

<b>University of Science and Technology of Hanoi</b> *** <b>Final Examination</b> <b>Subject: Algorithms and Data Structures</b> Sheet: 03 MST + MATH      No of pages: 01		<b>Intake: BIII      Academic year: 2021–2022</b> <b>Date: 26/11/2021      Time: 90 minutes</b> <u><b>Important instructions</b></u> <i>(according to lecturer's decision)</i> <ol style="list-style-type: none"> <li>Only the course slides and your own exercises' code are allowed in the examination venue.</li> <li>Copy or using Internet will lead to heavy penalty.</li> </ol>	
<b>Pathway coordinator</b>		<b>Lecturer (or Head of Subject)</b>	<b>Dr. Đoàn Nhật Quang</b>
<b>Student name</b>		<b>Student's ID</b>	

**Follow this instruction:**

- Create a folder "ADS\_YOURNAME\_STUDENTID" in the Desktop.
- Create the source files **question1.c** (or cpp) and **question2.c** for the corresponding problems.
- **Remove the executable files** (.exe) and **zip** all your source codes, submit to the Google classroom: <https://classroom.google.com/c/MzgyODQxMzI1Mzky?cjc=6khijwf>
- Verify your name in the files and mails, un-named or incorrect-name files lead to 0.

**Problem:**

Given an array of natural numbers as following: 4, 15, 45, 9, 40, 27, 3, 5, 10.

In this problem, we try to find all triplets (a, b, c) where a number is the product of two other numbers in the array i.e.  $a = b * c$ ; or  $b = a * c$ ; or  $c = a * b$ .

The expected outcome of the above array is: {(15, 3, 5), (45, 9, 5), (4, 40, 10), (9, 27, 3), (15, 45, 3)}

**Question 1:** (13 pts)

- Propose a pseudo-code to solve the above problem using Iteration. (2 pts)
- Implement the proposed algorithms in C/C++. (9pts)
- Calculate the complexity of your program (Best scenario, Worst scenario, Average). Justify your answer. (2 pts)

**Question 2:** (6 pts)

- Implement the Question 1 using **Recursion** (combined with iteration if necessary). (6pts)

**Question 3:** (1 pts)

- Propose a method to improve the proposed algorithm in Question 1, with the aims of reducing the complexity of proposed algorithm (time complexity or memory complexity). Justify your answer (1 pts)

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