Rajalakshmi Engineering College

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 6_CY_Updated

Attempt : 1
Total Mark : 30
Marks Obtained : 30

Section 1 : Coding

1. Problem Statement

Aryan is participating in a coding competition where he needs to sort a list of numbers using an efficient sorting algorithm. He decides to use Merge Sort, a divide-and-conquer algorithm, to achieve this. Given a list of n elements, Aryan must implement merge sort to arrange the numbers in ascending order.

Help Aryan by implementing the merge sort algorithm to correctly sort the given list of numbers.

Input Format

The first line of input contains an integer n, the number of elements in the list.

The second line contains n space-separated integers representing the elements

of the list.

Output Format

The output prints the sorted list of numbers in ascending order, separated by a space.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
80 40 20 50 30
Output: 20 30 40 50 80

Answer

```
// You are using GCC
#include <stdio.h>
void merge(int arr[], int left, int mid, int right) {
    int n1 = mid - left + 1;
    int n2 = right - mid;

    int leftArr[n1], rightArr[n2];

    for (int i = 0; i < n1; i++)
        leftArr[i] = arr[left + i];
    for (int i = 0; i < n2; i++)
        rightArr[i] = arr[mid + 1 + i];

    int i = 0, j = 0, k = left;
    while (i < n1 && j < n2) {
        if (leftArr[i] <= rightArr[j])
            arr[k++] = leftArr[i++];
        else
            arr[k++] = rightArr[j++];
    }

    while (i < n1) arr[k++] = leftArr[i++];
    while (j < n2) arr[k++] = rightArr[j++];
}
void mergeSort(int arr[], int left, int right) {
```

```
    if (left < right) {
        int mid = left + (right - left) / 2;

        mergeSort(arr, left, mid);
        mergeSort(arr, mid + 1, right);
        merge(arr, left, mid, right);
    }
}

int main() {
    int n;
    scanf("%d", &n);
    int arr[n];
    for (int i = 0; i < n; i++)
        scanf("%d", &arr[i]);
    mergeSort(arr, 0, n - 1);
    for (int i = 0; i < n; i++)
        printf("%d ", arr[i]);

    return 0;
}
```

Status : Correct **Marks : 10/10**

2. Problem Statement

Meera is organizing her art supplies, which are represented as a list of integers: red (0), white (1), and blue (2). She needs to sort these supplies so that all items of the same color are adjacent, in the order red, white, and blue. To achieve this efficiently, Meera decides to use QuickSort to sort the items. Can you help Meera arrange her supplies in the desired order?

Input Format

The first line of input consists of an integer n, representing the number of items in the list.

The second line consists of n space-separated integers, where each integer is either 0 (red), 1 (white), or 2 (blue).

Output Format

The output prints the sorted list of integers in a single line, where integers are arranged in the order red (0), white (1), and blue (2).

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 6
2 0 2 1 1 0
Output: Sorted colors:
0 0 1 1 2 2

Answer

```
// You are using GCC
#include <stdio.h>
void sortColors(int arr[], int n) {
    int low = 0, mid = 0, high = n - 1;

    while (mid <= high) {
        if (arr[mid] == 0) {
            int temp = arr[low];
            arr[low] = arr[mid];
            arr[mid] = temp;
            low++;
            mid++;
        } else if (arr[mid] == 1) {
            mid++;
        } else {
            int temp = arr[mid];
            arr[mid] = arr[high];
            arr[high] = temp;
            high--;
        }
    }
}

int main() {
    int n;
    scanf("%d", &n);
    int arr[n];
```

```
    for (int i = 0; i < n; i++)
        scanf("%d", &arr[i]);

    sortColors(arr, n);

    printf("Sorted colors:\n");
    for (int i = 0; i < n; i++)
        printf("%d ", arr[i]);

    return 0;
}
```

Status : Correct **Marks : 10/10**

3. Problem Statement

Priya, a data analyst, is working on a dataset of integers. She needs to find the maximum difference between two successive elements in the sorted version of the dataset. The dataset may contain a large number of integers, so Priya decides to use QuickSort to sort the array before finding the difference. Can you help Priya solve this efficiently?

Input Format

The first line of input consists of an integer n, representing the size of the array.

The second line consists of n space-separated integers, representing the elements of the array.

Output Format

The output prints a single integer, representing the maximum difference between two successive elements in the sorted form of the array.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 1

10

Output: Maximum gap: 0

Answer

```
// You are using GCC
#include <stdio.h>
void swap(int *a, int *b) {
    int temp = *a;
    *a = *b;
    *b = temp;
}
int partition(int arr[], int low, int high) {
    int pivot = arr[high];
    int i = low - 1;

    for (int j = low; j < high; j++) {
        if (arr[j] <= pivot) {
            i++;
            swap(&arr[i], &arr[j]);
        }
    }
    swap(&arr[i + 1], &arr[high]);
    return i + 1;
}
void quickSort(int arr[], int low, int high) {
    if (low < high) {
        int pi = partition(arr, low, high);

        quickSort(arr, low, pi - 1);
        quickSort(arr, pi + 1, high);
    }
}

int findMaxGap(int arr[], int n) {
    if (n < 2) return 0;

    int maxGap = 0;
    for (int i = 1; i < n; i++) {
        int gap = arr[i] - arr[i - 1];
        if (gap > maxGap) {
            maxGap = gap;
        }
```

```
    }
    return maxGap;
}

int main() {
    int n;
    scanf("%d", &n);
    int arr[n];

    for (int i = 0; i < n; i++)
        scanf("%d", &arr[i]);

    quickSort(arr, 0, n - 1);

    int maxGap = findMaxGap(arr, n);

    printf("Maximum gap: %d\n", maxGap);

    return 0;
}
```

Status : Correct ***Marks : 10/10***