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| **Objective** | **Students will be able to sort the given quantities using Bubble Sort Algorithm** |
| **Prior Knowledge** | Basic concepts of algorithms  Basic concepts about comparing similar quantities and objects, natural numbers  Comparison Operators |

**Session 1: Session time:** 40 minutes

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| **Goal:** | Students will be able to sort the given quantities using Bubble Sort Algorithm  Students will be able to |
| **Description:** | Emphasize sorting as a mode of organization with data samples  Walk through examples of sorting leading to an algorithm known as “Bubble Sort” |
| **Material required:** | **Word Cloud:** Prepare word cloud using cardboard paper for seven words 🡪 **value, position, compare, swap, iteration, iteration number, and compare\_condition**  **Other Material:** 20 A4 sheets for students to work on the Sorting Activity |
| **Essential Questions** | **How the change in the comparison condition changes the way list of elements is getting sorted?**  **Which two elements always gets compared? Explain in terms of position.** |
| **Procedure Summary:** | This lesson plan helps a teacher to explain the concept of Sorting using Bubble Sort Algorithm  Teacher is expected to ensure that every student understands the meaning and usage of word clouds of seven words  Follow the lesson plan and ask the students to type in the commands on their computer when required |
| **Opening Discussion** | Follow the slides 2-3:   1. The students are asked to re-order the containers by increasing capacity 2. Clearly, the glass followed by bottle, jar and the tank come in that order 3. We of course assumed some sizes, but those were “safe” assumptions 4. The size is a numerical, and therefore easy to compare and order 5. This leads to simple sorting of 4 numbers, where… 6. Each number represents the size of each container   Teacher can ask following questions to students  Which container stores more water?  Can you arrange them in an order?  How will you sort these containers? Storage Capacity? Or something else.  Ask students to explain the steps taken to sort these containers shown  Follow the slides 4-5:   1. Discuss the steps followed by students to sort the water containers as per their storage capacity 2. Storage Capacity was our test or comparison condition 3. If the next containers storage capacity was lesser than the current one, then we swapped the position 4. By swapping the positions of the containers if the condition is not met, we achieved sorted container list in ascending order.   Spend 7 minutes on this exercise. |
| **Teacher Led Practice of the Bubble Sort Algorithm** | Slide 6-7:   1. Summary of steps followed in sorting the water containers by their storage capacity 2. Explain the meaning of value, position, comparison, swap, iteration, iteration number and comparison condition    1. Value 🡪 Size of a bubble is marked by a number called value    2. Position 🡪 Bubbles are vertically arranged in boxes.    3. Comparison 🡪 Two arrowed curve points to two different numbers to be compared    4. Swap 🡪 When the comparison condition is met, exchange the values    5. Iteration 🡪 When the biggest bubble floats to the top by means of compare and swap, one round of sorting is complete    6. Iteration Number 🡪 Count of no of iteration    7. Comparison Condition 🡪 The condition under consideration for swap 3. The list of numbers is a 🡸 [9, 4, 3, 6, 2] 4. More the value bigger the size of the ball 5. And 9 is the value placed at the position **a [1]** 6. This will help us while comparing the two numbers adjacent to each other   Follow the slides from slide 8 to slide 22:   1. In the first step, compare the value at the position **a [1]** with **a [2]** 2. If the value at the position **a [1]** is greater than the value at **a [2]** then swap the values 3. Continue till all the elements in the list are sorted. 4. Show the students fully sorted list   Follow slide 23:   1. Explain students what is Bubble Sort Algorithm? 2. Compare with already sorted list and ask students to observe how the large bubbles are settling at the top through every iteration    1. After iteration 1 – Bubble of 9 is settled at the top    2. After iteration 2, 3, and 4 the next largest bubbles are floating towards the top of the list   Follow slide 23:   1. Give 7 random numbers with the students. 2. Ask the students to arrange the list of numbers in descending order 3. Ask the question    1. What condition was used to swap the numbers previously    2. Was the sorted list in ascending order or descending order?    3. How can we achieve list elements arranged in descending order?    4. What condition needs to be used?   **NOTE: List index is shown as 1 is for understanding purpose**  **In programming index of list will start with 0** |
| **Group Practice Question** | You have been given 5 random numbers.  Using Bubble Sort algorithm, arrange the numbers in a **descending order**  Answer following questions based on your observations-  No of iterations =?  No of Steps taken to sort the given list of 5 numbers =?  Ask students work on this problem with their study-buddy or person sitting next to them.  Give them 2 minutes to think.  Show the slide number 8 as a hint.  Revisit slide 7, check the SWAP condition.  Ask students to think about how this condition is affecting our sorting  What change can be done here in the SWAP condition? |
| **Independent Practice** | List1: **31, 68, 42, 1, 23, 78**  List2: **10, 50, 100, 200, 300, 400**  List3: **40, 50, 60, 100, 20, 200**  **Sort all the three lists in an ascending as well as descending order.** |
| **Higher Order Thinking Skill** | **Sort the list in only one way (either ascending or descending) and think of how you can produce the list in the other way)**  In the above examples, **List1, List2, List3** which problem took highest number of iterations to sort.  Write why you think so in a few words. |