Assignment 5

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1. Insertion Sort

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Original | 3 | 1 | 4 | 7 | 5 | 9 | 2 | 6 | 8 | Swap | Comparison |
| After P = 1 | 1 | 3 | 4 | 7 | 5 | 9 | 2 | 6 | 8 | 1 | 2 |
| After P = 2 | 1 | 3 | 4 | 7 | 5 | 9 | 2 | 6 | 8 | 0 | 1 |
| After P = 3 | 1 | 3 | 4 | 7 | 5 | 9 | 2 | 6 | 8 | 0 | 1 |
| After P = 4 | 1 | 3 | 4 | 5 | 7 | 9 | 2 | 6 | 8 | 1 | 2 |
| After P = 5 | 1 | 3 | 4 | 5 | 7 | 9 | 2 | 6 | 8 | 0 | 1 |
| After P = 6 | 1 | 2 | 3 | 4 | 5 | 7 | 9 | 6 | 8 | 5 | 6 |
| After P = 7 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 8 | 2 | 3 |
| After P = 8 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1 | 2 |

1. Shell Sort

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Original | 9 | | 8 | | 7 | | | | 6 | | | | | 5 | | | | | 4 | | | | 3 | | | 2 | | | 1 | | | Sub-Arrays | Swap |
| Distance = 7 |  |  |  |  |  | |  | | |  | |  | | |  | |  | | |  | |  | |  |  | |  |  | |  |  | {9, 2} | 1 |
|  |  |  |  |  | |  | | |  | |  | | |  | |  | | |  | |  | |  |  | |  |  | |  |  | {8, 1} | 1 |
|  |  |  |  |  | |  | | |  | |  | | |  | |  | | |  | |  | |  |  | |  |  | |  |  |  |  |
| After 7 sort | 2 | | 1 | | 7 | | | | | 6 | | | | | 5 | | | | | 4 | | | | 3 | | | 9 | | | 8 | |  |  |
| Distance = 3 |  |  |  |  |  | | |  | | |  | |  | | |  | |  | | |  |  | |  |  | |  |  | |  |  | {2, 6, 3} | 1 |
|  |  |  |  |  | | |  | | |  | |  | | |  | |  | | |  |  | |  |  | |  |  | |  |  | {1, 5, 9} | 0 |
|  |  |  |  |  | | |  | | |  | |  | | |  | |  | | |  |  | |  |  | |  |  | |  |  | {7, 4, 8} | 1 |
|  |  |  |  |  | | |  | | |  | |  | | |  | |  | | |  |  | |  |  | |  |  | |  |  |  |  |
| After 3 sort | 2 | | 1 | | 4 | | | | | 3 | | | | | 5 | | | | | 7 | | | | 6 | | | 9 | | | 8 | |  |  |
| Distance = 1 |  |  |  |  | |  | |  | | |  | |  | | |  | |  | | |  |  | |  |  | |  |  | |  |  |  | 4 |
|  |  |  |  | |  | |  | | |  | |  | | |  | |  | | |  |  | |  |  | |  |  | |  |  |  |  |
| After 1 sort | 1 | | 2 | | 3 | | | | | 4 | | | | | 5 | | | | | 6 | | | | 7 | | | 8 | | | 9 | |  |  |

Total number of swaps is 8.

1. Merge Sort

Original

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 7 | 5 | 9 | 2 | 6 | 8 |

Split 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 7 | 5 |  | 9 | 2 | 6 | 8 |

Split 2

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 |  | 7 | 5 |  | 9 | 2 |  | 6 | 8 |

Split 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 |  | 4 |  | 7 |  | 5 |  | 9 |  | 2 |  | 6 |  | 8 |

Split 4

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 |  | 1 |  | 4 |  | 7 |  | 5 |  | 9 |  | 2 |  | 6 |  | 8 |

Return 3

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 3 |  | 4 |  | 7 |  | 5 |  | 9 |  | 2 |  | 6 |  | 8 |

Return 2

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 3 | 4 |  | 5 | 7 |  | 2 | 9 |  | 6 | 8 |

Return 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 3 | 4 | 5 | 7 |  | 2 | 6 | 8 | 9 |

Return 0

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

1. Quick Sort

Original A[9]

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 7 | 5 | 9 | 2 | 6 | 8 |

Pivot = A[4] = 5

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 7 | 8 | 9 | 2 | 6 | 5 |

i j

Before 1st swap

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 7 | 8 | 9 | 2 | 6 | 5 |

i j

After 1st swap

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 2 | 8 | 9 | 7 | 6 | 5 |

i j

Before 2nd swap

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 2 | 8 | 9 | 7 | 6 | 5 |

j i

Swap (A[i], A[right])

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 3 | 1 | 4 | 2 | 5 | 9 | 7 | 6 | 8 |

2-1st partition

|  |  |  |  |
| --- | --- | --- | --- |
| 3 | 1 | 4 | 2 |

Before 1st swap

|  |  |  |  |
| --- | --- | --- | --- |
| 3 | 1 | 4 | 2 |

After 1st swap

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 3 | 4 | 2 |

Before 2nd swap

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 3 | 4 | 2 |

Swap (A[i], A[right])

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 2 | 4 | 3 |

2-2nd partition

|  |  |  |  |
| --- | --- | --- | --- |
| 9 | 7 | 6 | 8 |

Before 1st swap

|  |  |  |  |
| --- | --- | --- | --- |
| 9 | 7 | 6 | 8 |

After 1st swap

|  |  |  |  |
| --- | --- | --- | --- |
| 6 | 7 | 9 | 8 |

Before 2nd swap

|  |  |  |  |
| --- | --- | --- | --- |
| 6 | 7 | 9 | 8 |

Swap (A[i], A[right])

|  |  |  |  |
| --- | --- | --- | --- |
| 6 | 7 | 8 | 9 |

3-1st partition

|  |  |
| --- | --- |
| 4 | 3 |

After the 3-1st partition

|  |  |
| --- | --- |
| 3 | 4 |

3-2nd partition

|  |  |
| --- | --- |
| 6 | 7 |

After the 3-2nd partition

|  |  |
| --- | --- |
| 6 | 7 |

Final sorted output

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |