Assignment 8: Effect of Cache Design on performance

Submission Instructions: Make a directory named with your roll number. Write your results and observations with appropriate explanations in a file named report.pdf and include it in your directory. Other than this, include all the files you think are relevant e.g., the images showing plots, excel sheet (or any other format) for tables if you need etc. Finally submit a tar.gz i.e., [roll-no.1]_[roll-no.2]_[…].tar.gz (as follows) on moodle:

[roll-no.1]_[roll-no.2]_[…]
|----report.pdf (include the results and explanations (plots also if required in your method)
|----[codes for all parts]
|----[other files you think are relevant like plots or anything you think is required]

P1. The goal of this problem is to create a suite of programs to find the values of the following parameters of your desktop cache.

1. Line size of L1 and L2 (and optionally L3)
2. Size of L1, L2 (and optionally L3)
3. Associativities of L1, L2 (and optionally L3)
4. Average access times of L1, L2, L3 and MM

There are multiple ways of obtaining these values programmatically. You are free to use code on the internet but you should understand and explain its working. There are also multiple ways of measuring execution time of a program. Clearly specify how you have measured execution time.

Identify and elaborate upon the challenges faced by you in all the parts and how you handled them. Document them in your report.

P2. Write a simple program (e.g., matrix multiplication) to determine if the arrangement of data (e.g., matrix stored in row major or column major) affects the execution time of the program. Explain how, why and to what extent.

P3. (Optional) Modern processors have 1 or more pre-fetchers (adjacent/stride etc.). Write a simple program to study the effect of pre-fetchers on execution time. Disable the pre-fetchers one by one and check whether the performance is affected.