RAJALAKSHMI ENGINEERING COLLEGE

An Autonomous Institution
Affiliated to Anna University, Chennai,
Rajalakshmi Nagar, Thandalam – 602 105

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CS19641- COMPILER DESIGN LABORATORY
Laboratory Record Note Book

Name : ...…………T KAUSHIKA...………………………

Register No. : ...………240701239...……………………….……………………..

Year / Branch / Section : ……BE.COMPUTER SCIENCE ENGINEERING ...……………

Semester : ………2...………………………………………………………….……….

Academic Year: ……2024-25...…………………………………

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BONAFIDE CERTIFICATE

Name: ....T KAUSHIKA.....................................

Academic Year: ...2024-25... **Semester:** ......2...... **Branch:** ...BE CSE...

Register No. | 2116240701239 |

Certified that this is the bonafide record of work done by the above student in

the...........CS23231 - DATA STRUCTURE ....*Laboratory*

during the academic year 2023- 2024

Signature of Faculty in-charge

Submitted for the Practical Examination held on................................

Internal Examiner   **External Examiner**

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 0_Arrays and Functions

Attempt : 1
Total Mark : 5
Marks Obtained : 5

Section 1 : Coding

1. Problem Statement

Write a program that will read a Matrix (two-dimensional arrays) and print the sum of all elements of each row by passing the matrix to a function.

Function Signature: void calculateRowSum(int [ ][ ], int, int)

Input Format

The first line consists of an integer M representing the number of rows.

The second line consists of an integer N representing the number of columns.

The next M lines consist of N space-separated integers in each line representing the elements of the matrix.

Output Format

The output displays the sum of all elements of each row separated by a space.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 3
3
1 2 3
4 5 6
7 8 9
Output: 6 15 24

Answer

```c
#include <stdio.h>

// You are using GCC
void calculateRowSum(int matrix[20][20], int rows, int cols) {
    //Type your code here
    for(int i=0;i<rows;i++)
    {
        int row_sum=0;
        for(int j=0;j<cols;j++)
        {
            row_sum+=matrix[i][j];
        }
        printf("%d",row_sum);
    }

}
int main() {
    int matrix[20][20];
    int r, c;

    scanf("%d", &r);
    scanf("%d", &c);

    for (int i = 0; i < r; i++) {
        for (int j = 0; j < c; j++) {
            scanf("%d", &matrix[i][j]);
```

```
    }
  }

  calculateRowSum(matrix, r, c);
  return 0;
}
```

Status : Correct   *Marks : 1/1*

2. Problem Statement

Alex, a budding programmer, is tasked with writing a menu-driven program
to perform operations on an array of integers. The operations include
finding the smallest number, the largest number, the sum of all numbers,
and their average. The program must repeatedly display the menu until
Alex chooses to exit.

Write a program to ensure the specified tasks are implemented based on
Alex's choices.

Input Format

The first line contains an integer n, representing the number of elements in the
array.

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

The subsequent lines contain integers representing the menu choices:

Choice 1: Find and display the smallest number.

Choice 2: Find and display the largest number.

Choice 3: Calculate and display the sum of all numbers.

Choice 4: Calculate and display the average of all numbers as double.

Choice 5: Exit the program.

Output Format

For each valid menu choice, print the corresponding result:

For choice 1, print "The smallest number is: X", where X is the smallest number in the array.

For choice 2, print "The largest number is: X", where X is the largest number in the array.

For choice 3, print "The sum of the numbers is: X", where X is the sum of all numbers in the array.

For choice 4, print "The average of the numbers is: X. XX", where X.XX is the double value representing an average of all numbers in the array, rounded to two decimal places.

For choice 5, print "Exiting the program".

If an invalid choice is made, print "Invalid choice! Please enter a valid option (1-5)."

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 3
10 20 30
1
5
Output: The smallest number is: 10
Exiting the program

Answer

```
#include<stdio.h>
#include<stdlib.h>
int main()
{
    int n;
    int arr[10000];
    scanf("%d",&n);
    for(int i=0;i<n;i++)
```

```c
{
    scanf("%d",&arr[i]);
}
int small=arr[0],large=arr[0],sum=0;
for(int i=0;i<n;i++)
{
    sum+=arr[i];

    if(arr[i]>large)
    large=arr[i];
    else if(arr[i]<small)
    small=arr[i];
}

float avg=(float)sum/n;
int choice[5];
for(int i=0;i<=5;i++)
{
    scanf("%d\n",&choice[i]);

switch(choice[i])
{
case 1:
printf("The smallest number is: %d\n",small);
break;
case 2:
printf("The largest number is: %d\n",large);
break;
case 3:
printf("The sum of the numbers is: %d\n",sum);
break;
case 4:
printf("The average of the numbers is: %.2f\n",avg);
break;
case 5:
printf("Exiting the program\n");
exit(0);
default:
printf("Invalid choice! please enter a valid option (1-5).\n");
}
}
```

}

3.   Problem Statement

Tim is creating a program to track and analyze student attendance. The program requires two inputs: the total number of students (n) and the total number of class sessions (m). The task is to design and populate an attendance matrix, 'matrix', representing the attendance record of each student for each session.

The program's specific objective is to determine whether the last student on the list attended an even or odd number of classes. This functionality will aid teachers in quickly evaluating the attendance habits of individual students.

Input Format

The first line of input consists of a positive integer n, representing the number of students.

The second line consists of a positive integer m, representing the number of class sessions.

The next n lines consist of m space-separated positive integers representing the number of classes attended by the student.

Output Format

The output displays one of the following results:

If the last session is even the output prints "[LastSession] is even".

If the last session is odd the output prints "[LastSession] is odd".

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 2
2
1 2
3 100
Output: 100 is even

Answer

```c
#include<stdio.h>
int main()
{
   int n;
   int m;
   scanf("%d\n%d\n",&n,&m);
   int matrix[n][m];
   matrix[5][100];
   for(int i=0;i<n;i++)
   {
      for(int j=0;j<m;j++)
      {
         scanf("%d",&matrix[i][j]);
      }
   }
   if(matrix[n-1][m-1]%2==0)
   {
      printf("%d is even",matrix[n-1][m-1]);
   }
   else
   printf("%d is odd",matrix[n-1][m-1]);

}
```

Status : Correct   *Marks : 1/1*

4. Problem Statement

Write a program that reads an integer 'n' and a square matrix of size 'n x n' from the user. The program should then set all the elements in the lower triangular part of the matrix (including the main diagonal) to zero using a function and display the resulting matrix.

Function Signature: void setZeros(int [ ][ ], int)

Input Format

The first line consists of an integer M representing the number of rows & columns.

The next M lines consist of M space-separated integers in each line representing the elements of the matrix.

Output Format

The output displays the matrix containing M space-separated elements in M lines where the lower triangular elements are replaced with zero.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 3
10 20 30
40 50 60
70 80 90

Output: 0 20 30
0 0 60
0 0 0

Answer

```c
#include <stdio.h>

// You are using GCC
void setZeros(int arr[10][10], int n) {
    //Type your code here
    for(int i=0;i<n;i++)
    {
        for(int j=0;j<n;j++)
        {
            if(i==j || i>j)
            arr[i][j]=0;
        }
    }
}
```

```
    }
    int main() {
        int arr1[10][10];
        int n;

        scanf("%d", &n);

        for (int i = 0; i < n; i++) {
            for (int j = 0; j < n; j++) {
                scanf("%d", &arr1[i][j]);
            }
        }

        setZeros(arr1, n);

        for (int i = 0; i < n; i++) {
            for (int j = 0; j < n; j++) {
                printf("%d ", arr1[i][j]);
            }
            printf("\n");
        }

        return 0;
    }
```

Status : Correct   *Marks : 1/1*

5. Problem Statement

Saurabh is the manager of a growing tech company. He needs a program
to record and analyze the monthly salaries of his employees. The program
will take the number of employees and their respective salaries as input
and then calculate the average salary, and find the highest and lowest
salary among them.

Help Saurabh automate this task efficiently.

Input Format

The first line of input consists of an integer n, representing the number of
employees.

The second line consists of n integers, where each integer represents the salary of an employee.

Output Format

The output prints n lines, where each line will display: "Employee i: "Salary

Where i is the employee number (starting from 1) and salary is the respective salary of that employee.

After that, print the average salary in the following format: "Average Salary: "average_salary

Where average_salary is the average salary of all employees, rounded to two decimal places.

Next, print the highest salary in the following format: "Highest Salary: "max_salary

Where max_salary is the highest salary among all employees.

Finally, print the lowest salary in the following format:"Lowest Salary: "min_salary

Where min_salary is the lowest salary among all employees.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
4000

3500
6000
2500
4500

Output: Employee 1: 4000
Employee 2: 3500
Employee 3: 6000
Employee 4: 2500
Employee 5: 4500

Average Salary: 4100.00
Highest Salary: 6000
Lowest Salary: 2500

Answer

```c
// You are using GCC
#include<stdio.h>
int main()
{
    int n,arr[1000],sum=0;
    scanf("%d",&n);
    for(int i=0;i<n;i++)
    {
        scanf("%d",&arr[i]);
        printf("Employee %d: %d\n",i+1,arr[i]);
        sum+=arr[i];
    }
    int max_salary=arr[0],min_salary=arr[0];
    for(int i=0;i<n;i++)
    {
    if(arr[i]<min_salary)
    min_salary=arr[i];
    else if(arr[i]>max_salary)
    max_salary=arr[i];
    }

    float average_salary=(float)sum/n;

    printf("\n");
    printf("Average Salary:%.2f\n",average_salary);
    printf("Highest Salary:%d\n",max_salary);
    printf("Lowest Salary:%d\n",min_salary);
```

```
    }
```

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 0_Pointers

Attempt : 1
Total Mark : 5
Marks Obtained : 5

Section 1 : Coding

1. Problem Statement

Raj wants to create a program using pointers and a structure named Employee to manage employee information.

He seeks your assistance to input the employee's name, salary, and hours worked. Implement a salary increase based on hours worked, and calculate the final salary. Calculate the total salary for 30 days. Display the results of the final and total salary.

Salary increase criteria:

If hours worked >= 12, the increase is Rs. 150.00.If hours worked >= 10, but less than 12, the increase is Rs. 100.00.If hours worked >= 8, but less than 10, the increase is Rs. 50.00.If hours worked < 8, there is no increase.

Input Format

The first line of input consists of a string, representing the Employee's name.

The second line consists of a double-point number, representing the Employee's current salary.

The third line consists of an integer, representing the number of hours worked by the employee.

Output Format

The first line of output prints "Final Salary: Rs. " followed by a double value, representing the final salary, rounded off to two decimal places.

The second line prints "Total Salary: Rs. " followed by a double value, representing the total salary for 30 days, rounded off to two decimal places.

Refer to the sample outputs for formatting specifications.

Sample Test Case

Input: Akil
3000.00
6
Output: Final Salary: Rs. 3000.00
Total Salary: Rs. 90000.00

Answer

```c
#include<stdio.h>
#include<stdlib.h>
#include<string.h>
struct Employee
{
   char name[50];
   float salary;
   int hours;
};
   int main()
   {
      struct Employee *ptr;
      ptr=(struct Employee*)malloc(sizeof(struct Employee));
      scanf("%s%f%d",ptr->name,&ptr->salary,&ptr->hours);
```

```
if(ptr->hours>=12)
ptr->salary+=150;
else if(ptr->hours>=10 && ptr->hours<12)
ptr->salary+=100;
else if(ptr->hours>=8 && ptr->hours<10)
ptr->salary+=50;
else if(ptr->hours<8)
ptr->salary+=0;
printf("Final salary: Rs.%.2f\n",ptr->salary);
float t=ptr->salary*30;
printf("Total salary: Rs.%.2f",t);

}
```

Status : Correct   *Marks : 1/1*

2. Problem Statement

Daniel is working on a project that involves analyzing data stored in float arrays. He needs to determine whether a given float array contains only positive numbers.

To achieve this, he needs a program that can accurately evaluate the contents of float arrays using malloc().

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 float values, representing the elements of the array.

Output Format

If all the array elements are positive, print "All elements are positive."

If the array contains at least one positive element, print "At least one element is positive."

If there are no positive elements in the array, print "No positive elements in the array."

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
50.0 -2.3 3.7 -4.8 5.2
Output: At least one element is positive.

Answer

```c
// You are using GCC
#include<stdio.h>
#include<stdlib.h>
int main()
{
int n;
scanf("%d",&n);
float*arr=(float*)malloc(n*sizeof(float));
for(int i=0;i<n;i++)
scanf("%f ",&arr[i]);
int ap=1,hp=0;
for(int i=0;i<n;i++)
{
   if(arr[i]>0)
   {
     hp=1;
   }
   else{
      ap=0;
   }
}
   if(ap)
   printf("All elements are positive.");
   else if(hp)
   printf("At least one element is positive.");
   else
   printf("No positive elements in the array.");
   free(arr);
   return 0;
}
```

3.   Problem Statement

Rajwinder wants a program to determine retirement details for a person based on their age.

Create a program that uses a structure called Person to hold the age as an attribute with a pointer.

If the age is under 18, display "Invalid".If the age is 65 or older, print "Already retired!".Otherwise, calculate and output the retirement year, remaining years, and remaining days until retirement.

Note: Age 65 is considered as retirement age. Assume the current year as 2023 and there are 365 days per year for calculation.

Input Format

The input consists of an integer representing the person's age.

Output Format

If the age is under 18, the output displays "Invalid" and terminates.

If the age is 65 or older, the output displays "Already retired!" and terminates.

Otherwise, the output displays the following.

