Lab #3: Devide and Conquer

Students implemented the following problems using "Devide and Conquer" technique.

1. **Multiplication of Large Integers**

   Requirements: Multiplication of two positive integers of n bits.

Input	Output
Content of the *"input_ 1.txt"* file: 1^{st} Big integer 2^{nd} Big integer	Result of the multiplication
Example: 123456 100000	12345600000

2. **Strassen's Matrix Multiplication**

Input	Output
Content of the *"input_ 2.txt"* file: Integer n represent number of rows and columns. Matrix 1 [Blank line] Matrix 2	Result matrix
Example: 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4

3. Find the substring with largest sum of elements in an array: Given an integer array which has n elements: $a_0, a_2, ..., a_{n-1}$ Find (and identify the subarray) the largest value of: $\sum_{k=i}^{j} a_k, 0 \leq i \leq k \leq j \leq n-1$.

Input	Output
Content of the *"input_ 3.txt"* file: - 1^{st} line: positive integer `n` represent size of the given array. - 2^{nd} line: n integers, separated by a single space " ".	- 1^{st} line: The required subarray - 2^{nd} line: Begin index and End index. - 3^{rd} line: The largest total value.
Example: 6 -1 2 3 -4 5 -9	2 3 -4 5 1 4 6

4. **Closest-Pair Problem**: Let $P = \{p_0, p_1, ..., p_{n-1}\}$ be a list of $n > 1$ points in the Cartesian plane. Find a pair of points with the smallest distance between them.

Input	Output
Content of the *"input_ 4.txt"* file: - 1^{st} line: positive integer `n` represent the number of points - Next n lines: each line is a pair of diaphragm degrees and bounce degrees represent the point. Separated by a single space `" "`.	ALL pair of points with the smallest distance. Each pair located on a single line.
Example: 4 0 0 0 1 1 1 2 2	(0,0) (0,1) (0,1) (1,1)

5. **The change-making problem**: Given `k` denominations $x_1 < x_2 < ... < x_k$. Find the minimum number of coins (of certain denominations) that add up to a given amount of money n.
Note: Assumed the minimum denomination is 1.

Requirement: Using upgrade version

Input	Output
Content of the *"input_ 5.txt"* file: - 1^{st} line: `k` positive integers represent `k` denominations, sorted descending, separated by a single space `" "`. The last value is `1`. - 2^{nd} line: positive integers n represent the amount money to be exchanged.	- Denomination 1: amount - Denomination 2: amount - ... - Denomination k: amount
Example: 25 10 5 1 72	25: 2 10: 2 5: 0 1: 2

- **FILE SUBMISSION REGULATION**
  - Only submit files with `.cpp` extensions: `1.cpp`, `2-1.cpp`, `2-2.cpp` ... . **Project submission is illegal**.
  - `.cpp` files must be located in `MSSV` folder, then be compressed into `MSSV.zip(.rar)`.
  - Source code must receive input and return output as specified for each problem. Submissions with wrong regulation will result in a "0" (zero).
  - Plagiarism and Cheating will result in a "0" (zero) for the entire course.
  - Contact: **bhthong@fit.hcmus.edu.vn** for more information.

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