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SUBJECT	DAA
EXPERIMENT NO :	2
DATE OF PERFORMANCE	9/2/23
DATE OF SUBMISSION	14/2/23
AIM:	Experiment on finding running time of mergesort and quicksort
PROBLEM STATEMENT 1:	
THEORY	MergeSort- Merge sort is a sorting algorithm that works by dividing an array into smaller subarrays, sorting each subarray, and then merging the sorted subarrays back together to form the final sorted array. In simple terms, we can say that the process of merge sort is to divide the array into two halves, sort each half, and then merge the sorted halves back together. This process is repeated until the entire array is sorted. QuickSort- Like Merge Sort, QuickSort is a Divide and Conquer

	algorithm. It picks an element as a pivot and partitions the given array around the picked pivot. There are many different versions of quickSort that pick pivot in different ways. Always pick the first element as a pivot. Always pick the last element as a pivot (implemented below) Pick a random element as a pivot. Pick median as the pivot. The key process in quickSort is a partition(). The target of partitions is, given an array and an element x of an array as the pivot, put x at its correct position in a sorted array and put all smaller elements (smaller than x) before x, and put all greater elements (greater than x) after x. All this should be done in linear time.
ALGORITHM	MergeSort- MERGE(A,p,q,r): nL = q-p+1 nR = r - q let L[0:nL-1] and R[0:nR-1] be new arrays for i=0 to nL-1 L[i] = A[p+i] for j=0 to nR-1 R[j] = A[q+j+1] i=0 j=0

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  k=p
  while i < nL and j < nR
    if L[i] < R[j]
      A[k] = L[i]
      i = i+1
    else
      A[k] = R[j]
      j = j+1
  k = k+1
  while i < nL
    A[k] = L[i]
    i = i+1
    k = k+1
  while j < nR
    A[k] = R[j]
    j = j+1
    k = k+1

MERGE-SORT(A,p,r):
  if p >= r
    return
  q = (q+r)/2
  MERGE-SORT(A,p,q)
  MERGE-SORT(A,q+1,r)
  MERGE(A,p,q,r)



QuickSort-
PARTITION(A,low,high):
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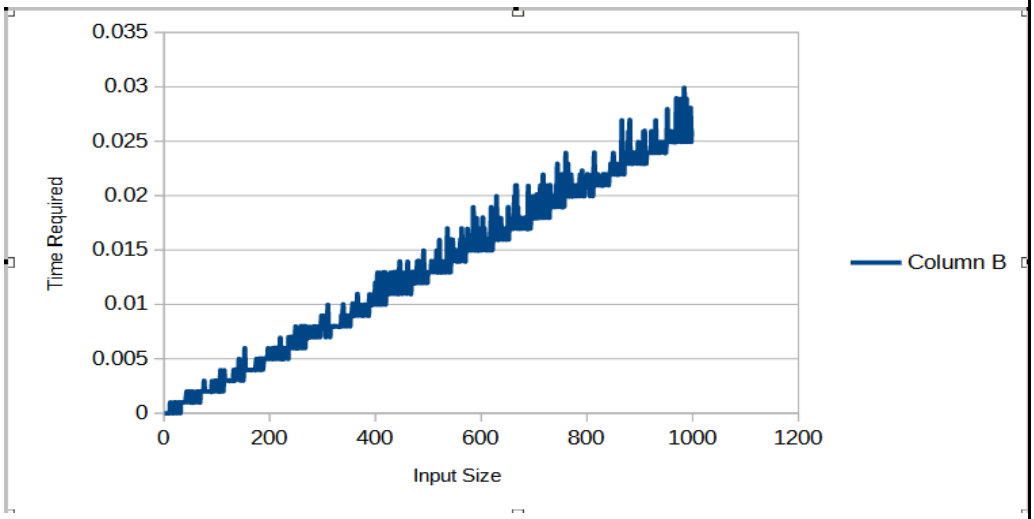
```
  x = A[high]
  i = low-1
  for j=p to r-1
    if A[j] <= x
      i = i+1
      swap A[i] with A[j]
  swap A[i+1] with A[r]
  return i+1

QUICKSORT(A,p,r):
  if q < r
    q = PARTITION(A,p,r)
    QUICKSORT(A,p,q-1)
    QUICKSORT(A,q+1,r)
```