1. The first line displays "Retirement Year: " followed by an integer representing the retirement year.
2. The second line displays "Remaining Years: " followed by an integer representing the remaining years left for retirement.
3. The third line displays "Remaining Days: " followed by an integer representing the remaining days left for retirement.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 43

Output: Retirement Year: 2045
Remaining Years: 22
Remaining Days: 8030

Answer

```c
#include<stdio.h>
typedef struct{
    int age;
    }Person;
void det(Person*P){
     int cy=2023;
    int rage=65;
    if (P->age<18)
    {
    printf("Invalid\n");
    return;
    }
    if(P->age>=rage)
    {
    printf("Already retired!");
    return;
    }

    int ryears=rage-P->age;
    int rdays= ryears*365;
    int reyear=cy+ryears;
    printf("Retirement Year: %d\n",reyear);
    printf("Remaining Years: %d\n",ryears);
    printf("Remaining Days: %d\n",rdays);

}
int main(){
    Person P;
    scanf("%d",&P.age);
    det(&P);
    return 0;

}
```

4.   Problem Statement

Ria is a mathematician who loves exploring combinatorics. She is working on a project that involves calculating permutations.

Ria wants to create a program that takes the values of n and r as input and calculates the permutations of n elements taken r at a time.

Write a program using pointers and a function calculatePermutations that, given the values of n and r, calculates and prints the permutations of n elements taken r at a time.

Permutation: n! / (n - r)!

Input Format

The first line consists of an integer n, representing the total number of elements.

The second line consists of an integer r, representing the number of elements to be taken at a time.

Output Format

The output prints the result of the permutation.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4
3
Output: 24

Answer

```
// You are using GCC
#include<stdio.h>
long fact(int n,int r)
```

```
{
    long f=1;
    for(int i=0;i<r;i++)
    f*=(n-i);
    return f;
}
int main()
{
    int n,r;
    scanf("%d",&n);
    scanf("%d",&r);
    long X=fact(n,r);
    printf("%ld\n",X);
    return 0;
}
```

Status : Correct   *Marks : 1/1*

5. Problem Statement

Sam is developing a program for analyzing daily temperature fluctuations. Users input the number of days, followed by daily temperature values whose memory is allocated using malloc.

The program calculates and displays the following:

The absolute temperature changes between consecutive days (The first value remains the same).The average temperature of adjacent days.

This allows users to gain insights into daily temperature variations for better analysis.

For Example,

Let us assume the temperature for 3 days as 25.5, 28.0, and 23.5.

The absolute differences:

Day 1: (N/A, as there is no previous day) = 25.50Day 2: abs(28.0 - 25.5) = 2.50Day 2: abs(23.5 - 28.0) = 4.50

The average temperatures:

Day 1: (N/A, as there is no previous day) = 25.50Day 2: (25.5 + 23.5) / 2.0 = 24.50Day 3: (N/A, as there is no next day) = 23.50

Input Format

The first line consists of an integer N, representing the number of days.

The second line consists of N space-separated float values, representing the temperature values for N days.

Output Format

The first line displays the absolute temperature change for N days as float values, rounded to two decimal places, separated by a space.

The second line displays the average temperature for N days as float values, rounded to two decimal places, separated by a space.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 3
25.5 28.0 23.5
Output: 25.50 2.50 4.50
25.50 24.50 23.50

Answer

```
// You are using GCC
#include<stdio.h>
#include<stdlib.h>
#include<math.h>
int main()
{
    int n;
    scanf("%d",&n);
    float *temp=(float*)malloc(n*sizeof(float));
    for(int i=0;i<n;i++)
    scanf("%f",&temp[i]);
    printf("%.2f ",temp[0]);
    for(int i=1;i<n;i++)
```

```c
        printf("%.2f ",fabs(temp[i]-temp[i-1]));
    printf("\n");
    printf("%.2f ",temp[0]);
    for(int i=1;i<n-1;i++){
        printf("%.2f ",(temp[i+1]+temp[i-1])/2.0);
        temp[i]=(temp[i+1]+temp[i-1])/2.0;
    }
    printf("%.2f",temp[n-1]);
    free(temp);
    return 0;
}
```

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_MCQ

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : MCQ

1. The following function takes a singly linked list of integers as a parameter and rearranges the elements of the lists.

The function is called with the list containing the integers 1, 2, 3, 4, 5, 6, 7 in the given order. What will be the contents of the list after the function completes execution?

```
struct node {
    int value;
    struct node* next;
};

void rearrange (struct node* list) {
    struct node *p,q;
    int temp;
    if (! List || ! list->next) return;
```

```
    p=list; q=list->next;
    while(q) {
        temp=p->value; p->value=q->value;
        q->value=temp;p=q->next;
        q=p?p->next:0;
    }
}
```

Answer

2, 1, 4, 3, 6, 5, 7

Status : Correct   *Marks : 1/1*

2.   Consider an implementation of an unsorted singly linked list. Suppose it has its representation with a head pointer only. Given the representation, which of the following operations can be implemented in O(1) time?

i) Insertion at the front of the linked list

ii) Insertion at the end of the linked list

iii) Deletion of the front node of the linked list

iv) Deletion of the last node of the linked list

Answer

I and III

Status : Correct   *Marks : 1/1*

3.   In a singly linked list, what is the role of the "tail" node?

Answer

It stores the last element of the list

Status : Correct   *Marks : 1/1*

4.   Consider the singly linked list: 13 -> 4 -> 16 -> 9 -> 22 -> 45 -> 5 -> 16 -> 6, and an integer K = 10, you need to delete all nodes from the list that are

less than the given integer K.

What will be the final linked list after the deletion?

Answer

13 -> 16 -> 22 -> 45 -> 16

Status : Correct   *Marks : 1/1*

5.   Which of the following statements is used to create a new node in a singly linked list?

```
struct node {
    int data;
    struct node * next;
}
typedef struct node NODE;
NODE *ptr;
```

Answer

ptr = (NODE*)malloc(sizeof(NODE));

Status : Correct   *Marks : 1/1*

6.   The following function reverse() is supposed to reverse a singly linked list. There is one line missing at the end of the function.

What should be added in place of "/*ADD A STATEMENT HERE*/", so that the function correctly reverses a linked list?

```
struct node {
    int data;
    struct node* next;
};
static void reverse(struct node** head_ref) {
    struct node* prev   = NULL;
    struct node* current = *head_ref;
    struct node* next;
```

```
while (current != NULL) {
    next  = current->next;
    current->next = prev;
    prev = current;
    current = next;
}
/*ADD A STATEMENT HERE*/
}
```

Answer

*head_ref = prev;

Status : Correct   *Marks : 1/1*

7.   Given a pointer to a node X in a singly linked list. If only one point is given and a pointer to the head node is not given, can we delete node X from the given linked list?

Answer

Possible if X is not last node.

Status : Correct   *Marks : 1/1*

8.   Linked lists are not suitable for the implementation of?

Answer

Binary search

Status : Correct   *Marks : 1/1*

9.   Given the linked list: 5 -> 10 -> 15 -> 20 -> 25 -> NULL. What will be the output of traversing the list and printing each node's data?

Answer

5 10 15 20 25

Status : Correct   *Marks : 1/1*

10. Consider the singly linked list: 15 -> 16 -> 6 -> 7 -> 17. You need to delete all nodes from the list which are prime.

What will be the final linked list after the deletion?

Answer

15 -> 16 -> 6

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

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Phone: 6381820352
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Degree: B.E - CSE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Janani is a tech enthusiast who loves working with polynomials. She wants to create a program that can add polynomial coefficients and provide the sum of their coefficients.

The polynomials will be represented as a linked list, where each node of the linked list contains a coefficient and an exponent. The polynomial is represented in the standard form with descending order of exponents.

Input Format

The first line of input consists of an integer n, representing the number of terms in the first polynomial.

The following n lines of input consist of two integers each: the coefficient and the exponent of the term in the first polynomial.

The next line of input consists of an integer m, representing the number of terms in the second polynomial.

The following m lines of input consist of two integers each: the coefficient and the exponent of the term in the second polynomial.

Output Format

The output prints the sum of the coefficients of the polynomials.

Sample Test Case

Input: 3
2 2
3 1
4 0
3
2 2
3 1
4 0
Output: 18

Answer

```c
#include<stdio.h>
#include<stdlib.h>
typedef struct poly{
    int coeff;
    int expon;
    struct poly* next;
}Node;
Node* newnode(int coeff,int expon){
    Node* new_node = (Node*) malloc(sizeof(Node));
    new_node->coeff = coeff;
    new_node->expon = expon;
    new_node->next = NULL;
    return new_node;
}
void insertNode(Node** head, int coeff, int expon){
    Node* temp = *head;
    if(temp == NULL){
    *head = newnode(coeff,expon);
        return;
    }
```

```c
        while(temp->next != NULL){
            temp = temp->next;
        }
        temp->next = newnode(coeff,expon);
    }
    int main()
    {
        int n, coeff, expon;
        scanf("%d",&n);
        Node* poly1;
        Node* poly2;
        for(int i=0; i<n; i++)
        {
            scanf("%d %d",&coeff,&expon);
            insertNode(&poly1, coeff, expon);
        }
        scanf("%d",&n);
        for(int i=0; i<n; i++)
        {
            scanf("%d %d",&coeff,&expon);
            insertNode(&poly2, coeff, expon);
        }
        int sum = 0;
        while(poly1 != NULL)
        {
            sum += poly1->coeff;
            poly1 = poly1->next;
        }
        while(poly2 != NULL)
        {
            sum += poly2->coeff;
            poly2 = poly2->next;
        }
        printf("%d",sum);
    }
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Imagine you are working on a text processing tool and need to implement a feature that allows users to insert characters at a specific position.

Implement a program that takes user inputs to create a singly linked list of characters and inserts a new character after a given index in the list.

Input Format

The first line of input consists of an integer N, representing the number of characters in the linked list.

The second line consists of a sequence of N characters, representing the linked list.

The third line consists of an integer index, representing the index(0-based) after

which the new character node needs to be inserted.

The fourth line consists of a character value representing the character to be inserted after the given index.

Output Format

If the provided index is out of bounds (larger than the list size):

1. The first line of output prints "Invalid index".
2. The second line prints "Updated list: " followed by the unchanged linked list values.

Otherwise, the output prints "Updated list: " followed by the updated linked list after inserting the new character after the given index.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
a b c d e
2
X
Output: Updated list: a b c X d e

Answer

```
// You are using GCC
#include<stdio.h>
#include<stdlib.h>
typedef struct Char{
    char value;
    struct Char*next;
}Node;
Node*newNode(char value){
    Node* new_node=(Node*)malloc(sizeof(Node));
    new_node->value=value;
    new_node->next=NULL;
    return new_node;
```

```c
    }
    void insertNode(Node** head,char value){
        Node* temp=*head;
        if(temp==NULL){
            *head=newNode(value);
            return;
        }
        while(temp->next!=NULL){
            temp=temp->next;
        }
        temp->next=newNode(value);
    }
    int length(Node* head){
        int len=0;
        while(head != NULL){
            head=head->next;
            len++;
        }
        return len;
    }
    void traverse(Node* head){
        while(head!=NULL){
            printf("%c",head->value);
            head=head->next;
        }
        printf("\n");
    }
    void insert(Node** head, int pos, char value){
        if (pos>=length(*head)){
            printf("Invalid index\n");
            return;
        }
        Node* temp=*head;
        for(int i=0;i<pos;i++){
            temp=temp->next;
        }
        Node* new_node=newNode(value);
        new_node->next=temp->next;
        temp->next=new_node;
    }
    int main()
    {
```

```c
    int n;
    char value;
    Node* head=NULL;
    scanf("%d",&n);
    for(int i=0;i<=n;i++){
        scanf("%c ",&value);
        if(value== ' '||value=='\n'){
            continue;
        }
        insertNode(&head, value);
    }
    scanf("%d %c",&n,&value);
    insert(&head, n, value);
    printf("Updated list: ");
    traverse(head);
}
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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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

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

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

// You are using GCC
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\t",current->data);
        current = current->next;
    }
    printf("\n");
}
int main(){
    struct Node* head = NULL;
```

```c
    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**

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Imagine you are tasked with developing a simple GPA management system using a singly linked list. The system allows users to input student GPA values, insertion should happen at the front of the linked list, delete record by position, and display the updated list of student GPAs.

Input Format

The first line of input contains an integer n, representing the number of students.

The next n lines contain a single floating-point value representing the GPA of each student.

The last line contains an integer position, indicating the position at which a student record should be deleted. Position starts from 1.

