Assignment 4 Report

For this assignment I opted to complete the first and third experiments. The first experiment involved finding the average time taken to access an element in an array when there is a cache miss and the average time for a cache miss. To complete this, I made two large arrays with the sequence of integer values and two for loops. The first for loop traverse the first array, Array A, by loading in the first 16 elements of every 64th element in the array. This ensures that there is an equal number of cache misses from the first for loop as there is in the second. For the second for loop, I iterate sequentially through the array but this time incrementing 64 elements after each loop. This way we produce cache misses as well.

For loop 1:

For loop 2:

Using these two equations and measuring the total time taken for each loop, I was able to determine the following results for experiment 1:

|  |  |
| --- | --- |
| Average Time taken for array access with a cache miss [ms] |  |
| Average Time taken for array access with a cache hit [ms] |  |

As expected the cache miss, takes significantly longer than the cache hit.

For the second experiment, we initiated an array, an unrolled linked list and a singly linked list and compared the traversal times for each given the same number of elements in each data structure.

The following are my results for experiment 2:

|  |  |
| --- | --- |
|  | Average Time taken to traverse data structure [ms] |
| Array with 100000 elements | 0.209 |
| Unrolled Linked list with 10 nodes and 10000 elements per node | 10.987 |
| Singly linked list with 100000 nodes. | 31.979 |

As expected, The array traverses the quickest, the unrolled linked list takes longer but is still faster than the singly linked list because it is more cache friendly since each node in the unrolled linked list contains an array of elements that can be traversed quickly rather than having to access random regions in memory and have a cache miss for each node which happens in the singly linked list.

References:

Source code retrieved for Unrolled linked list: [https://www.codespeedy.com/a-c-program-for-unrolled-list/#:~:text=Unrolled%20Linked%20List%20is%20a,also%20decreases%20the%20storage%20requirements.](https://www.codespeedy.com/a-c-program-for-unrolled-list/%23:~:text=Unrolled%20Linked%20List%20is%20a,also%20decreases%20the%20storage%20requirements.)

Source code retrieved for Singly linked list: <https://www.geeksforgeeks.org/program-to-implement-singly-linked-list-in-c-using-class/>