RESULT:

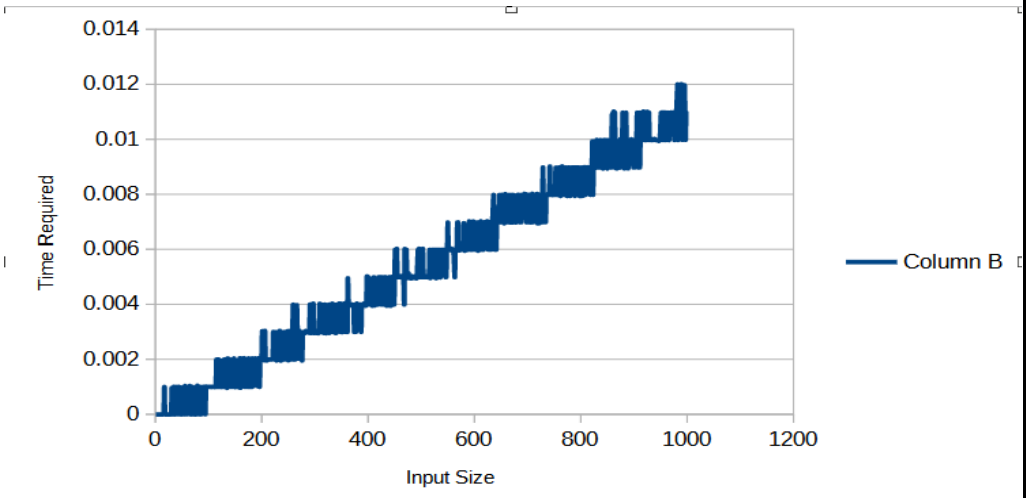
MergeSort-



From graph it can be seen that as the size of input increases the time taken for sorting increase in a kind of linear manner.Comparing with the 2 sorting algorithms which we have seen before i.e insertion sort and selection

sort merge sort is effecient for high input size.
The time complexity for merge sort is O(nlogn).