Output Format

After deleting the data in the given position, display the output in the format "GPA: " followed by the GPA value, rounded off to one decimal place.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4
3.8
3.2
3.5
4.1
2
Output: GPA: 4.1
GPA: 3.2
GPA: 3.8

Answer

```c
#include<stdio.h>
#include<stdlib.h>
struct Node{
    float GPA;
    struct Node*next;
};
struct Node* createNode(float GPA){
    struct Node* newNode =(struct Node*)malloc(sizeof(struct Node));
    newNode->GPA=GPA;
    newNode->next=NULL;
    return newNode;
}
void insertFront(struct Node** head,float GPA){
    struct Node* newNode = createNode(GPA);
    newNode->next = *head;
    *head= newNode;
}
void deleteAtPosition(struct Node** head,int position){
    if(*head==NULL){
        return ;
```

```c
        }
        struct Node* temp=*head;
        if(position==1){
            *head=temp->next;
            free(temp);
            return;
        }
        for(int i=1;temp!=NULL && i<position-1;i++){
            temp=temp->next;
        }
        if(temp==NULL||temp->next==NULL){
            return;
        }
        struct Node* nodeToDelete=temp->next;
        temp->next=temp->next->next;
        free(nodeToDelete);
    }
    void displayList(struct Node*head){
        struct Node*temp=head;
        while(temp!=NULL){
            printf("GPA: %.1f\n",temp->GPA);
            temp=temp->next;
        }
    }
    int main()
    {
        int n,position;
        scanf("%d",&n);
        struct Node*head=NULL;
        for(int i=0;i<n;i++){
            float GPA;
            scanf("%f",&GPA);
            insertFront(&head,GPA);
        }
        scanf("%d",&position);
        deleteAtPosition(&head,position);
        displayList(head);
        return 0;
    }
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_COD_Question 6

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

John is tasked with creating a program to manage student roll numbers using a singly linked list.

Write a program for John that accepts students' roll numbers, inserts them at the end of the linked list, and displays the numbers.

Input Format

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

The second line consists of N space-separated integers, representing the roll numbers of students.

Output Format

The output prints the space-separated integers singly linked list, after inserting the roll numbers of students at the end.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
23 85 47 62 31

Output: 23 85 47 62 31

Answer

```c
#include<stdio.h>
#include<stdlib.h>
typedef struct student
{
    int roll;
    struct student* next;
}Node;
Node* newNode(int rollno)
{
    Node* data=(Node*)malloc(sizeof(Node));
    data->roll=rollno;
    data->next=NULL;
    return data;
}
void traverse(Node* head)
{
    while(head!=NULL)
    {
        printf("%d\t",head->roll);
        head=head->next;
    }
}
int main()
{
    int n,rollno;
    scanf("%d",&n);
    scanf("%d",&rollno);
    Node* head=newNode(rollno);
```

```
Node* temp=head;
while(--n)
{
    scanf("%d",&rollno);
    temp->next=newNode(rollno);
    temp=temp->next;
}
traverse(head);
}
```

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

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 1_COD_Question 7

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1.   Problem Statement

Dev is tasked with creating a program that efficiently finds the middle element of a linked list. The program should take user input to populate the linked list by inserting each element into the front of the list and then determining the middle element.

Assist Dev, as he needs to ensure that the middle element is accurately identified from the constructed singly linked list:

If it's an odd-length linked list, return the middle element.If it's an even-length linked list, return the second middle element of the two elements.

Input Format

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

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

Output Format

The first line of output displays the linked list after inserting elements at the front.

The second line displays "Middle Element: " followed by the middle element of the linked list.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 20 30 40 50

Output: 50 40 30 20 10
Middle Element: 30

Answer

```c
#include <stdio.h>
#include <stdlib.h>
struct Node {
    int data;
    struct Node* next;
};

struct Node*push(struct Node*head,int data)
{
    struct Node* newNode=(struct Node*)malloc(sizeof(struct Node));
    newNode->data=data;
    newNode->next=head;
    return newNode;
}
int printMiddle(struct Node*head)
{
    struct Node*slow=head;
    struct Node*fast=head;
```

```c
    while(fast!=NULL&&fast->next!=NULL)
    {
        slow=slow->next;
        fast=fast->next->next;
    }
    return slow->data;
}

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

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

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

    struct Node* current = head;
    while (current != NULL) {
        printf("%d ", current->data);
        current = current->next;
    }
    printf("\n");


    int middle_element = printMiddle(head);
    printf("Middle Element: %d\n", middle_element);


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

    return 0;
}
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_MCQ_Updated

Attempt : 1
Total Mark : 20
Marks Obtained : 19

Section 1 : MCQ

1. What is a memory-efficient double-linked list?

Answer

Each node has only one pointer to traverse the list back and forth

Status : Wrong   *Marks : 0/1*

2. How many pointers does a node in a doubly linked list have?

Answer

2

Status : Correct   *Marks : 1/1*

3. How do you reverse a doubly linked list?

Answer

By swapping the next and previous pointers of each node

Status : Correct   *Marks : 1/1*

4. Which of the following information is stored in a doubly-linked list's nodes?

Answer

All of the mentioned options

Status : Correct   *Marks : 1/1*

5. Which of the following statements correctly creates a new node for a doubly linked list?

Answer

struct Node* newNode = (struct Node*) malloc(sizeof(struct Node));

Status : Correct   *Marks : 1/1*

6. What happens if we insert a node at the beginning of a doubly linked list?

Answer

The previous pointer of the new node is NULL

Status : Correct   *Marks : 1/1*

7. What is the main advantage of a two-way linked list over a one-way linked list?

Answer

Two-way linked lists allow for traversal in both directions.

8. What will be the output of the following program?

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

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

int main() {
   struct Node* head = NULL;
   struct Node* tail = NULL;
   for (int i = 0; i < 5; i++) {
      struct Node* temp = (struct Node*)malloc(sizeof(struct Node));
      temp->data = i + 1;
      temp->prev = tail;
      temp->next = NULL;
      if (tail != NULL) {
         tail->next = temp;
      } else {
         head = temp;
      }
      tail = temp;
   }
   struct Node* current = head;
   while (current != NULL) {
      printf("%d ", current->data);
      current = current->next;
   }
   return 0;
}
```

Answer

1 2 3 4 5

9.   Consider the following function that refers to the head of a Doubly Linked List as the parameter. Assume that a node of a doubly linked list has the previous pointer as prev and the next pointer as next.

Assume that the reference of the head of the following doubly linked list is passed to the below function 1 <--> 2 <--> 3 <--> 4 <--> 5 <-->6. What should be the modified linked list after the function call?

```
Procedure fun(head_ref: Pointer to Pointer of node)
    temp = NULL
    current = *head_ref

    While current is not NULL
        temp = current->prev
        current->prev = current->next
        current->next = temp
        current = current->prev
    End While

    If temp is not NULL
        *head_ref = temp->prev
    End If
End Procedure
```

Answer

6 <--> 5 <--> 4 <--> 3 <--> 2 <--> 1.

Status : Correct   *Marks : 1/1*

10.   How do you delete a node from the middle of a doubly linked list?

Answer

All of the mentioned options

Status : Correct   *Marks : 1/1*

11. What will be the output of the following code?

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

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

int main() {
    struct Node* head = NULL;
    struct Node* temp = (struct Node*)malloc(sizeof(struct Node));
    temp->data = 2;
    temp->next = NULL;
    temp->prev = NULL;
    head = temp;
    printf("%d\n", head->data);
    free(temp);
    return 0;
}
```

Answer

2

Status : Correct   *Marks : 1/1*

12.   Where Fwd and Bwd represent forward and backward links to the adjacent elements of the list. Which of the following segments of code deletes the node pointed to by X from the doubly linked list, if it is assumed that X points to neither the first nor the last node of the list?

A doubly linked list is declared as

```c
struct Node {
    int Value;
    struct Node *Fwd;
    struct Node *Bwd;
```

);

  X->Bwd->Fwd = X->Fwd; X->Fwd->Bwd = X->Bwd;

Status : Correct   *Marks : 1/1*

13.   What does the following code snippet do?

```
struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
newNode->data = value;
newNode->next = NULL;
newNode->prev = NULL;
```

Answer

Creates a new node and initializes its data to 'value'

Status : Correct   *Marks : 1/1*

14.   Which code snippet correctly deletes a node with a given value from a doubly linked list?

```
void deleteNode(Node** head_ref, Node* del_node) {
    if (*head_ref == NULL || del_node == NULL) {
        return;
    }
    if (*head_ref == del_node) {
        *head_ref = del_node->next;
    }
    if (del_node->next != NULL) {
        del_node->next->prev = del_node->prev;
    }
    if (del_node->prev != NULL) {
        del_node->prev->next = del_node->next;
    }
    free(del_node);
}
```

Answer

Deletes the first occurrence of a given data value in a doubly linked list.

Status : Correct   *Marks : 1/1*

15. Which of the following is true about the last node in a doubly linked list?

Answer

Its next pointer is NULL

Status : Correct   *Marks : 1/1*

16. Which of the following is false about a doubly linked list?

Answer

Implementing a doubly linked list is easier than singly linked list

Status : Correct   *Marks : 1/1*

17. Which pointer helps in traversing a doubly linked list in reverse order?

Answer

prev

Status : Correct   *Marks : 1/1*

18. What will be the effect of setting the prev pointer of a node to NULL in a doubly linked list?

Answer

The node will become the new head

Status : Correct   *Marks : 1/1*

19. Consider the provided pseudo code. How can you initialize an empty two-way linked list?

Define Structure Node
  data: Integer
  prev: Pointer to Node
  next: Pointer to Node
End Define

Define Structure TwoWayLinkedList
  head: Pointer to Node
  tail: Pointer to Node
End Define

Answer

struct TwoWayLinkedList* list = malloc(sizeof(struct TwoWayLinkedList)); list->head = NULL; list->tail = NULL;

Status : Correct   *Marks : 1/1*

20. What is the correct way to add a node at the beginning of a doubly linked list?

Answer

void addFirst(int data){   Node* newNode = new Node(data);   newNode->next = head;   if (head != NULL) {   head->prev = newNode;   }   head = newNode;   }

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1.   Problem Statement

Your task is to create a program to manage a playlist of items. Each item is represented as a character, and you need to implement the following operations on the playlist.

Here are the main functionalities of the program:

Insert Item: The program should allow users to add items to the front and end of the playlist. Items are represented as characters.Display Playlist: The program should display the playlist containing the items that were added.

To implement this program, a doubly linked list data structure should be used, where each node contains an item character.

Input Format

The input consists of a sequence of space-separated characters, representing the items to be inserted into the doubly linked list.

The input is terminated by entering - (hyphen).

Output Format

The first line of output prints "Forward Playlist: " followed by the linked list after inserting the items at the end.

The second line prints "Backward Playlist: " followed by the linked list after inserting the items at the front.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: a b c -
Output: Forward Playlist: a b c
Backward Playlist: c b a

Answer

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

struct Node {
char item;
    struct Node* next;
    struct Node* prev;
};
// You are using GCC
typedef struct Node Node;
Node *create(char x){
    Node *newnode;
    newnode=(Node *)malloc(sizeof(Node));
    newnode->item=x;
    newnode->next=NULL;
    newnode->prev=NULL;
    return newnode;
}
```

```c
void insertAtEnd(struct Node** head, char item) {
    Node *newnode=create(item);
    if(*head==NULL){
        *head=newnode;
        return;
    }
    Node *current= *head;
    while(current->next!=NULL){
        current=current->next;
    }
    newnode->prev=current;
    current->next=newnode;
    return;
}
void displayForward(struct Node* head) {
    //type your code here
    Node *current=head;
    while(current!=NULL){
        printf("%c ",current->item);
        current=current->next;
    }
    printf("\n");
    return;
}

void displayBackward(struct Node* tail) {
    //type your code here
    Node *current=tail;
    while(tail!=NULL){
        printf("%c ",tail->item);
        tail=tail->prev;
    }
    printf("\n");
    return;
}

void freePlaylist(struct Node* head) {
    //type your code here
    while(head!=NULL){
        Node *temp=head;
        head=head->next;
```

```c
        free(temp);
    }
    return;
}
int main() {
    struct Node* playlist = NULL;
    char item;

    while (1) {
        scanf(" %c", &item);
        if (item == '-') {
            break;
        }
        insertAtEnd(&playlist, item);
    }

    struct Node* tail = playlist;
    while (tail->next != NULL) {
        tail = tail->next;
    }

    printf("Forward Playlist: ");
    displayForward(playlist);

    printf("Backward Playlist: ");
    displayBackward(tail);

    freePlaylist(playlist);

    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Moniksha, a chess coach organizing a tournament, needs a program to manage participant IDs efficiently. The program maintains a doubly linked list of IDs and offers two functions: Append to add IDs as students register, and Print Maximum ID to identify the highest ID for administrative tasks.

This tool streamlines tournament organization, allowing Moniksha to focus on coaching her students effectively.

Input Format

The first line consists of an integer n, representing the number of participant IDs to be added.

The second line consists of n space-separated integers representing the participant IDs.

Output Format

The output displays a single integer, representing the maximum participant ID.

If the list is empty, the output prints "Empty list!".

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 3
163 137 155
Output: 163

Answer

```c
#include<stdio.h>
#include<stdlib.h>
struct node
{
   int data;
   struct node *next;
   struct node *prev;
};
typedef struct node node;
node *create(int x){
   node *newnode;
   newnode=(node*)malloc(sizeof(node));
   newnode->data=x;
   newnode->next=NULL;
   newnode->prev=NULL;
   return newnode;
}
void insert_end(node **head,int x)
{
   node *newnode=create(x);
   if(*head==NULL){
      *head=newnode;
      return;
   }
   node *current=*head;
```

```c
        while(current->next!=NULL){
            current=current->next;
        }
        newnode->prev=current;
        current->next=newnode;
    }
    void find_large(node **head){
        if(*head==NULL||(*head)->data==0){
            printf("Empty list!");
            return;
        }
        node *current=*head;
        node *max=current;
        while(current!=NULL){
            if(current->data > max->data){
                max=current;
            }
            current=current->next;
        }
        printf("%d",max->data);
        return;
    }
    int main()
    {
        node *head=NULL;
        int n,x;
        scanf("%d",&n);
        for(int i=0;i<n;i++){
            scanf("%d ",&x);
            insert_end(&head,x);
        }
        find_large(&head);
    }
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Bob is tasked with developing a company's employee record management system. The system needs to maintain a list of employee records using a doubly linked list. Each employee is represented by a unique integer ID.

Help Bob to complete a program that adds employee records at the front, traverses the list, and prints the same for each addition of employees to the list.

Input Format

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

The second line consists of N space-separated integers, representing the employee IDs.

Output Format

For each employee ID, the program prints "Node Inserted" followed by the current state of the doubly linked list in the next line, with the data values of each node separated by spaces.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4
101 102 103 104
Output: Node Inserted
101
Node Inserted
102 101
Node Inserted
103 102 101
Node Inserted
104 103 102 101

Answer

```cpp
#include <iostream>
using namespace std;

struct node {
    int info;
    struct node* prev, * next;
};

struct node* start = NULL;

// You are using GCC
typedef struct node node;
void traverse() {
  //type your code heret
  node *current=start;
  printf("Node Inserted\n");
  while(current!=NULL){
    printf("%d\t",current->info);
    current=current->next;
```

```
    }
    printf("\n");
    return;
  }

  void insertAtFront(int data) {
    //type your code here
    node *newnode;
    newnode=(node *)malloc(sizeof(node));
    newnode->info=data;
    if(start==NULL){
      start=newnode;
      return;
    }
    newnode->prev=NULL;
    (start)->prev=newnode;
    newnode->next=start;
    start=newnode;
  }

  int main() {
    int n, data;
    cin >> n;
    for (int i = 0; i < n; ++i) {
      cin >> data;
      insertAtFront(data);
      traverse();
    }
    return 0;
  }
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Ravi is developing a student registration system for a college. To efficiently store and manage the student IDs, he decides to implement a doubly linked list where each node represents a student's ID.

