers incoming messages to be displayed in the order they arrive.

■ Propose an appropriate **data structure** to handle this display task. Justify your choice. (2pts)

■ What are the basic functions to manipulate the proposed data structure? (1pt)

■ Calculate the complexity of the display process. (1pt)

--END --