Rajalakshmi Engineering College

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

As part of a programming assignment in a data structures course, students are required to create a program to construct a singly linked list by inserting elements at the beginning.

You are an evaluator of the course and guide the students to complete the task.

Input Format

The first line of input consists of an integer N, which is the number of elements.

The second line consists of N space-separated integers.

Output Format

The output prints the singly linked list elements, after inserting them at the beginning.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
78 89 34 51 67

Output: 67 51 34 89 78

Answer

```
#include <stdio.h>
#include <stdlib.h>

struct Node {
   int data;
   struct Node* next;
};

void insertAtFront(struct Node**head,int data){
   struct Node* newnode=(struct Node*)malloc(sizeof(struct Node));
   newnode->data=data;
   newnode->next=*head;
   *head=newnode;
}
void printList(struct Node* head){
   struct Node*current=head;
   while(current!=NULL){
      printf("%d ",current->data);
      current = current->next;
   }
}

int main(){
   struct Node* head = NULL;

   int n;
   scanf("%d", &n);

   for (int i = 0; i < n; i++) {
        int activity;
        scanf("%d", &activity);
        insertAtFront(&head, activity);
    }

    printList(head);
    struct Node* current = head;
    while (current != NULL) {
        struct Node* temp = current;
        current = current->next;
        free(temp);
    }

    return 0;
}
```

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

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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

Marie, the teacher, wants her students to implement the ascending order of numbers while also exploring the concept of prime numbers.

Students need to write a program that sorts an array of integers using the merge sort algorithm while counting and returning the number of prime integers in the array. Help them to complete the program.

Input Format

The first line of input consists of an integer N, representing the number of array elements.

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

Output Format

The first line of output prints the sorted array of integers in ascending order.

The second line prints the number of prime integers in the array.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 7
5 3 6 8 9 7 4

Output: Sorted array: 3 4 5 6 7 8 9
Number of prime integers: 3

Answer

```
#include <stdio.h>
#include <math.h>

void merge(int arr[], int l, int m, int r) {
   int n1 = m - l + 1;
   int n2 = r - m;

   int L[n1], R[n2];
   for (int i = 0; i < n1; i++)
      L[i] = arr[l + i];
   for (int j = 0; j < n2; j++)
      R[j] = arr[m + 1 + j];

   int i = 0, j = 0, k = l;
   while (i < n1 && j < n2) {
      if (L[i] <= R[j]) {
         arr[k++] = L[i++];
      } else {
         arr[k++] = R[j++];
      }
   }

   while (i < n1) {
      arr[k++] = L[i++];
```

```
    }

    while (j < n2) {
        arr[k++] = R[j++];
    }
}

void mergeSort(int arr[], int l, int r) {
    if (l < r) {
        int m = l + (r - l) / 2;
        mergeSort(arr, l, m);
        mergeSort(arr, m + 1, r);
        merge(arr, l, m, r);
    }
}

int isPrime(int n) {
    if (n < 2) return 0;
    for (int i = 2; i <= sqrt(n); i++) {
        if (n % i == 0) return 0;
    }
    return 1;
}

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);

    int primeCount = 0;
    for (int i = 0; i < N; i++) {
        if (isPrime(arr[i])) primeCount++;
    }

    printf("Sorted array: ");
    for (int i = 0; i < N; i++) {
        printf("%d ", arr[i]);
    }
    printf("\nNumber of prime integers: %d\n", primeCount);

    return 0;
}
```

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

2. 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

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

    printf("Maximum gap: %d\n", maxGap);
    return 0;
}
```

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

3. Problem Statement

Reshma is passionate about sorting algorithms and has recently learned about the merge sort algorithm. She wants to implement a program that utilizes the merge sort algorithm to sort an array of integers, both positive and negative, in ascending order.

Help her in implementing the program.

Input Format

The first line of input consists of an integer N, representing the number of elements in the array.

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

Output Format

The output prints N space-separated integers, representing the array elements sorted in ascending order.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 9
5 -3 0 12 7 -8 2 1 6

Output: -8 -3 0 1 2 5 6 7 12

Answer

```
#include <stdio.h>

void merge(int arr[], int l, int m, int r) {
    int n1 = m - l + 1;
    int n2 = r - m;

    int L[n1], R[n2];
    for (int i = 0; i < n1; i++)
        L[i] = arr[l + i];
    for (int j = 0; j < n2; j++)
        R[j] = arr[m + 1 + j];

    int i = 0, j = 0, k = l;
    while (i < n1 && j < n2) {
        if (L[i] <= R[j]) {
            arr[k++] = L[i++];
        } else {
            arr[k++] = R[j++];
        }
    }

    while (i < n1) {
        arr[k++] = L[i++];
    }

    while (j < n2) {
        arr[k++] = R[j++];
    }
}

void mergeSort(int arr[], int l, int r) {
    if (l < r) {
        int m = l + (r - l) / 2;
        mergeSort(arr, l, m);
        mergeSort(arr, m + 1, r);
        merge(arr, l, m, r);
    }
}

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]);
    }
    printf("\n");

    return 0;
}
```

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