In this system, each student's ID is stored sequentially, and the system needs to display all registered student IDs in the order they were entered.

Implement a program that creates a doubly linked list, inserts student IDs, and displays them in the same order.

Input Format

The first line contains an integer N the number of student IDs.

The second line contains N space-separated integers representing the student IDs.

Output Format

The output should display the single line containing N space-separated integers representing the student IDs stored in the doubly linked list.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 20 30 40 50
Output: 10 20 30 40 50

Answer

```c
#include<stdio.h>
#include<stdlib.h>
struct node
{
    int data;
    struct node *next;
    struct node *prev;
};
typedef struct node node;
node *create (int x)
{
    node *newnode;
    newnode=(node *)malloc(sizeof(node));
    newnode->data=x;
    newnode->prev=NULL;
    newnode->next=NULL;
    return newnode;
}
void insert_end(node **head,int x)
{
    node *newnode;
    newnode=create(x);
    if(*head==NULL){
        *head=newnode;
```

```c
        return;
    }
    node *current=*head;
    while(current->next!=NULL){
        current=current->next;
    }
    newnode->prev=current;
    current->next=newnode;
    return;
}
void display(node *head)
{
    node *current=head;
    while(current!=NULL){
        printf("%d ",current->data);
        current=current->next;
    }
    printf("\n");
    return;
}
int main()
{
    node *head=NULL;
    int n,x;
    scanf("%d",&n);
    for(int i=0;i<n;i++){
        scanf("%d",&x);
        insert_end(&head,x);
    }
    display(head);
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 2_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Ashwin is tasked with developing a simple application to manage a list of items in a shop inventory using a doubly linked list. Each item in the inventory has a unique identification number. The application should allow users to perform the following operations:

Create a List of Items: Initialize the inventory with a given number of items. Each item will be assigned a unique number provided by the user and insert the elements at end of the list.

Delete an Item: Remove an item from the inventory at a specific position.

Display the Inventory: Show the list of items before and after deletion.

If the position provided for deletion is invalid (e.g., out of range), it should

display an error message.

Input Format

The first line contains an integer n, representing the number of items to be initially entered into the inventory.

The second line contains n integers, each representing the unique identification number of an item separated by spaces.

The third line contains an integer p, representing the position of the item to be deleted from the inventory.

Output Format

The first line of output prints "Data entered in the list:" followed by the data values of each node in the doubly linked list before deletion.

If p is an invalid position, the output prints "Invalid position. Try again."

If p is a valid position, the output prints "After deletion the new list:" followed by the data values of each node in the doubly linked list after deletion.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 4
1 2 3 4
5
Output: Data entered in the list:
 node 1 : 1
 node 2 : 2
 node 3 : 3
 node 4 : 4
Invalid position. Try again.

Answer

```
// You are using GCC
#include<stdio.h>
#include<stdlib.h>
```

```c
struct node{
    int data;
    struct node *prev;
    struct node *next;
};
struct node* head=NULL;
void insert_end(int data){
    struct node* newnode=(struct node*)malloc(sizeof(struct node));
    newnode->data=data;
    newnode->prev=NULL;
    newnode->next=NULL;
    if(head==NULL){
        head=newnode;
        return;
    }
    struct node*temp=head;
    while(temp->next!=NULL)
    temp=temp->next;
    temp->next=newnode;
    newnode->prev=temp;
}
void display(){
    struct node*temp=head;
    int pos=1;
    while(temp!=NULL){
        printf(" node %d : %d\n",pos,temp->data);
        temp=temp->next;
        pos++;
    }
}
int delete_at_position(int pos){
    if(head==NULL)
    return 0;
    struct node* temp=head;
    int count = 1;
    if(pos==1){
        head=temp->next;
        if(head!=NULL)
        head->prev=NULL;
        free(temp);
        return 1;
    }
```

```c
        while(temp!=NULL&&count<pos){
            temp=temp->next;
            count++;
        }
        if(temp==NULL)
        return 0;
        if(temp->prev!=NULL)
        temp->prev->next=temp->next;
        if(temp->next!=NULL)
        temp->next->prev=temp->prev;
        free(temp);
        return 1;
    }
    int main(){
    int n,p,i,value;
        scanf("%d",&n);
        for(i=0;i<n;i++){
            scanf("%d",&value);
            insert_end(value);
        }
        scanf("%d", &p);
        printf("Data entered in the list:\n");
        display();
        if(p<1||p>n){
            printf("Invalid position. Try again.\n");
        }else{
            delete_at_position(p);
            printf("\nAfter deletion the new list:\n");
            display();
        }
        return 0;
    }
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_MCQ_Updated

Attempt : 1
Total Mark : 20
Marks Obtained : 19

Section 1 : MCQ

1. Pushing an element into the stack already has five elements. The stack size is 5, then the stack becomes

Answer

Overflow

Status : Correct   *Marks : 1/1*

2. What is the advantage of using a linked list over an array for implementing a stack?

Answer

Linked lists can dynamically resize

Status : Correct   *Marks : 1/1*

3.   The result after evaluating the postfix expression 10 5 + 60 6 / * 8 - is

Answer

142

Status : Correct   *Marks : 1/1*

4.   In a stack data structure, what is the fundamental rule that is followed for performing operations?

Answer

Last In First Out

Status : Correct   *Marks : 1/1*

5.   What is the value of the postfix expression 6 3 2 4 + - *?

Answer

-18

Status : Correct   *Marks : 1/1*

6.   Elements are Added on _____ of the Stack.

Answer

Top

Status : Correct   *Marks : 1/1*

7.   Consider a linked list implementation of stack data structure with three operations:

push(value): Pushes an element value onto the stack.pop(): Pops the top element from the stack.top(): Returns the item stored at the top of the stack.

Given the following sequence of operations:

push(10);pop();push(5);top();

What will be the result of the stack after performing these operations?

Answer

The top element in the stack is 5

Status : Correct   *Marks : 1/1*

8. What is the primary advantage of using an array-based stack with a fixed size?

Answer

Efficient memory usage

Status : Correct   *Marks : 1/1*

9. What will be the output of the following code?

```c
#include <stdio.h>
#define MAX_SIZE 5
int stack[MAX_SIZE];
int top = -1;
void display() {
    if (top == -1) {
        printf("Stack is empty\n");
    } else {
        printf("Stack elements: ");
        for (int i = top; i >= 0; i--) {
            printf("%d ", stack[i]);
        }
        printf("\n");
    }
}
void push(int value) {
    if (top == MAX_SIZE - 1) {
        printf("Stack Overflow\n");
    } else {
```

```
    stack[++top] = value;
  }
}
int main() {
  display();
  push(10);
  push(20);
  push(30);
  display();
  push(40);
  push(50);
  push(60);
  display();
  return 0;
}
```

Answer

Stack is emptyStack elements: 30 20 10Stack OverflowStack elements: 50 40 30 20 10

Status : Correct   *Marks : 1/1*

10. Which of the following operations allows you to examine the top element of a stack without removing it?

Answer

Peek

Status : Correct   *Marks : 1/1*

11. In the linked list implementation of the stack, which of the following operations removes an element from the top?

Answer

Pop

Status : Correct   *Marks : 1/1*

12. Consider the linked list implementation of a stack.

Which of the following nodes is considered as Top of the stack?

Answer

Last node

Status : Wrong   *Marks : 0/1*

13.   What will be the output of the following code?

```c
#include <stdio.h>
#define MAX_SIZE 5
void push(int* stack, int* top, int item) {
    if (*top == MAX_SIZE - 1) {
        printf("Stack Overflow\n");
        return;
    }
    stack[++(*top)] = item;
}
int pop(int* stack, int* top) {
    if (*top == -1) {
        printf("Stack Underflow\n");
        return -1;
    }
    return stack[(*top)--];
}

int main() {
    int stack[MAX_SIZE];
    int top = -1;
    push(stack, &top, 10);
    push(stack, &top, 20);
    push(stack, &top, 30);
    printf("%d\n", pop(stack, &top));
    printf("%d\n", pop(stack, &top));
    printf("%d\n", pop(stack, &top));
    printf("%d\n", pop(stack, &top));
    return 0;
```

}

Answer

302010Stack Underflow-1

Status : Correct   *Marks : 1/1*

14.   What will be the output of the following code?

```c
#include <stdio.h>
#define MAX_SIZE 5
int stack[MAX_SIZE];
int top = -1;
int isEmpty() {
    return (top == -1);
}
int isFull() {
    return (top == MAX_SIZE - 1);
}
void push(int item) {
    if (isFull())
        printf("Stack Overflow\n");
    else
        stack[++top] = item;
}
int main() {
    printf("%d\n", isEmpty());
    push(10);
    push(20);
    push(30);
    printf("%d\n", isFull());
    return 0;
}
```

Answer

10

Status : Correct   *Marks : 1/1*

15. Which of the following Applications may use a Stack?

Answer

All of the mentioned options

Status : Correct   *Marks : 1/1*

16. When you push an element onto a linked list-based stack, where does the new element get added?

Answer

At the beginning of the list

Status : Correct   *Marks : 1/1*

17. The user performs the following operations on the stack of size 5 then at the end of the last operation, the total number of elements present in the stack is

push(1);
pop();
push(2);
push(3);
pop();
push(4);
pop();
pop();
push(5);

Answer

1

Status : Correct   *Marks : 1/1*

18. Here is an Infix Expression: 4+3*(6*3-12). Convert the expression from Infix to Postfix notation. The maximum number of symbols that will appear on the stack AT ONE TIME during the conversion of this expression?

Answer

4

Status : Correct   *Marks : 1/1*

19. In an array-based stack, which of the following operations can result in a Stack underflow?

Answer

Popping an element from an empty stack

Status : Correct   *Marks : 1/1*

20. A user performs the following operations on stack of size 5 then which of the following is correct statement for Stack?

push(1);
pop();
push(2);
push(3);
pop();
push(2);
pop();
pop();
push(4);
pop();
pop();
push(5);

Answer

Underflow Occurs

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1.   Problem Statement

In a coding competition, you are assigned a task to create a program that simulates a stack using a linked list.

The program should feature a menu-driven interface for pushing an integer to stack, popping, and displaying stack elements, with robust error handling for stack underflow situations. This challenge tests your data structure skills.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the integer value onto the stack. If the choice is 1, the following input is a space-separated integer, representing the element to be pushed onto

the stack.

Choice 2: Pop the integer from the stack.

Choice 3: Display the elements in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

If the choice is 1, push the given integer to the stack and display the following: "Pushed element: " followed by the value pushed.

If the choice is 2, pop the integer from the stack and display the following: "Popped element: " followed by the value popped.

If the choice is 2, and if the stack is empty without any elements, print "Stack is empty. Cannot pop."

If the choice is 3, print the elements in the stack: "Stack elements (top to bottom): " followed by the space-separated values.

If the choice is 3, and there are no elements in the stack, print "Stack is empty".

If the choice is 4, exit the program and display the following: "Exiting program".

If any other choice is entered, print "Invalid choice".

Refer to the sample input and output for the exact format.

Sample Test Case

Input: 1 3
1 4
3
2
3
4
Output: Pushed element: 3
Pushed element: 4
Stack elements (top to bottom): 4 3
Popped element: 4
Stack elements (top to bottom): 3
Exiting program

Answer

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

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

struct Node* top = NULL;

// You are using GCC
void push(int value) {
   //Type your code here
   struct Node *newnode;
   newnode=(Node *)malloc(sizeof(Node));
   newnode->data=value;
   printf("Pushed element: %d\n",value);
   if(newnode==NULL){
      top=newnode;
```

```c
    }
    else{
        newnode->next=top;
        top=newnode;
    }
}

void pop() {
   //Type your code here
   if(top==NULL){
       printf("stack is empty. cannot pop.\n");
   }
   else{

       struct Node *tempnode;
       tempnode=top;
       top=top->next;
       printf("Popped element: %d\n",tempnode->data);
       free(tempnode);
   }
}

void displayStack() {
   //Type your code here
   if(top==NULL){
       printf("stack is empty\n");
   }
   else{
       printf("Stack elements (top to bottom): ");
       struct Node *position=top;
       while(position!=NULL)
       {
          printf("%d ",position->data);
          position=position->next;
       }
       printf("\n");
       return;
   }

}
int main() {
```

```c
    int choice, value;
    do {
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                scanf("%d", &value);
                push(value);
                break;
            case 2:
                pop();
                break;
            case 3:
                displayStack();
                break;
            case 4:
                printf("Exiting program\n");
                return 0;
            default:
                printf("Invalid choice\n");
        }
    } while (choice != 4);

    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 2

Attempt : 2
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1.   Problem Statement

Sanjeev is in charge of managing a library's book storage, and he wants to create a program that simplifies this task. His goal is to implement a program that simulates a stack using an array.

Help him in writing a program that provides the following functionality:

Add Book ID to the Stack (Push): You can add a book ID to the top of the book stack. Remove Book ID from the Stack (Pop): You can remove the top book ID from the stack and display its details. If the stack is empty, you cannot remove any more book IDs.Display Books ID in the Stack (Display): You can view the books ID currently on the stack.Exit the Library: You can choose to exit the program.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the book onto the stack. If the choice is 1, the following input is a space-separated integer, representing the ID of the book to be pushed onto the stack.

Choice 2: Pop the book ID from the stack.