QuickSort(End Pivot)-



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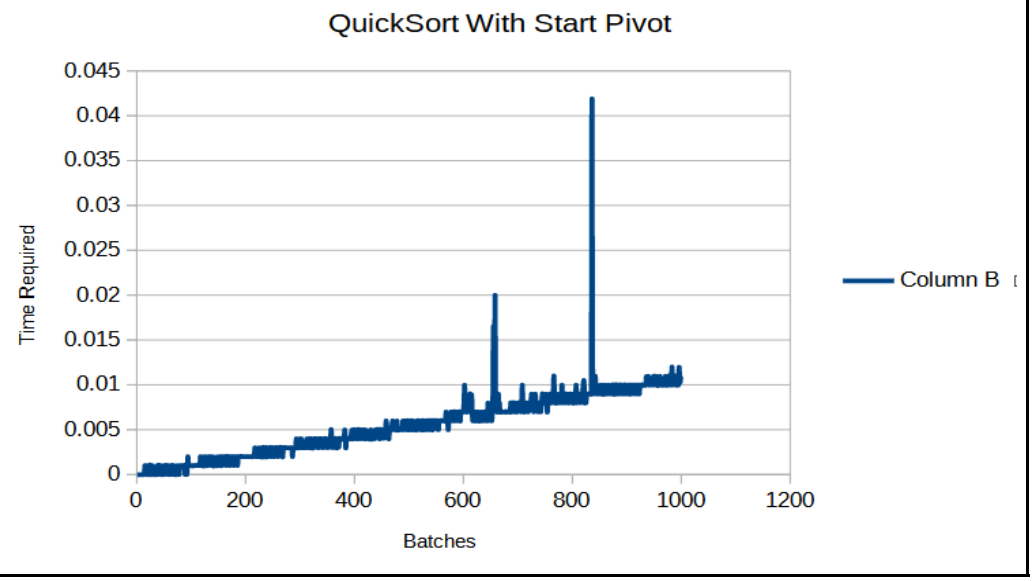
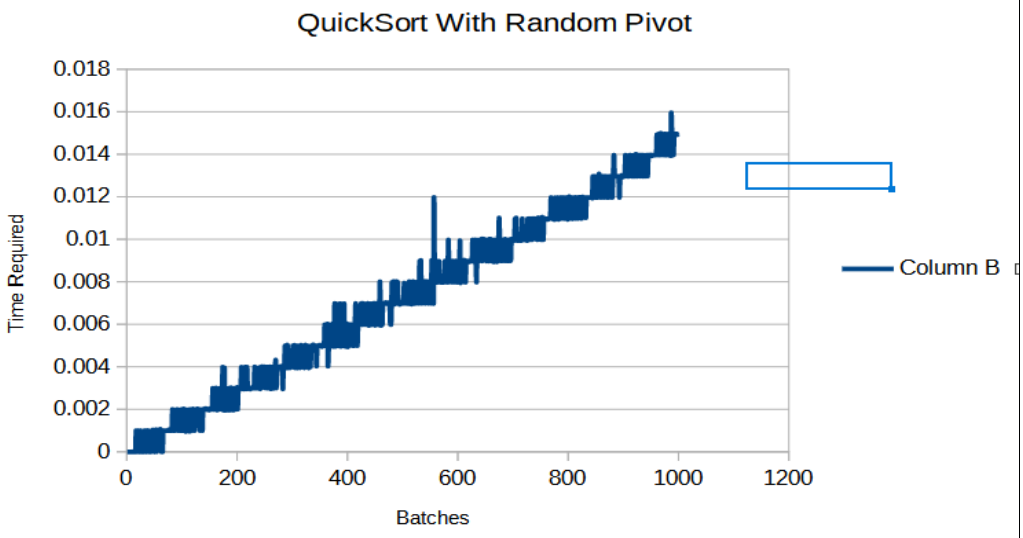
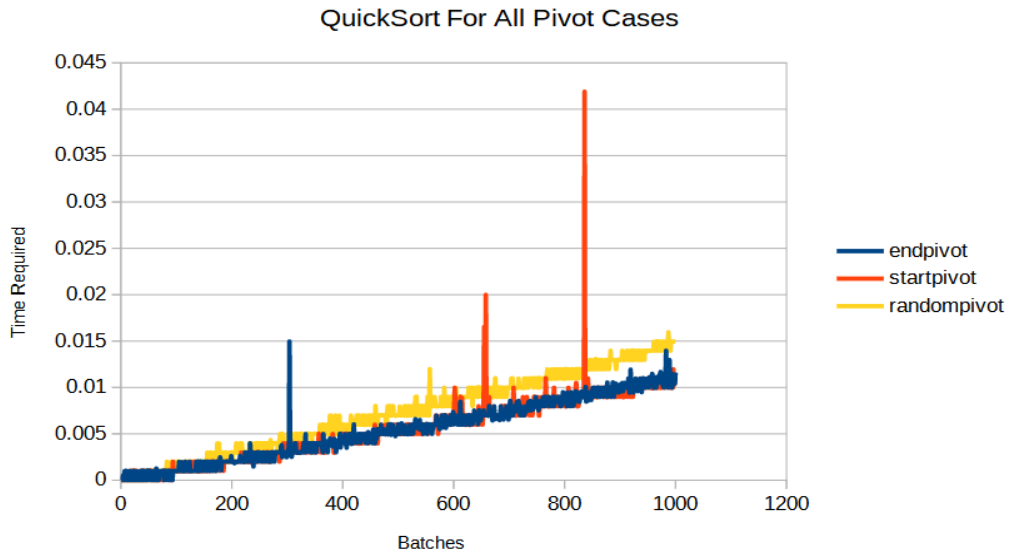
QuickSort(Start Pivot)-



