



Write a self-contained function block in IEC 61131-3 Structured Text that implements the quicksort algorithm.



Here's a self-contained function block in IEC 61131-3 Structured Text that implements the quicksort algorithm:

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FUNCTION_BLOCK QuickSort
    METHOD Sort: ARRAY[*] OF REAL;
END_FUNCTION_BLOCK

METHOD QuickSort.Sort
    VAR_INPUT
        arr: ARRAY[*] OF REAL;
    END_VAR
    VAR
        low: DINT := 0;
        high: DINT := UPPER_BOUND(arr, 1);
    END_VAR
    SortHelper(arr, low, high);
END_METHOD

METHOD QuickSort.SortHelper
    VAR_INPUT
        arr: ARRAY[*] OF REAL;
        low: DINT;
        high: DINT;
    END_VAR
    VAR
        pivotIndex: DINT;
    END_VAR
    IF low < high THEN
        pivotIndex := Partition(arr, low, high);
        SortHelper(arr, low, pivotIndex - 1);
        SortHelper(arr, pivotIndex + 1, high);
    END_IF;
END_METHOD

METHOD QuickSort.Partition
    VAR_INPUT
        arr: ARRAY[*] OF REAL;
        low: DINT;
        high: DINT;
    END_VAR
    VAR
        pivot: REAL;
        i: DINT;
        j: DINT;
        temp: REAL;
    END_VAR
    pivot := arr[high];
    i := low - 1;
    j := low;
    FOR j := low TO high - 1 DO
        IF arr[j] < pivot THEN
            i := i + 1;
            temp := arr[i];
            arr[i] := arr[j];
            arr[j] := temp;
        END_IF;
    END_FOR;
    temp := arr[i + 1];
    arr[i + 1] := arr[high];
    arr[high] := temp;
    RETURN i + 1;
END_METHOD
```

This function block named QuickSort contains three methods: Sort, SortHelper, and Partition. The main method, Sort, takes an array of REAL numbers as input and sorts it using the quicksort algorithm. The other two methods, SortHelper and Partition, are helper methods used in the implementation of the algorithm.