Choice 3: Display the book ID in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

1. If the choice is 1, push the given book ID to the stack and display the corresponding message.
2. If the choice is 2, pop the book ID from the stack and display the corresponding message.
3. If the choice is 2, and if the stack is empty without any book ID, print "Stack Underflow"
4. If the choice is 3, print the book IDs in the stack.
5. If the choice is 3, and there are book IDs in the stack, print "Stack is empty"
6. If the choice is 4, exit the program and display the corresponding message.
7. If any other choice is entered, print "Invalid choice"

Refer to the sample output for the exact text and format.

Sample Test Case

Input: 1 19
1 28
2
3
2
4
Output: Book ID 19 is pushed onto the stack
Book ID 28 is pushed onto the stack

Book ID 28 is popped from the stack
Book ID in the stack: 19
Book ID 19 is popped from the stack
Exiting the program

Answer

```c
// You are using GCC
#include<stdio.h>
#include<stdlib.h>
#define MAX_SIZE 100
int book[MAX_SIZE];
int top = -1;
void push(int bookID){
    top=top+1;
    book[top]=bookID;
    printf("Book ID %d is pushed onto the stack\n",bookID);
}
void pop(){
    if(top==-1)
    {
        printf("Stack Underflow\n");
    }
    else{
        printf("Book ID %d is popped from the stack\n",book[top]);
        top=top-1;
    }
}
void display(){
    if(top!=-1){
    int a=top;
    printf("Book ID in the stack:");
    while(a!=-1){
        printf("%d ",book[a]);
        a=a-1;
    }
    printf("\n");
    }
    else{
        printf("Stack is empty\n");
    }
}
int main(){
```

```c
    int choice,bookID;
    while(1){
        if(scanf("%d",&choice)!=1){
            printf("invalid input\n");
            break;
        }
        switch(choice){
            case 1:
                if (scanf("%d",&bookID)!=1){
                    printf("invalid input\n");
                    exit(0);
                }
                push(bookID);
                break;
            case 2:
                pop();
                break;
            case 3:
                display();
                break;
            case 4:
                printf("Exiting the program\n");
                exit(0);
            default:
                printf("Invalid choice\n");
        }
    }
    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 3

Attempt : 2
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Sharon is developing a programming challenge for a coding competition. The challenge revolves around implementing a character-based stack data structure using an array.

Sharon's project involves a stack that can perform the following operations:

Push a Character: Users can push a character onto the stack.Pop a Character: Users can pop a character from the stack, removing and displaying the top character.Display Stack: Users can view the current elements in the stack.Exit: Users can exit the stack operations application.

Write a program to help Sharon to implement a program that performs the given operations.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the character onto the stack. If the choice is 1, the following input is a space-separated character, representing the character to be pushed onto the stack.

Choice 2: Pop the character from the stack.

Choice 3: Display the characters in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

1. If the choice is 1, push the given character to the stack and display the pushed character having the prefix "Pushed: ".
2. If the choice is 2, undo the character from the stack and display the character that is popped having the prefix "Popped: ".
3. If the choice is 2, and if the stack is empty without any characters, print "Stack is empty. Nothing to pop."
4. If the choice is 3, print the elements in the stack having the prefix "Stack elements: ".
5. If the choice is 3, and there are no characters in the stack, print "Stack is empty."
6. If the choice is 4, exit the program.
7. If any other choice is entered, print "Invalid choice"

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 2
4
Output: Stack is empty. Nothing to pop.

Answer

#include <stdio.h>

```c
#include <stdbool.h>

#define MAX_SIZE 100

char items[MAX_SIZE];
int top = -1;

void initialize() {
    top = -1;
}
bool isFull() {
    return top == MAX_SIZE - 1;
}

bool isEmpty() {
    return top == -1;
}
// You are using GCC
void push(char value) {
    //Type your code here
    top=top+1;
    items[top]=value;
    printf("Pushed: %c\n",items[top]);

}

char pop() {
    //Type your code here
    if(top==-1)
    {
        printf("Stack is empty. Nothing to pop.\n");
        return '\0';
    }
    else{

    printf("Popped: %c\n",items[top]);
    top=top-1;
    return items[top];
    }
}
void display() {
    //Type your code here
```

```c
        if(top!=-1){

        int a=top;
        printf("Stack elements: ");
        while(a!=-1){
            printf("%c ",items[a]);
            a=a-1;
        }
        printf("\n");
        }
        else{
            printf("Stack is empty.\n");
        }
    }
    int main() {
        initialize();
        int choice;
        char value;

        while (true) {
            scanf("%d", &choice);
            switch (choice) {
                case 1:
                    scanf(" %c", &value);
                    push(value);
                    break;
                case 2:
                    pop();
                    break;
                case 3:
                    display();
                    break;
                case 4:
                    return 0;
                default:
                    printf("Invalid choice\n");
            }
        }
        return 0;
    }
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

You are a software developer tasked with building a module for a scientific calculator application. The primary function of this module is to convert infix mathematical expressions, which are easier for users to read and write, into postfix notation (also known as Reverse Polish Notation). Postfix notation is more straightforward for the application to evaluate because it removes the need for parentheses and operator precedence rules.

The scientific calculator needs to handle various mathematical expressions with different operators and ensure the conversion is correct. Your task is to implement this infix-to-postfix conversion algorithm using a stack-based approach.

Example

Input:

a+b

Output:

ab+

Explanation:

The postfix representation of (a+b) is ab+.

Input Format

The input is a string, representing the infix expression.

Output Format

The output displays the postfix representation of the given infix expression.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: a+(b*e)
Output: abe*+

Answer

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

struct Stack {
    int top;
    unsigned capacity;
    char* array;
};

struct Stack* createStack(unsigned capacity) {
    struct Stack* stack = (struct Stack*)malloc(sizeof(struct Stack));

    if (!stack)
```

```c
        return NULL;

    stack->top = -1;
    stack->capacity = capacity;
    stack->array = (char*)malloc(stack->capacity * sizeof(char));

    return stack;
}

int isEmpty(struct Stack* stack) {
    return stack->top == -1;
}

char peek(struct Stack* stack) {
    return stack->array[stack->top];
}

char pop(struct Stack* stack) {
    if (!isEmpty(stack))
        return stack->array[stack->top--];
    return '$';
}

void push(struct Stack* stack, char op) {
    stack->array[++stack->top] = op;
}
// You are using GCC
int isOperand(char ch) {
    //type your code here
    return((ch>='a' && ch<='z')||(ch>='A'&&ch<='Z')||(ch>='0'&&ch<='9'));
}

int Prec(char ch) {
  //type your code here
  if(ch=='^'){
      return 3;
  }
  else if (ch=='*'||ch=='/')
  return 2;
  else if (ch=='+'||ch=='-')
  return 1;
  else
```

```c
        return 0;
    }

    void infixToPostfix(char* exp){
        struct Stack* stack=createStack(100);
        int l=strlen(exp);

        for(int i=0;i<l;i++){
            int temp=exp[i];
            if(isOperand(temp)){
                printf("%c",temp);
            }else if(temp=='('){
                push(stack,temp);
            }else if(temp==')'){
                while(!isEmpty(stack)&&peek(stack)!='('){
                    printf("%c",pop(stack));
                }
                if(!isEmpty(stack)&&peek(stack)=='(')
                pop(stack);
            }else{
                while(!isEmpty(stack)&&Prec(temp)<=Prec(peek(stack))){
                    printf("%c",pop(stack));
                }
                push(stack,temp);
            }

        }
        while(!isEmpty(stack)){
            printf("%c",pop(stack));
        }
    }

    int main() {
        char exp[100];
        scanf("%s", exp);

        infixToPostfix(exp);
        return 0;
    }
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 3_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Milton is a diligent clerk at a school who has been assigned the task of managing class schedules. The school has various sections, and Milton needs to keep track of the class schedules for each section using a stack-based system.

He uses a program that allows him to push, pop, and display class schedules for each section. Milton's program uses a stack data structure, and each class schedule is represented as a character. Help him write a program using a linked list.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Push the character onto the stack. If the choice is 1, the following input is a space-separated character, representing the class schedule to be pushed onto the stack.

Choice 2: Pop class schedule from the stack

Choice 3: Display the class schedules in the stack.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the stack:

- If the choice is 1, push the given class schedule to the stack and display the following: "Adding Section: [class schedule]"
- If the choice is 2, pop the class schedule from the stack and display the following: "Removing Section: [class schedule]"
- If the choice is 2, and if the stack is empty without any class schedules, print "Stack is empty. Cannot pop."
- If the choice is 3, print the class schedules in the stack in the following: "Enrolled Sections: " followed by the class schedules separated by space.
- If the choice is 3, and there are no class schedules in the stack, print "Stack is empty"
- If the choice is 4, exit the program and display the following: "Exiting the program"
- If any other choice is entered, print "Invalid choice"

Refer to the sample output for the exact format.

Sample Test Case

Input: 1 d
1 h
3
2

3
4
Output: Adding Section: d
Adding Section: h
Enrolled Sections: h d
Removing Section: h
Enrolled Sections: d
Exiting program

Answer

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

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

struct Node* top = NULL;

// You are using GCC
void push(char value) {
    //Type your code here
    struct Node *newnode;
    newnode=(Node*)malloc(sizeof(Node));
    newnode->data=value;
    printf("Adding Section: %c\n",value);
    if(newnode==NULL){
       top=newnode;
    }
    else{
    newnode->next=top;
    top=newnode;
    }
}

void pop() {
    //Type your code here
    if(top==NULL){
        printf("Stack is empty.cannot pop.\n");
    }
    else{
```

```c
        struct Node *tempnode;
        tempnode=top;
        top=top->next;
        printf("Removing section: %c\n",tempnode->data);
        free(tempnode);
    }
}

void displayStack() {
    //Type your code here
    if(top==NULL){
        printf("Stack is empty\n");
    }
    else{
        printf("Enrolled Sections: ");
        struct Node *pos=top;
        while(pos!=NULL){
            printf("%c ",pos->data);
            pos=pos->next;
        }
        printf("\n");
        return;
    }
}
int main() {
    int choice;
    char value;
    do {
        scanf("%d", &choice);
        switch (choice) {
            case 1:
                scanf(" %c", &value);
                push(value);
                break;
            case 2:
                pop();
                break;
            case 3:
                displayStack();
                break;
            case 4:
                printf("Exiting program\n");
```

```c
            break;
        default:
            printf("Invalid choice\n");
    }
} while (choice != 4);

    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 4_MCQ_Updated

Attempt : 1
Total Mark : 20
Marks Obtained : 16

Section 1 : MCQ

1. When new data has to be inserted into a stack or queue, but there is no available space. This is known as

Answer

overflow

Status : Correct   *Marks : 1/1*

2. After performing this set of operations, what does the final list look to contain?

InsertFront(10);
InsertFront(20);
InsertRear(30);
DeleteFront();

InsertRear(40);
InsertRear(10);
DeleteRear();
InsertRear(15);
display();

Answer

10 30 40 15

Status : Correct   *Marks : 1/1*

3.   Which of the following can be used to delete an element from the front end of the queue?

Answer

public Object deleteFront() throws emptyDEQException{if(isEmpty())throw new emptyDEQException("Empty");else{Node temp = head.getNext();Node cur = temp;Object e = temp.getEle();head.setNext(cur);size--;return e;}}

Status : Wrong   *Marks : 0/1*

4.   Which of the following properties is associated with a queue?

Answer

First In First Out

Status : Correct   *Marks : 1/1*

5.   The essential condition that is checked before insertion in a queue is?

Answer

Overflow

Status : Correct   *Marks : 1/1*

6.   The process of accessing data stored in a serial access memory is similar to manipulating data on a

Answer

Stack

Status : Wrong   *Marks : 0/1*

7. Front and rear pointers are tracked in the linked list implementation of a queue. Which of these pointers will change during an insertion into the EMPTY queue?

Answer

Both front and rear pointer

Status : Correct   *Marks : 1/1*

8. What will the output of the following code?

```c
#include <stdio.h>
#include <stdlib.h>
typedef struct {
    int* arr;
    int front;
    int rear;
    int size;
} Queue;
Queue* createQueue() {
    Queue* queue = (Queue*)malloc(sizeof(Queue));
    queue->arr = (int*)malloc(5 * sizeof(int));
    queue->front = 0;
    queue->rear = -1;
    queue->size = 0;
    return queue;
}
int main() {
    Queue* queue = createQueue();
    printf("%d", queue->size);
    return 0;
}
```

Answer

0

Status : Correct   *Marks : 1/1*

9. Which one of the following is an application of Queue Data Structure?

Answer

All of the mentioned options

Status : Correct   *Marks : 1/1*

10. What will be the output of the following code?

```c
#include <stdio.h>
#include <stdlib.h>
#define MAX_SIZE 5
typedef struct {
    int* arr;
    int front;
    int rear;
    int size;
} Queue;
Queue* createQueue() {
    Queue* queue = (Queue*)malloc(sizeof(Queue));
    queue->arr = (int*)malloc(MAX_SIZE * sizeof(int));
    queue->front = -1;
    queue->rear = -1;
    queue->size = 0;
    return queue;
}
int isEmpty(Queue* queue) {
    return (queue->size == 0);
}
int main() {
    Queue* queue = createQueue();
    printf("Is the queue empty? %d", isEmpty(queue));
    return 0;
```

}

Answer

Is the queue empty? 1

Status : Correct   *Marks : 1/1*

11.   In a linked list implementation of a queue, front and rear pointers are tracked. Which of these pointers will change during an insertion into a non-empty queue?