QuickSort(Random Pivot)-

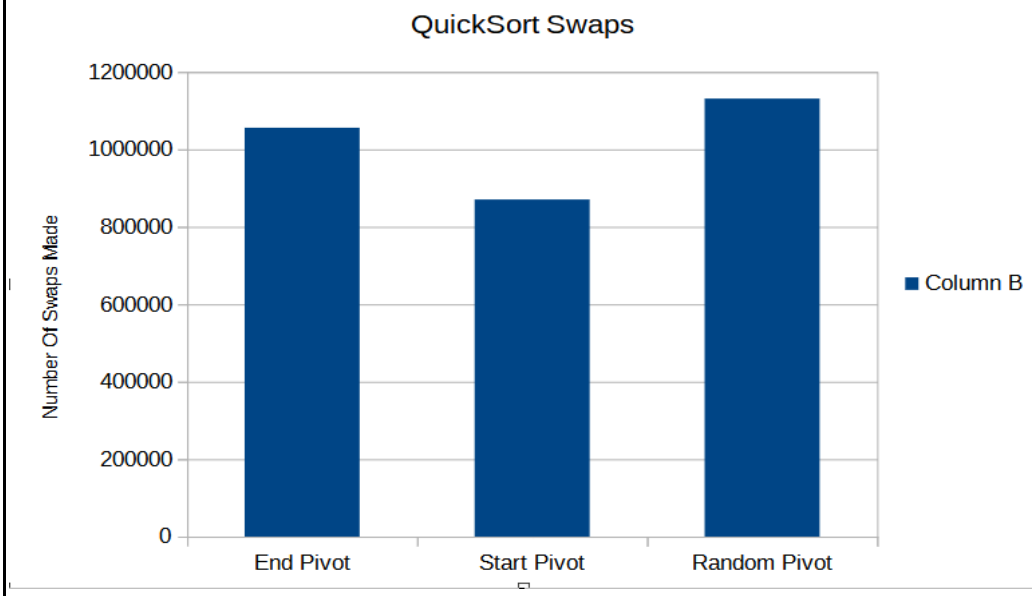


QuickSort(All Cases)-



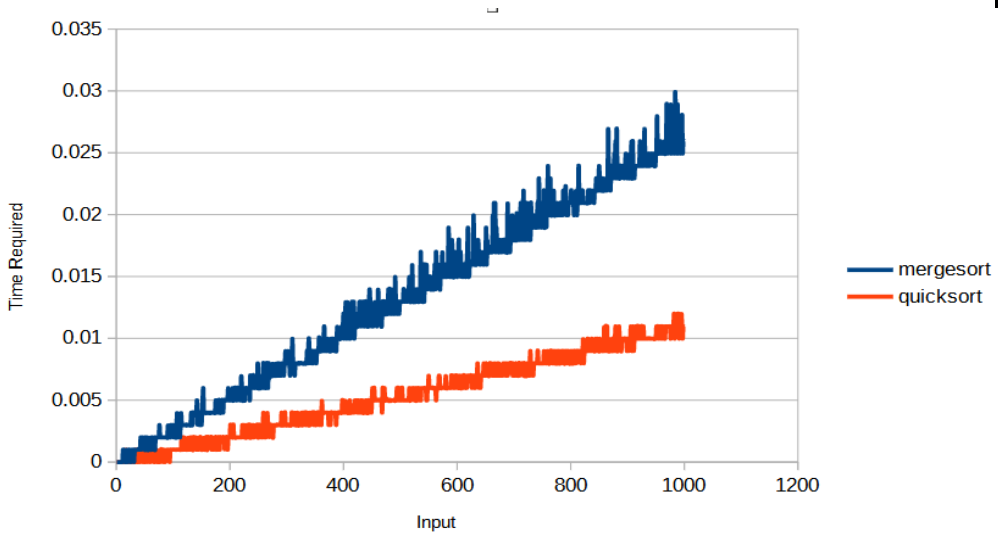
From above graph it can be seen that the time required for sorting with start pivot and end pivot is same while time required for sorting in case of random pivot is bit higher.

Number of swaps made in all cases of QuickSort-



From above it can be seen that the number of swaps required for start pivot are least.

MergeSort Vs QuickSort-



From above graph shows that the time required for merge sort is bit higher than the time required for quicksort.

CONCLUSION:	Through this experiment I understood about mergesort and quicksort and how important and efficient they are when compared with other sorting algorithm like insertion sort and selection sort.