Cache Simulator ,Intelligent Coding

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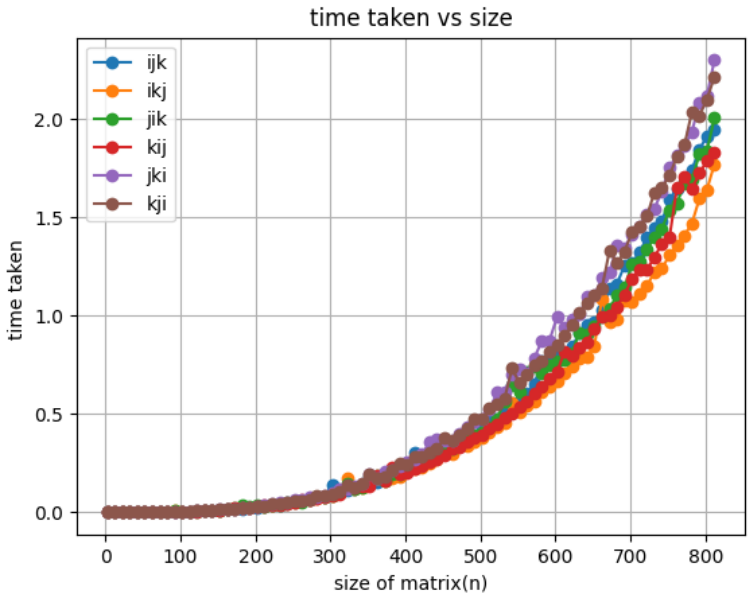
1 Matrix Multiplication

When run over different combinations of i,j,k iterations,(we vary n over 2 to 815),we observe the graph given which changes due to the features of locality and size of cache. The observation is as follows:-

- We observe that the worst performance is for j,k,i,which shows that each time the data of array which is accessed is far from the data stored at the last position ,so it takes more time .
- We also observe that ikj performs the best since although its spatial locality is worse than ijk,but initially ijk takes time to fetch all the data in cache with takes time ,and overshadow its superiority over i,k,j in spacial locality,making ikj most efficient.
- Also,other iterations are in the middle of the bounds ,as they performs average.

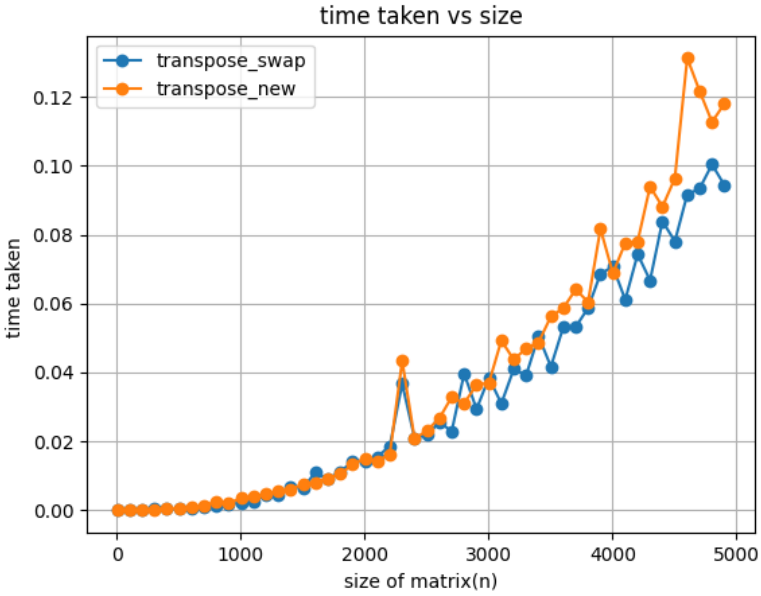


Graph for time vs size for matrix multiplication

2 Matrix Transpose

In matrix transpose ,I created a new array in array coping method ,and swapped the elements in in-place method .The n for this experiment is around 5000.The observations are as follows:-

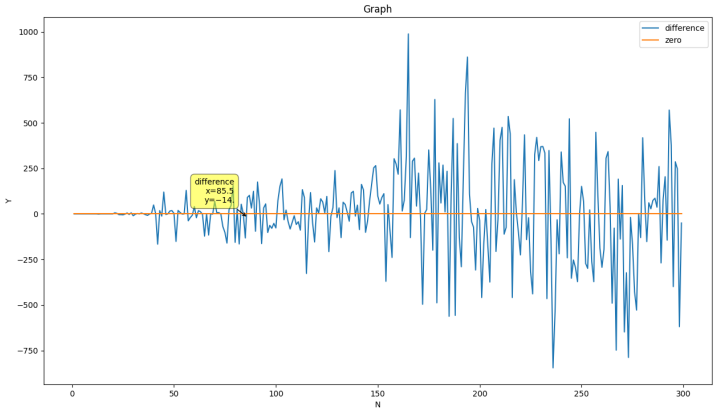
- Almost always,transpose_swap performs better than transpose_new as trivially ,creating a new array would take more than than just swapping the elements of current array .
- Also,around n=2500,a slight peak for both methods is observed Which can be due to the fact that initially all cache is empty ,and as the time passes ,it gets filled up .When it reaches all its blocks filled,it shows a sudden rise in time since for new n's, the old blocks needs to be popped out .But it again normalizes since the cache again uses spatial locality and 'adapts' to this change.



Graph for time vs size for Matrix transpose

3 Difference Graph for conclusion

We observe a peak at n =263 here. This signifies that the cache is almost equal to $4n^2, Whichisequaltoalmost270KB$.



Difference graph

4 Conclusion

In short ,cache effects the memory systems and the way our functions and codes run .The first experiment demonstrate the importance of spatial locality in cache functioning while the second one shows that creating new memory loacations and fetching them to cache takes some time .