Answer

Both front and rear pointer

Status : Wrong   *Marks : 0/1*

12.   Which operations are performed when deleting an element from an array-based queue?

Answer

Dequeue

Status : Correct   *Marks : 1/1*

13.   What is the functionality of the following piece of code?

```
public void function(Object item)
{
  Node temp=new Node(item,trail);
  if(isEmpty())
  {
    head.setNext(temp);
    temp.setNext(trail);
  }
  else
  {
    Node cur=head.getNext();
    while(cur.getNext()!=trail)
```

```
    {
        cur=cur.getNext();
    }
    cur.setNext(temp);
  }
  size++;
}
```

Answer

Insert at the rear end of the dequeue

Status : Correct   *Marks : 1/1*

14. Insertion and deletion operation in the queue is known as

Answer

Enqueue and Dequeue

Status : Correct   *Marks : 1/1*

15. In linked list implementation of a queue, the important condition for a
queue to be empty is?

Answer

FRONT==REAR-1

Status : Wrong   *Marks : 0/1*

16. What does the front pointer in a linked list implementation of a queue
contain?

Answer

The address of the first element

Status : Correct   *Marks : 1/1*

17. A normal queue, if implemented using an array of size MAX_SIZE, gets

full when

Answer

Rear = MAX_SIZE − 1

Status : Correct   *Marks : 1/1*

18.   In what order will they be removed If the elements "A", "B", "C" and "D" are placed in a queue and are deleted one at a time

Answer

ABCD

Status : Correct   *Marks : 1/1*

19.   What are the applications of dequeue?

Answer

All the mentioned options

Status : Correct   *Marks : 1/1*

20.   What will be the output of the following code?

```
#include <stdio.h>
#define MAX_SIZE 5
typedef struct {
    int arr[MAX_SIZE];
    int front;
    int rear;
    int size;
} Queue;

void enqueue(Queue* queue, int data) {
    if (queue->size == MAX_SIZE) {
        return;
    }
```

```c
    queue->rear = (queue->rear + 1) % MAX_SIZE;
    queue->arr[queue->rear] = data;
    queue->size++;
}
int dequeue(Queue* queue) {
    if (queue->size == 0) {
        return -1;
    }
    int data = queue->arr[queue->front];
    queue->front = (queue->front + 1) % MAX_SIZE;
    queue->size--;
    return data;
}
int main() {
    Queue queue;
    queue.front = 0;
    queue.rear = -1;
    queue.size = 0;
    enqueue(&queue, 1);
    enqueue(&queue, 2);
    enqueue(&queue, 3);
    printf("%d ", dequeue(&queue));
    printf("%d ", dequeue(&queue));
    enqueue(&queue, 4);
    enqueue(&queue, 5);
    printf("%d ", dequeue(&queue));
    printf("%d ", dequeue(&queue));
    return 0;
}
```

Answer

1 2 3 4

Status : Correct   **Marks : 1/1**

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 4_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Imagine a bustling coffee shop, where customers are placing their orders for their favorite coffee drinks. The cafe owner Sheeren wants to efficiently manage the queue of coffee orders using a digital system. She needs a program to handle this queue of orders.

You are tasked with creating a program that implements a queue for coffee orders. Each character in the queue represents a customer's coffee order, with 'L' indicating a latte, 'E' indicating an espresso, 'M' indicating a macchiato, 'O' indicating an iced coffee, and 'N' indicating a nabob.

Customers can place orders and enjoy their delicious coffee drinks.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Enqueue the coffee order into the queue. If the choice is 1, the following input is a space-separated character ('L', 'E', 'M', 'O', 'N').

Choice 2: Dequeue a coffee order from the queue.

Choice 3: Display the orders in the queue.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the queue:

If the choice is 1:

1. Insert the given order into the queue and display "Order for [order] is enqueued." where [order] is the coffee order that is inserted.
2. If the queue is full, print "Queue is full. Cannot enqueue more orders."

If the choice is 2:

1. Dequeue a character from the queue and display "Dequeued Order: " followed by the corresponding order that is dequeued.
2. If the queue is empty without any orders, print "No orders in the queue."

If the choice is 3:

1. The output prints "Orders in the queue are: " followed by the space-separated orders present in the queue.
2. If there are no orders in the queue, print "Queue is empty. No orders available."

If the choice is 4:

1. Exit the program and print "Exiting program"

If any other choice is entered, the output prints "Invalid option."

Refer to the sample output for the exact text and format.

Sample Test Case

Input: 1 L
1 E
1 M
1 O
1 N
1 O
3
2
3
4

Output: Order for L is enqueued.
Order for E is enqueued.
Order for M is enqueued.
Order for O is enqueued.
Order for N is enqueued.
Queue is full. Cannot enqueue more orders.
Orders in the queue are: L E M O N
Dequeued Order: L
Orders in the queue are: E M O N
Exiting program

Answer

```
#include <stdio.h>
#define MAX_SIZE 5

char orders[MAX_SIZE];
int front = -1;
int rear = -1;

void initializeQueue() {
    front = -1;
    rear = -1;
}
// You are using GCC
```

```c
int isEmpty() {
//Type your code here
   if(front == -1)
      return 1;
   else
      return 0;
}

int isFull() {
   //Type your code here
   if(rear== MAX_SIZE - 1)
      return 1;
   else
      return 0;
}

int enqueue(char order) {
   //Type your code here
   if(isFull()){
      printf("Queue is full.cannot enqueue more orders.\n");
      return -1;
   }else{
      if(front==-1)
         front = 0;
      rear=rear+1;
      orders[rear]=order;
      printf("Order for %c is enqueued.\n",orders[rear]);
      return 0;
   }
}

int dequeue() {
   //Type your code here
   if(isEmpty()){
      printf("No orders in the queue.\n");
      return -1;
   }else{
      printf("Dequeued Order : %c\n",orders[front]);
      if(front==rear)
         front = rear = -1;
      else
         front++;
```

```c
        return 0;
    }
}

    void display() {
        //Type your code here
        int i;
        if(isEmpty()){
            printf("Queue is empty. No orders available.\n");
        }else{
            printf("Orders in the queue are:");
            for(i = front;i<=rear;i++){
                printf("%c\t",orders[i]);
            }
            printf("\n");
        }

    }
    int main() {
        char order;
        int option;
        initializeQueue();
        while (1) {
            if (scanf("%d", &option) != 1) {
                break;
            }
            switch (option) {
                case 1:
                    if (scanf(" %c", &order) != 1) {
                        break;
                    }
                    if (enqueue(order)) {
                    }
                    break;
                case 2:
                    dequeue();
                    break;
                case 3:
                    display();
                    break;
                case 4:
                    printf("Exiting program");
```

```c
            return 0;
        default:
            printf("Invalid option.\n");
            break;
    }
}
return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 4_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1.   Problem Statement

In a bustling IT department, staff regularly submit helpdesk tickets to request technical assistance. Managing these tickets efficiently is vital for providing quality support.

Your task is to develop a program that uses an array-based queue to handle and prioritize helpdesk tickets based on their unique IDs.

Implement a program that provides the following functionalities:

Enqueue Helpdesk Ticket: Add a new helpdesk ticket to the end of the queue. Provide a positive integer representing the ticket ID for the new ticket.Dequeue Helpdesk Ticket: Remove and process the next helpdesk ticket from the front of the queue. The program will display the ticket ID of the processed ticket.Display Queue: Display the ticket IDs of all the

helpdesk tickets currently in the queue.

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Enqueue the ticket ID into the queue. If the choice is 1, the following input is a space-separated integer, representing the ticket ID to be enqueued into the queue.

Choice 2: Dequeue a ticket from the queue.

Choice 3: Display the ticket IDs in the queue.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the queue:

If the choice is 1:

1. Insert the given ticket ID into the queue and display "Helpdesk Ticket ID [id] is enqueued." where [id] is the ticket ID that is inserted.
2. If the queue is full, print "Queue is full. Cannot enqueue."

If the choice is 2:

1. Dequeue a ticket ID from the queue and display "Dequeued Helpdesk Ticket ID: " followed by the corresponding ID that is dequeued.
2. If the queue is empty without any elements, print "Queue is empty."

If the choice is 3:

1. The output prints "Helpdesk Ticket IDs in the queue are: " followed by the space-separated ticket IDs present in the queue.
2. If there are no elements in the queue, print "Queue is empty."

If the choice is 4:

1. Exit the program and print "Exiting the program"

If any other choice is entered, print "Invalid option."

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 1 101
1 202
1 203
1 204
1 205
1 206
3
2
3
4
Output: Helpdesk Ticket ID 101 is enqueued.
Helpdesk Ticket ID 202 is enqueued.
Helpdesk Ticket ID 203 is enqueued.
Helpdesk Ticket ID 204 is enqueued.
Helpdesk Ticket ID 205 is enqueued.
Queue is full. Cannot enqueue.
Helpdesk Ticket IDs in the queue are: 101 202 203 204 205
Dequeued Helpdesk Ticket ID: 101
Helpdesk Ticket IDs in the queue are: 202 203 204 205
Exiting the program

Answer

```c
#include <stdio.h>
#define MAX_SIZE 5

int ticketIDs[MAX_SIZE];
int front = -1;
int rear = -1;
int lastDequeued;

void initializeQueue() {
    front = -1;
    rear = -1;
}
```

```c
// You are using GCC
int isEmpty() {
    //type your code here
    return (front==-1);
}
int isFull() {
    //type your code here
    return (rear==MAX_SIZE - 1);
}

int enqueue(int ticketID) {
    //type your code here
    if(isFull()){
        printf("Queue is full.cannot enqueue.\n");
        return 1;
    }else{
        if(front==-1)
            front = 0;
        rear=rear+1;
        ticketIDs[rear]=ticketID;
        printf("Helpdesk Ticket ID %d is enqueued.\n",ticketIDs[rear]);
        return 1;
    }
}

int dequeue() {
    //type your code he
    if(isEmpty()){
        return 0;
    }
    lastDequeued = ticketIDs[front];
    if(front==rear){
        front = rear = -1;
    }else{
        front=front + 1;
    }
    return 1;

}

void display() {
    //type your code here
```

```c
        int i;
        if(isEmpty()){
        printf("Queue is empty.\n");
        }else{
            printf("Helpdesk Ticket IDs in the queue are: ");
            for(i=front;i<=rear;i++){
                printf("%d\t",ticketIDs[i]);
            }
            printf("\n");
        }
    }

    int main() {
        int ticketID;
        int option;
        initializeQueue();
        while (1) {
            if (scanf("%d", &option) == EOF) {
                break;
            }
            switch (option) {
                case 1:
                    if (scanf("%d", &ticketID) == EOF) {
                        break;
                    }
                    enqueue(ticketID);
                    break;
                case 2:
                    if (dequeue()) {
                        printf("Dequeued Helpdesk Ticket ID: %d\n", lastDequeued);
                    } else {
                        printf("Queue is empty.\n");
                    }
                    break;
                case 3:
                    display();
                    break;
                case 4:
                    printf("Exiting the program\n");
                    return 0;
                default:
                    printf("Invalid option.\n");
                    break;
```

```
        }
    }
    return 0;
}
```

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

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 4_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Write a program to implement a queue using an array and pointers. The program should provide the following functionalities:

Insert an element into the queue.Delete an element from the queue.Display the elements in the queue.

The queue has a maximum capacity of 5 elements. If the queue is full and an insertion is attempted, a "Queue is full" message should be displayed. If the queue is empty and a deletion is attempted, a "Queue is empty" message should be displayed.

Input Format

Each line contains an integer representing the chosen option from 1 to 3.

Option 1: Insert an element into the queue followed by an integer representing the element to be inserted, separated by a space.

Option 2: Delete an element from the queue.

Option 3: Display the elements in the queue.

Output Format

For option 1 (insertion):-

1. The program outputs: "<data> is inserted in the queue." if the data is successfully inserted.
2. "Queue is full." if the queue is already full and cannot accept more elements.

For option 2 (deletion):-

1. The program outputs: "Deleted number is: <data>" if an element is successfully deleted and returns the value of the deleted element.
2. "Queue is empty." if the queue is empty no elements can be deleted.

For option 3 (display):-

1. The program outputs: "Elements in the queue are: <element1> <element2> ... <elementN>" where <element1>, <element2>, ..., <elementN> represent the elements present in the queue.
2. "Queue is empty." if the queue is empty no elements can be displayed.

For invalid options, the program outputs: "Invalid option."

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 1 10

3
5
Output: 10 is inserted in the queue.
Elements in the queue are: 10
Invalid option.

Answer

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

#define max 5

int queue[max];
int front = -1, rear = -1;
// You are using GCC
int insertq(int *data)
{
   if(rear== max - 1)
      return 0;
   if(front==-1)
      front=0;
   rear=rear+1;
   queue[rear]=*data;
   return 1;

}

int delq()
{
   //Type your code here
   if(front==-1){
      printf("Queue is empty.\n");
      return -1;
   }
   else{
      printf("Deleted number is: %d",queue[front]);
      if(front==rear)
         front=rear=-1;
      else
         front++;
      return 0;
```

```c
        }
    }

    void display()
    {
        //Type your code here
        if(front==-1){
            printf("Queue is empty.\n");
        }else{
            printf("Elements in the queue are:");
            for(int i=front;i<=rear;i++){
                printf("%d",queue[i]);
            }
        printf("\n");
        }
    }

    int main()
    {
        int data, reply, option;
        while (1)
        {
            if (scanf("%d", &option) != 1)
                break;
            switch (option)
            {
            case 1:
                if (scanf("%d", &data) != 1)
                    break;
                reply = insertq(&data);
                if (reply == 0)
                    printf("Queue is full.\n");
                else
                    printf("%d is inserted in the queue.\n", data);
                break;
            case 2:
                delq();  //    Called without arguments
                break;
            case 3:
                display();
                break;
            default:
                printf("Invalid option.\n");
```

```
                break;
        }
    }
    return 0;
}
```

Status : Correct

Marks : 10/10

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 4_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

In an office setting, a print job management system is used to efficiently handle and process print jobs. The system is implemented using a queue data structure with an array.

The program provides the following operations:

Enqueue Print Job: Add a print job with a specified number of pages to the end of the queue.Dequeue Print Job: Remove and process the next print job in the queue.Display Queue: Display the print jobs in the queue

The program should ensure that print jobs are processed in the order they are received.

Input Format

The input consists of integers corresponding to the operation that needs to be performed:

Choice 1: Enqueue the print job into the queue. If the choice is 1, the following input is a space-separated integer, representing the pages to be enqueued into the queue.

