ADVANCED C PROGRAMMING TRAINING



| **Version** | **Author** | **Date** | **Reason/what changed** |
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| 0.1 | Elon Nguyen | 23/03/2023 | Create assignments for training new software engineers. |
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**NOTES:**

* **Trainees must create a “makefile” project for each problem/assignment.**
* **Build environment: Linux OS, Makefile, and GCC compiler.**

# Assignment 1. Memory Management and Pointers

**Duration: 1 hour.**

Write a program that calculates the sum/product of 2 matrices.

Requirements:

- There is a function that allows users to input a matrix from the keyboard using a dynamic memory allocation.

- There is a function to print the matrix on the screen.

- There is a function to calculate the sum of 2 matrices.

- There is a function to calculate the product of 2 matrices.

| **Input screen:**  Matrix A Row: 2  Matrix A Col: 2  Matrix B Row: 2  Matrix B Col: 2    Matrix A:  1 2 3 4    Matrix B:  5 6 7 8    **Output screen:**  Matrix A, Matrix B can/ can’t add together.  Matrix A, Matrix B can/ can’t multi together  Matrix B, Matrix A can/ can’t multi together    Matrix A:  1 2  3 4    Matrix B:  5 6  7 8    Matrix A + Matrix B: (*if cannot, print N/A at here*)  6 8  10 12    Matrix A \* Matrix B: (*if cannot, print N/A at here*)  6 8  10 12    Matrix B \* Matrix A: (*if cannot, print N/A at here*)  6 8  10 12 |
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# Assignment 2. Data Structure and Algorithms

**Duration: 3 hours.**

## Problem 1. Basic searching and sorting algorithms. (1 hour)

Write a program that allows users to input an array of N integers:

- Calculate the average value of the elements of the array (A) and the number of elements less than this average value (L). Print all array elements, P, and L values.

- Write a function that moves **even values to the right** and odd values to the left of the array. Print the array before and after calling this function.

**N max = 50;**

## Problem 2. Data structures. (2 hours)

Write a program to generate a table showing the salary slips of Gemtek’s employees.

Requirements:

* The “employee” structure includes:
  + ID
  + Full name
  + Department
  + Salary
  + Start date.
* There is a function that allows users to input the number of employees (Maximum = 50) and all employees’ information.
* There is a function that supports sorting the salary list in descending and ascending order.
* Allow users to select the sorted order of employees’ salary (1 = descending or 2 =ascending or 0 = sorting employee’s full name alphabetically) before printing the table.
* **Use linked list data structure.**

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# MINI PROJECT. Cryptography

**Duration: 16 hours.**

Wire an application in C that supports encoding and decoding [Morse code cipher](https://en.wikipedia.org/wiki/Morse_code) using **file handling techniques and binary tree data structure**.

*References:* [*https://drive.google.com/drive/folders/1R0IZjQ6SufA-IhSPpYW52mF1qq0bUK\_D*](https://drive.google.com/drive/folders/1R0IZjQ6SufA-IhSPpYW52mF1qq0bUK_D)

*Sample:*

*Select 1 (encoding) or 2 (decoding): 2*

*Enter your encoded file: /path/to/encoded\_test.txt.*

*Your decoded file is: /path/to/decoded\_test.txt*