**HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY**

FACULTY OF COMPUTER SCIENCE AND ENGINEERING



REPORT ASSIGNMENT

COMPUTER ARCHITECTURE

Class: CC02

Student ID: 1852312

Full Name: Dang Tran Dat

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1. **Introduction**
   1. **An overview**

The assignment is about writing a C/C++ program with specific tasks and writing some MIPS procedures, which will be call in a MIPS program to perform some requirements.

* C/C++ Program:

The main task of this program is to calculate the percentage of the difference between two matrices, the golden result matrix and the result matrix.

The golden result matrix is a product of two matrices A and B. Their dimensions are input from the user and the matrix’s data is read from a file, A.txt for matrix A and B.txt for matrix B.

Data of the result matrix is also read from file result.txt, its height is equal to the height of matrix A and the width is assigned by the width of matrix B.

The error checking while manipulating the file is necessary for this program.

* MIPS Program:

The main task of this program is to calculate the product of two matrices A and B, then write them to three separate files include A.txt, B.txt and result.txt.

The dimensions of matrix A and matrix B get from the user, the memory to store data of these matrices are allocated dynamically and the value of matrix’s elements are randomly generated by the program with the data type is an integer.

Two errors that need to be checked during the program include allocating dynamically memory fail (error code -1) and unsatisfying matrix multiplication condition (error code -1).

* 1. **Procedures/Functions description:**
* C/C++ Program:

There is one supported function in this program to help read matrix from file task to be more convenient and code will be cleaner to read.

- getMatrix: From the information about row and column of matrix passed to the function, allocating the associated dynamic array to store the value of matrix’s elements. Saved the first array address to the pointer passed then

opening with checking error and using the loop to read data of matrix from a file.

- Main: Let user input the dimension of two matrices A and B, then call getMatrix function to read data of three matrices (A, B and result) from file and store in program’s memory, check the error while manipulating with the file. From the data read of matrix A and B, performing algorithm to calculate the product of these matrices and store result to golden result matrix. Compare the value of the result matrix and golden result matrix to compute the percentage of difference and print the result to the console.

* MIPS Program:

In this assignment, three procedures for requirement 2, 3, 4 and a program for last instruction must be implemented. However, some processes are complicated or repeat many times, I write these processes as new procedures to make the code cleaner and more convenient in performing the program.

- IO\_File: There are three input arguments include name of file, a value to identify write to file or read from file and an array storing data. Because the data written to file must be an array of character’s ascii code, I have to convert data to their ascii codes before storing to the array by using Mat\_2\_Ascii\_Arr procedure to traverse each element of matrix and Write\_Int procedure to convert element to ascii code then write to buffer.

- Dynamic\_Alloc\_Memory: Two parameter are the number of array’s elements and size of each element are passed into this function for dynamic allocation. Error code -1 will be returned if allocating fail, otherwise success code 0 and first array’s address will be return.

- Matrix\_Mul: This procedure get three input arguments include first address of matrix’s array of three matrices A, B and result. The condition of matrix multiplication will be checked first and error code -1 will be return if unsatisfied. Next, the algorithm of computing the product of two matrices A and B is performed and results are saved to result matrix.

**2 Algorithm Implementation**