Choice 2: Dequeue a print job from the queue.

Choice 3: Display the print jobs in the queue.

Choice 4: Exit the program.

Output Format

The output displays messages according to the choice and the status of the queue:

If the choice is 1:

1. Insert the given page into the queue and display "Print job with [page] pages is enqueued." where [page] is the number of pages that are inserted.
2. If the queue is full, print "Queue is full. Cannot enqueue."

If the choice is 2:

1. Dequeue a page from the queue and display "Processing print job: [page] pages" where [page] is the corresponding page that is dequeued.
2. If the queue is empty without any elements, print "Queue is empty."

If the choice is 3:

1. The output prints "Print jobs in the queue: " followed by the space-separated pages present in the queue.
2. If there are no elements in the queue, print "Queue is empty."

If the choice is 4:

1. Exit the program and print "Exiting program"

If any other choice is entered, the output prints "Invalid option."

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 1
10
1
20
1
30
1
40
1
50
1
60
3
2
3
4
Output: Print job with 10 pages is enqueued.
Print job with 20 pages is enqueued.
Print job with 30 pages is enqueued.
Print job with 40 pages is enqueued.
Print job with 50 pages is enqueued.
Queue is full. Cannot enqueue.
Print jobs in the queue: 10 20 30 40 50
Processing print job: 10 pages
Print jobs in the queue: 20 30 40 50
Exiting program

Answer

```
// You are using GCC
#include<stdio.h>
#define MAX 5
int queue[MAX];
int front=-1;
int rear=-1;
```

```c
int isEmpty(){
    if(front==-1){
        return 1;
    }else{
        return 0;
    }
}
int isFull(){
    if(rear==MAX-1){
        return 1;
    }else{
        return 0;
    }
}
int enqueue(int job){
    if(isFull()){
        printf("Queue is full.cannot enqueue.\n");
        return 0;
    }
    else{
        rear=rear+1;
        queue[rear]=job;
        printf("Print job with %d pages is enqueued.\n",job);
        if(front==-1){
            front=0;
        }
        return 1;
    }
}
int dequeue(){
    if(isEmpty()){
        printf("Queue is empty.\n");
        return 0;
    }
    else{
        printf("Processing print job:%d\n pages",queue[front]);
        if(front==rear){
            front=rear=-1;
        }
        else{
            front=front+1;
```

```c
        }
    }return 1;
}
void display(){
    if (isEmpty()){
        printf("Queue is empty.\n");
    }
    else{
        printf("Print jobs in the queue:");
        for(int i=front;i<=rear;i++){
            printf("%d ",queue[i]);
        }
        printf("\n");
    }
}
int main(){
    int choice;
    while(1){
        scanf("%d",&choice);
        switch(choice){
            case 1:
            int x;
            scanf("%d",&x);
            enqueue(x);
            break;
            case 2:
            dequeue();
            break;
            case 3:
            display();
            break;
            case 4:
            printf("Exiting program\n");
            return 0;
            default:
            printf("Invalid option.\n");
            break;
        }
    }
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 4_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

You are tasked with implementing basic operations on a queue data structure using a linked list.

You need to write a program that performs the following operations on a queue:

Enqueue Operation: Implement a function that inserts an integer element at the rear end of the queue.Print Front and Rear: Implement a function that prints the front and rear elements of the queue. Dequeue Operation: Implement a function that removes the front element from the queue.

Input Format

The first line of input consists of an integer N, representing the number of elements to be inserted into the queue.

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

Output Format

The first line prints "Front: X, Rear: Y" where X is the front and Y is the rear elements of the queue.

The second line prints the message indicating that the dequeue operation (front element removed) is performed: "Performing Dequeue Operation:".

The last line prints "Front: M, Rear: N" where M is the front and N is the rear elements after the dequeue operation.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 5
12 56 87 23 45

Output: Front: 12, Rear: 45
Performing Dequeue Operation:
Front: 56, Rear: 45

Answer

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

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

struct Node* front = NULL;
struct Node* rear = NULL;

// You are using GCC

void enqueue(int d) {
    //Type your code here
```

```c
        struct Node* temp;
        temp=(struct Node*)malloc(sizeof(struct Node));
        temp->data=d;
        temp->next=NULL;
        if(rear==NULL){
            rear=front=temp;
        }
        else{
            rear->next=temp;
            rear = temp;
        }

    }

    void printFrontRear() {
        //Type your code here
        if(front&&rear)
            printf("Front: %d, Rear: %d\n",front->data,rear->data);

    }
    void dequeue() {
        //Type your code here
        if(front==NULL)return;
        struct Node* temp = front;
        front=front->next;
        if(front==NULL) rear = NULL;
        free(temp);

    }

    int main() {
        int n, data;
        scanf("%d", &n);
        for (int i = 0; i < n; i++) {
            scanf("%d", &data);
            enqueue(data);
        }
        printFrontRear();
        printf("Performing Dequeue Operation:\n");
        dequeue();
        printFrontRear();
        return 0;
    }
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_MCQ

Attempt : 1
Total Mark : 15
Marks Obtained : 15

Section 1 : MCQ

1. Find the postorder traversal of the given binary search tree.

Answer

1, 4, 2, 18, 14, 13

Status : Correct   *Marks : 1/1*

2. While inserting the elements 5, 4, 2, 8, 7, 10, 12 in a binary search tree, the element at the lowest level is _____.

Answer

12

Status : Correct   *Marks : 1/1*

3. In a binary search tree with nodes 18, 28, 12, 11, 16, 14, 17, what is the value of the left child of the node 16?

Answer

14

Status : Correct   *Marks : 1/1*

4. Which of the following is a valid preorder traversal of the binary search tree with nodes: 18, 28, 12, 11, 16, 14, 17?

Answer

18, 12, 11, 16, 14, 17, 28

Status : Correct   *Marks : 1/1*

5. Find the preorder traversal of the given binary search tree.

Answer

9, 2, 1, 6, 4, 7, 10, 14

Status : Correct   *Marks : 1/1*

6. Find the pre-order traversal of the given binary search tree.

Answer

13, 2, 1, 4, 14, 18

Status : Correct   *Marks : 1/1*

7. Which of the following is the correct in-order traversal of a binary search tree with nodes: 9, 3, 5, 11, 8, 4, 2?

Answer

2, 3, 4, 5, 8, 9, 11

Status : Correct   *Marks : 1/1*

8.   While inserting the elements 71, 65, 84, 69, 67, 83 in an empty binary search tree (BST) in the sequence shown, the element in the lowest level is _____.

Answer

67

Status : Correct   *Marks : 1/1*

9.   Which of the following operations can be used to traverse a Binary Search Tree (BST) in ascending order?

Answer

Inorder traversal

Status : Correct   *Marks : 1/1*

10.   Find the post-order traversal of the given binary search tree.

Answer

10, 17, 20, 18, 15, 32, 21

Status : Correct   *Marks : 1/1*

11.   The preorder traversal of a binary search tree is 15, 10, 12, 11, 20, 18, 16, 19. Which one of the following is the postorder traversal of the tree?

Answer

11, 12, 10, 16, 19, 18, 20, 15

Status : Correct   *Marks : 1/1*

12. Which of the following is the correct post-order traversal of a binary search tree with nodes: 50, 30, 20, 55, 32, 52, 57?

Answer

20, 32, 30, 52, 57, 55, 50

Status : Correct   *Marks : 1/1*

13. Find the in-order traversal of the given binary search tree.

Answer

1, 2, 4, 13, 14, 18

Status : Correct   *Marks : 1/1*

14. How many distinct binary search trees can be created out of 4 distinct keys?

Answer

14

Status : Correct   *Marks : 1/1*

15. Which of the following is the correct pre-order traversal of a binary search tree with nodes: 50, 30, 20, 55, 32, 52, 57?

Answer

50, 30, 20, 32, 55, 52, 57

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1.   Problem Statement

John is learning about Binary Search Trees (BST) in his computer science class. He wants to create a program that allows users to delete a node with a given value from a BST and print the remaining nodes using an in-order traversal.

Implement a function to help him delete a node with a given value from a BST.

Input Format

The first line of input consists of an integer N, representing the number of nodes in the BST.

The second line consists of N space-separated integers, representing the values of the BST nodes.

The third line consists of an integer V, which is the value to delete from the BST.

Output Format

The output prints the space-separated values in the BST in an in-order traversal, after the deletion of the specified value.

If the specified value is not available in the tree, print the given input values in-order traversal.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 5 15 2 7
15
Output: 2 5 7 10

Answer

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

struct TreeNode {
    int data;
    struct TreeNode* left;
    struct TreeNode* right;
};

struct TreeNode* createNode(int key) {
    struct TreeNode* newNode = (struct TreeNode*)malloc(sizeof(struct TreeNode));
    newNode->data = key;
    newNode->left = newNode->right = NULL;
    return newNode;
}

// You are using GCC
typedef struct TreeNode node;
struct TreeNode* insert(struct TreeNode* root, int key) {
```

```c
    //Type your code here
    struct TreeNode *newnode;
    newnode=(node *)malloc(sizeof(node));
    if(root==NULL){
        newnode->data=key;
        newnode->left=NULL;
        newnode->right=NULL;
        root=newnode;
    }
    else if(key<root->data)
        root->left=insert(root->left,key);
    else if(key>root->data)
        root->right=insert(root->right,key);
    return root;
}

struct TreeNode* findMin(struct TreeNode* root) {
    //Type your code here
    if(root==NULL)
    {
        return root;
    }
    while(root&&root->left!=NULL)
        root=root->left;
    return root;
}

struct TreeNode* deleteNode(struct TreeNode* root, int key) {
    //Type your code here
    if(root==NULL){
        return root;
    }
    struct TreeNode *tempnode;
    if(key<root->data){
        root->left=deleteNode(root->left,key);
    }
    else if(key>root->data){
        root->right=deleteNode(root->right,key);
    }
    else if(root->left&&root->right){
        tempnode=findMin(root->right);
        root->data=tempnode->data;
```

```c
        root->right=deleteNode(root->right,root->data);

    }
    else{
        tempnode=root;
        if(root->left==NULL)
            root=root->right;
        else if(root->right==NULL)
            root=root->left;
        free(tempnode);
    }
    return root;
}

void inorderTraversal(struct TreeNode* root) {
    //Type your code here
    if(root!=NULL){
        inorderTraversal(root->left);
        printf("%d ",root->data);
        inorderTraversal(root->right);
    }
}

int main()
{
    int N, rootValue, V;
    scanf("%d", &N);
    struct TreeNode* root = NULL;
    for (int i = 0; i < N; i++) {
        int key;
        scanf("%d", &key);
        if (i == 0) rootValue = key;
        root = insert(root, key);
    }
    scanf("%d", &V);
    root = deleteNode(root, V);
    inorderTraversal(root);
    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Mike is learning about Binary Search Trees (BSTs) and wants to implement various operations on them. He wants to write a basic program for creating a BST, inserting nodes, and printing the tree in the pre-order traversal.

Write a program to help him solve this program.

Input Format

The first line of input consists of an integer N, representing the number of values to insert into the BST.

The second line consists of N space-separated integers, representing the values to insert into the BST.

Output Format

The output prints the space-separated values of the BST in the pre-order traversal.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
3 1 5 2 4

Output: 3 1 2 5 4

Answer

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

struct Node {
    int data;
    struct Node* left;
    struct Node* right;
};

struct Node* createNode(int value) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = value;
    newNode->left = newNode->right = NULL;
    return newNode;
}
// You are using GCC
typedef struct Node node;
struct Node* insert(struct Node* root, int value) {
    //Type your code here
    struct Node *newnode;
    newnode=(node *)malloc(sizeof(node));
    if(root==NULL){
        newnode->data=value;
        newnode->left=NULL;
        newnode->right=NULL;
        root=newnode;
    }
```

```c
        else if(value<root->data)
            root->left=insert(root->left,value);
        else if(value>root->data)
            root->right=insert(root->right,value);
        return root;
    }

    void printPreorder(struct Node* node) {
        //Type your code here
        if(node!=NULL){
            printf("%d ",node->data);
            printPreorder(node->left);
            printPreorder(node->right);
        }
    }
    int main() {
        struct Node* root = NULL;

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

        for (int i = 0; i < n; i++) {
            int value;
            scanf("%d", &value);
            root = insert(root, value);
        }

        printPreorder(root);
        return 0;
    }
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

You are required to implement basic operations on a Binary Search Tree (BST), like insertion and searching.

Insertion: Given a list of integers, construct a Binary Search Tree by repeatedly inserting each integer into the tree according to the rules of a BST.

Searching: Given an integer, search for its presence in the constructed Binary Search Tree. Print whether the integer is found or not.

Write a program to calculate this efficiently.

Input Format

The first line of input consists of an integer n, representing the number of nodes

in the binary search tree.

The second line consists of the values of the nodes, separated by space as integers.

The third line consists of an integer representing, the value that is to be searched.

Output Format

The output prints, "Value <value> is found in the tree." if the given value is present, otherwise it prints: "Value <value> is not found in the tree."

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 7
8 3 10 1 6 14 23
6
Output: Value 6 is found in the tree.

Answer

```
// You are using GCC
typedef struct Node node;
struct Node* insertNode(struct Node* root, int value) {
   //Type your code here
   node *newnode;
   newnode=(node *)malloc(sizeof(node));
   if(root==NULL){
      newnode->data=value;
      newnode->left=NULL;
      newnode->right=NULL;
      root=newnode;
   }
   else if(value<root->data)
      root->left=insertNode(root->left,value);
   else if(value>root->data)
      root->right=insertNode(root->right,value);
   return root;

}
```

```
struct Node* searchNode(struct Node* root, int value) {
//Type your code here
  if(root==NULL)
     return NULL;
  if(value==root->data)
     return root;
  else if(value<root->data)
     return searchNode(root->left,value);
  else
     return searchNode(root->right,value);

}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

John, a computer science student, is learning about binary search trees (BST) and their properties. He decides to write a program to create a BST, display it in post-order traversal, and find the minimum value present in the tree.

