Bubble sort:

Highlight element are the swapped elements, also we can refer print statements in the program to see the entire swapping process

| i value | j value | array | swap |
| --- | --- | --- | --- |
| 0 | 1-8 | {4,77,98,30,20,50,77,22,49,2} | No |
|  | 9 | {2,77,98,30,20,50,77,22,49,4} | Yes |
| 1 | 2 |  | No |
|  | 3 | {2,30,98,77,20,50,77,22,49,4} | Yes |
|  | 4 | {2,20,98,77,30,50,77,22,49,4} | Yes |
|  | 5-8 |  | No |
|  | 9 | {2,4,98,77,30,50,77,22,49,20} | Yes |
| 2 | 3 | {2,4,77,98,30,50,77,22,49,20} | Yes |
|  | 4 | {2,4,30,98,77,50,77,22,49,20} | Yes |
|  | 5-7 | {2,4,22,98,77,50,77,30,49,20} | Yes |
|  | 8 |  | No |
|  | 9 | {2,4,20,98,77,50,77,30,49,22} | Yes |
| 3 | 4 | {2,4,20,77,98,50,77,30,49,22} | Yes |
|  | 5 | {2,4,20,50,98,77,77,30,49,22} | Yes |
|  | 6 |  | No |
|  | 7 | {2,4,20,30,98,77,77,50,49,22} | Yes |
|  | 8 |  | No |
|  | 9 | {2,4,20,22,98,77,77,50,49,30} | Yes |

End result = {2,4,20,22,30,49,50,77,77,98}

Bubble Sort (Recursive)

| Recursive Method call | Array | changes |
| --- | --- | --- |
| bubble(x,10) | {4,77,30,20,50,77,22,49,2,98} | 98 moved to the end from index 2, the process is shown in the non-recursive trace |
| bubble(x, 9) | {4,30,20,50,77,22,49,2,77,98} | The first 77 moved to the 8th index |
| bubble(x, 8) | {4,30,20,50,22,49,2,77,77,98} | The second 77 moved to the 7th index |
| bubble(x, 7) | {4,30,20,22,49,2,50,77,77,98} | 50 is moved to the 6th index |
| bubble(x, 6) | {4,30,20,22,2,49,50,77,77,98} | 49 is moved to the 5th index |
| bubble(x, 5) | {4,20,22,2,30,49,50,77,77,98} | 30 is moved to the 4th index |
| bubble(x, 4) | {4,20,2,22,30,49,50,77,77,98} | 22 is moved to the 3rd index |
| bubble(x, 3) | {4,2,20,22,30,49,50,77,77,98} | 20 is moved to the 2rd index |
| bubble(x, 2) | {2,4,20,22,30,49,50,77,77,98} | 4 is moved to the 1st index |

End result = {2,4,20,22,30,49,50,77,77,98}

Selection Sort

| i | j | mi | array |
| --- | --- | --- | --- |
| 0 | 1-8 | 0 | {4,77,98,30,20,50,77,22,49,2} |
|  | 9 | 9 | {2,77,98,30,20,50,77,22,49,4} |
| 1 |  | 1 |  |
|  | 2 | 1 (no change) |  |
|  | 3 | 3 |  |
|  | 4 | 4 |  |
|  | 5-8 | 4 (no change) |  |
|  | 9 | 9 | {2,4,98,30,20,50,77,22,49,77} |
| 2 |  | 2 |  |
|  | 3 | 3 |  |
|  | 4 | 4 |  |
|  | 5-9 | 4 (no change) | {2,4,20,30,98,50,77,22,49,77} |
| 3 |  | 3 |  |
|  | 4-6 | 3 |  |
|  | 7 | 7 |  |
|  | 8-9 | 7 | {2,4,20,22,98,50,77,30,49,77} |
| 4 |  | 4 |  |
|  | 5 | 5 |  |
|  | 6 | 5 |  |
|  | 7 | 7 |  |
|  | 8-9 | 7 | {2,4,20,22,30,50,77,98,49,77} |

End result = {2,4,20,22,30,49,50,77,77,98}

Insertion Sort

| i | j | t | array |
| --- | --- | --- | --- |
| 1 | / | 77 | {4,77,98,30,20,50,77,22,49,2} |
| 2 | / | 98 | {4,77,98,30,20,50,77,22,49,2} |
| 3 | 3 | 30 | {4,98,98,30,20,50,77,22,49,2} |
|  | 2 |  | {4,77,77,30,20,50,77,22,49,2} |
|  | 1 |  | {4,30,77,98,20,50,77,22,49,2} |
| 4 | 4 | 20 | {4,30,77,98,98,50,77,22,49,2} |
|  | 3 |  | {4,30,77,77,20,50,77,22,49,2} |
|  | 2 |  | {4,30,30,77,98,50,77,22,49,2} |
|  | 1 |  | {4,20,30,77,98,50,77,22,49,2} |
| 5 | 5 | 50 | {4,20,30,77,98,98,77,22,49,2} |
|  | 4 |  | {4,20,30,77,77,98,77,22,49,2} |
|  | 3 |  | {4,20,30,50,77,98,77,22,49,2} |

End result = {2,4,20,22,30,49,50,77,77,98}