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Question No. 2

Answer the following questions. [2.5 X 4= 10 marks]

- a. In what case(s) if any, is the bubble sort (may be modified one) $O(n)$?

In almost sorted cases, Bubble sort with a Boolean in the inner loop to check whether any pair of elements still in inversion or not, bubble sort is linear for the size of array that is to say $O(n)$.

- b. How Comb Sort gain advantage over Bubble sort? In term of which fundamental operation (compare /exchange) it beats Bubble?

The comb sort uses comparisons between a far element (fixed distance) while bubble sort does comparison between adjacent elements, if they are not in order of precedence an exchange is done. A known fact in bubble sort is it takes longer to move a light bubble displace at the heavy end. In comb sort this element is quickly reach to it proper /closer position hence an advantage over bubble sort. Comb beats bubble on both number of compares and number of exchange.

- c. In what case(s) if any, someone preferred Insertion sort over selection sort?

If the data to be sort is incremental / online available with coming time, an insertion sort will be a valid/ preferred choice in this case over selection.

- d. How Shaker's Cocktail sort gain advantage over bubble sort? Explain its improvement strategy.

Shaker's sort differs in that instead of repeatedly passing through the list from bottom to top, it passes alternately from bottom to top and then from top to bottom. It can achieve slightly better performance than a standard bubble sort. The reason for this is that bubble sort only passes through the list in one direction and therefore can only move items backward one step each iteration.

Question No. 2

Answer the following questions. [2.5 X 4= 10 marks]

- e. In what case(s) if any, Insertion sort is of $O(n)$?

For a given instance of data if it is already sorted insertion sort will be linear on the input size that is to say $O(n)$.

- f. If someone has a large file with large record size and a small integer key values, what sorting algorithm you suggest to him? Why?

In this given scenario, selection sort will be preferred as it will only move the large record once for the key and placed it at its final position in the collection/list/array.

- g. In what case(s) if any, someone preferred Insertion sort over Bubble sort?

If the collection array/list etc are already sorted ideally insertion sort performs better than bubble sort. Hence someone must prefer insertion in this case. Moreover, if the data is incremental or online in this case also insertion is preferred.

- h. Outline the strategies for both Comb sort and Shaker's Sort to improve over Bubble sort.

Both Comb sort and Shaker's sort are improvements over Bubble sort.

The comb sort specifically compares and exchanges elements with a certain gap unlike bubble sort which compares and exchanges adjacent elements. Hence it will take advantage of lesser comparisons for a light weight element misplaced at the higher end.

On the other hand, shaker sort uses both directions to push a heavy element at the right hand side and picking the light weight element from the right side to push it at the left hand side, hence it will alternate its direction and improve over bubble sort.

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- a. In what case(s) if any, is the bubble sort (may be modified one) $O(n)$?

In almost sorted cases, Bubble sort with a Boolean in the inner loop to check whether any pair of elements still in inversion bubble sort is linear for the size of array that is to say $O(n)$.

- b. In what case(s) if any, someone preferred Selection sort over Bubble sort?

In case, when the dataset for sorting has large record size and the key on which sorting to be performed is small to medium in size. Than selection sort will be a good choice as it will exchange lowest number of records to achieve sorting results.

- c. What is the main difference in the working of the inner loop of Selection sort and Insertion sort?

The inner loop of selection sort places the element at the final position in the sorting list, while the inner loop of insertion sort only places the element at the partial sorting list so far arrange for the outer loop.

- d. How a comb sort is similar to bubble sort?

The comb sort is an improvement over bubble sort, the main problem in bubble sort is turtles, or small values near the end of the list, since in a bubble sort these slow the sorting down tremendously. Comb sort compares these turtles with high gap values (bubble sort uses $gap=1$) to move them quickly to the place where they belong.