Help him by implementing the program.

Input Format

The first line of input consists of an integer N, representing the number of elements to insert into the BST.

The second line consists of N space-separated integers data, which is the data to be inserted into the BST.

Output Format

The first line of output prints the space-separated elements of the BST in post-order traversal.

The second line prints the minimum value found in the BST.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 3
5 10 15
Output: 15 10 5
The minimum value in the BST is: 5

Answer

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

struct Node {
    int data;
    struct Node* left;
    struct Node* right;
};

struct Node* createNode(int data) {
    struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));
    newNode->data = data;
    newNode->left = newNode->right = NULL;
    return newNode;
}
// You are using GCC
typedef struct Node node;
struct Node* insert(struct Node* root, int data) {
    //Type your code here
    node *newnode;
    newnode=(node *)malloc(sizeof(node));
    if(root==NULL){
        newnode->data=data;
```

```c
            newnode->left=NULL;
            newnode->right=NULL;
            root=newnode;
        }
        else if(data<root->data)
            root->left=insert(root->left,data);
        else if (data>root->data)
            root->right=insert(root->right,data);
        return root;
    }

    void displayTreePostOrder(struct Node* root) {
        //Type your code here
        if(root==NULL) return;
            displayTreePostOrder(root->left);
            displayTreePostOrder(root->right);
            printf("%d ",root->data);
    }

    int findMinValue(struct Node* root) {
        //Type your code here
        if(root!=NULL)
            while(root->left!=NULL)
                root=root->left;
        return root->data;

    }
    int main() {
        struct Node* root = NULL;
        int n, data;
        scanf("%d", &n);

        for (int i = 0; i < n; i++) {
            scanf("%d", &data);
            root = insert(root, data);
        }

        displayTreePostOrder(root);
        printf("\n");

        int minValue = findMinValue(root);
        printf("The minimum value in the BST is: %d", minValue);
```

```
    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 5_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

In his computer science class, John is learning about Binary Search Trees (BST). He wants to build a BST and find the maximum value in the tree.

Help him by writing a program to insert nodes into a BST and find the maximum value in the tree.

Input Format

The first line of input consists of an integer N, representing the number of nodes in the BST.

The second line consists of N space-separated integers, representing the values of the nodes to insert into the BST.

Output Format

The output prints the maximum value in the BST.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
10 5 15 2 7
Output: 15

Answer

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

struct TreeNode {
    int data;
    struct TreeNode* left;
    struct TreeNode* right;
};
struct TreeNode* createNode(int key) {
    struct TreeNode* newNode = (struct TreeNode*)malloc(sizeof(struct
TreeNode));
    newNode->data = key;
    newNode->left = newNode->right = NULL;
    return newNode;
}

// You are using GCC
typedef struct TreeNode node;
struct TreeNode* insert(struct TreeNode* root, int key) {
    //Type your code here
    TreeNode *newnode;
    newnode=(node *)malloc(sizeof(node));
    if(root==NULL){
        newnode->data=key;
        newnode->left=NULL;
        newnode->right=NULL;
        root=newnode;
    }
    else if(key<root->data)
```

```c
        root->left=insert(root->left,key);
    else if(key>root->data)
        root->right=insert(root->right,key);
    return root;
}
int findMax(struct TreeNode* root) {
    //Type your code her
        while(root && root->right!=NULL)
            root=root->right;
        return root->data;
}

int main() {
    int N, rootValue;
    scanf("%d", &N);

    struct TreeNode* root = NULL;

    for (int i = 0; i < N; i++) {
        int key;
        scanf("%d", &key);
        if (i == 0) rootValue = key;
        root = insert(root, key);
    }

    int maxVal = findMax(root);
    if (maxVal != -1) {
        printf("%d", maxVal);
    }

    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 6_MCQ_Updated_1

Attempt : 1
Total Mark : 20
Marks Obtained : 17

Section 1 : MCQ

1. Which of the following is true about Quicksort?

Answer

It is an in-place sorting algorithm

Status : Correct   *Marks : 1/1*

2. The following code snippet is an example of a quick sort. What do the 'low' and 'high' parameters represent in this code?

```
void quickSort(int arr[], int low, int high) {
    if (low < high) {
        int pivot = partition(arr, low, high);
        quickSort(arr, low, pivot - 1);
        quickSort(arr, pivot + 1, high);
```

```
    }
}
```

Answer

The range of elements to sort within the array

Status : Correct   *Marks : 1/1*

3. What happens during the merge step in Merge Sort?

Answer

Two sorted subarrays are combined into one sorted array

Status : Correct   *Marks : 1/1*

4. Which of the following scenarios is Merge Sort preferred over Quick Sort?

Answer

 When minimizing recursion depth

Status : Wrong   *Marks : 0/1*

5. In a quick sort algorithm, what role does the pivot element play?

Answer

It is used to partition the array

Status : Correct   *Marks : 1/1*

6. Which of the following is not true about QuickSort?

Answer

It as an adaptive sorting algorithm

Status : Wrong   *Marks : 0/1*

7.   Why is Merge Sort preferred for sorting large datasets compared to Quick Sort?

Answer

Merge Sort has better worst-case time complexity

Status : Correct   *Marks : 1/1*

8.   What is the best sorting algorithm to use for the elements in an array that are more than 1 million in general?

Answer

Quick sort.

Status : Correct   *Marks : 1/1*

9.   Consider the Quick Sort algorithm, which sorts elements in ascending order using the first element as a pivot. Then which of the following input sequences will require the maximum number of comparisons when this algorithm is applied to it?

Answer

22 25 56 67 89

Status : Correct   *Marks : 1/1*

10.   Which of the following strategies is used to improve the efficiency of Quicksort in practical implementations?

Answer

Choosing the pivot randomly or using the median-of-three method

Status : Correct   *Marks : 1/1*

11.   Which of the following methods is used for sorting in merge sort?

Answer

merging

Status : Correct   *Marks : 1/1*

12.   Merge sort is _____.

Answer

Comparison-based sorting algorithm

Status : Correct   *Marks : 1/1*

13.   Which of the following sorting algorithms is based on the divide and conquer method?

Answer

Merge Sort

Status : Correct   *Marks : 1/1*

14.   In a quick sort algorithm, where are smaller elements placed to the pivot during the partition process, assuming we are sorting in increasing order?

Answer

To the left of the pivot

Status : Correct   *Marks : 1/1*

15.   Which of the following statements is true about the merge sort algorithm?

Answer

It requires additional memory for merging

Status : Correct   *Marks : 1/1*

16.   What happens when Merge Sort is applied to a single-element array?

Answer

The array remains unchanged and no merging is required

Status : Correct   *Marks : 1/1*

17. What is the main advantage of Quicksort over Merge Sort?

Answer

Quicksort requires less auxiliary space

Status : Correct   *Marks : 1/1*

18. Which of the following modifications can help Quicksort perform better on small subarrays?

Answer

Switching to Insertion Sort for small subarrays

Status : Correct   *Marks : 1/1*

19. Let P be a quick sort program to sort numbers in ascending order using the first element as a pivot. Let t1 and t2 be the number of comparisons made by P for the inputs {1, 2, 3, 4, 5} and {4, 1, 5, 3, 2}, respectively. Which one of the following holds?

Answer

t1 < t2

Status : Wrong   *Marks : 0/1*

20. Is Merge Sort a stable sorting algorithm?

Answer

Yes, always stable.

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 6_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

John and Mary are collaborating on a project that involves data analysis. They each have a set of age data, one sorted in ascending order and the other in descending order. However, their analysis requires the data to be in ascending order.

Write a program to help them merge the two sets of age data into a single sorted array in ascending order using merge sort.

Input Format

The first line of input consists of an integer N, representing the number of age values in each dataset.

The second line consists of N space-separated integers, representing the ages of participants in John's dataset (in ascending order).

The third line consists of N space-separated integers, representing the ages of participants in Mary's dataset (in descending order).

Output Format

The output prints a single line containing space-separated integers, which represents the merged dataset of ages sorted in ascending order.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
1 3 5 7 9
10 8 6 4 2
Output: 1 2 3 4 5 6 7 8 9 10

Answer

```c
#include <stdio.h>

// You are using GCC
#include<stdlib.h>
void merge(int arr[], int left[], int right[], int left_size, int right_size) {
    //Type your code here
    int i=0,j=0,k=0;
    while(i<left_size && j<right_size){
        if(left[i]<=right[j]){
            arr[k++]=left[i++];
        }
        else{
            arr[k++]=right[j++];
        }
    }
    while(i<left_size){
        arr[k++]=left[i++];
    }
    while(j<right_size){
        arr[k++]=right[j++];
    }
}
```

```c
}

void mergeSort(int arr[], int size) {
    //Type your code here
    if(size<2) return;
    int mid=size/2;
    int *left=(int*)malloc(mid* sizeof(int));
    int *right=(int*)malloc(mid* sizeof(int));
    for(int i=0;i<mid;i++){
        left[i]=arr[i];
    }
    for(int i=mid;i<size;i++){
        right[i-mid]=arr[i];
    }
    mergeSort(left,mid);
    mergeSort(right,size-mid);
    merge(arr,left,right,mid,size-mid);
    free(left);
    free(right);

}

int main() {
    int n, m;
    scanf("%d", &n);
    int arr1[n], arr2[n];
    for (int i = 0; i < n; i++) {
        scanf("%d", &arr1[i]);
    }
    for (int i = 0; i < n; i++) {
        scanf("%d", &arr2[i]);
    }
    int merged[n + n];
    mergeSort(arr1, n);
    mergeSort(arr2, n);
    merge(merged, arr1, arr2, n, n);
    for (int i = 0; i < n + n; i++) {
        printf("%d ", merged[i]);
    }
    return 0;
}
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 6_COD_Question 2

Attempt : 2
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1.   Problem Statement

Nandhini asked her students to arrange a set of numbers in ascending order. She asked the students to arrange the elements using insertion sort, which involves taking each element and placing it in its appropriate position within the sorted portion of the array.

Assist them in the task.

Input Format

The first line of input consists of the value of n, representing the number of array elements.

The second line consists of n elements, separated by a space.

Output Format

The output prints the sorted array, separated by a space.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5
67 28 92 37 59
Output: 28 37 59 67 92

Answer

```c
#include <stdio.h>

// You are using GCC

void insertionSort(int arr[], int n) {
    //Type your code here
    for(int i=0;i<n;i++){
        for(int j=0;j<i;j++){
            if(arr[i]<arr[j]){
                int t=arr[i];
                arr[i]=arr[j];
                arr[j]=t;
            }
        }
    }
}

void printArray(int arr[], int n) {
    //Type your code here
    for(int i=0;i<n;i++){
        printf("%d ",arr[i]);
    }
}

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

```
    }

    insertionSort(arr, n);
    printArray(arr, n);
    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 6_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

You are the lead developer of a text-processing application that assists writers in organizing their thoughts. One crucial feature is a character-sorting service that helps users highlight the most critical elements of their text.

To achieve this, you decide to enhance the service to sort characters in descending order using the Quick-Sort algorithm. Implement the algorithm to efficiently rearrange the characters, ensuring that it is sorted in descending order.

Input Format

The first line of the input consists of a positive integer value N, representing the number of characters to be sorted.

The second line of input consists of N space-separated lowercase alphabetical characters.

Output Format

The output displays the set of alphabetical characters, sorted in descending order.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 5
a d g j k
Output: k j g d a

Answer

```c
#include <stdio.h>
#include <string.h>

// You are using GCC
void swap(char* a, char* b) {
    //Type your code here
    char temp=*a;
    *a=*b;
    *b=temp;

}

int partition(char arr[], int low, int high) {
    //Type your code here
    char pivot=arr[low];
    int i=low;
    int j=high;
    while(i<j){
        while(arr[i]>=pivot){
            i++;
        }
        while(arr[j]<pivot){
            j--;
```

```c
        }
        if(i<j){
            swap(&arr[i],&arr[j]);
        }

    }
    swap(&arr[low],&arr[j]);
    return j;

}

void quicksort(char arr[], int low, int high) {
    //Type your code here
    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);

    char characters[n];

    for (int i = 0; i < n; i++) {
        char input;
        scanf(" %c", &input);
        characters[i] = input;
    }

    quicksort(characters, 0, n - 1);

    for (int i = 0; i < n; i++) {
        printf("%c ", characters[i]);
    }

    return 0;
}
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 6_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Kavya, a software developer, is analyzing data trends. She has a list of integers and wants to identify the nth largest number in the list after sorting the array using QuickSort.

To optimize performance, Kavya is required to use QuickSort to sort the list before finding the nth largest number.

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 nums.

The third line consists of an integer k, representing the position of the largest

number you need to print after sorting the array.

Output Format

The output prints the k-th largest number in the sorted array (sorted in ascending order).

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 6
-1 0 1 2 -1 -4
3
Output: 0

Answer

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

// You are using GCC
void swap(int *a,int *b){
    int temp=*a;
    *a=*b;
    *b=temp;
}
int partition(int arr[], int low, int high) {
    //Type your code here
    int pivot=arr[low];
    int i=low;
    int j=high;
    while(i<j){
        while(arr[i]<=pivot){
            i++;
        }
        while(arr[j]>pivot){
            j--;
        }
        if(i<j){
            swap(&arr[i],&arr[j]);
        }
```

```c
        }
        swap(&arr[low],&arr[j]);
        return j;

    }

    void quicksort(int arr[], int low, int high) {
        //Type your code here
        if(low<high){
            int pi=partition(arr,low, high);
            quicksort(arr,low,pi-1);
            quicksort(arr,pi+1,high);
        }
    }

    void findNthLargest(int* nums, int n, int k) {
        //Type your code here
        quicksort(nums,0,n-1);
        printf("%d",nums[n-k]);



    }

    int main() {
        int n, k;
        scanf("%d", &n);
        int* nums = (int*)malloc(n * sizeof(int));
        for (int i = 0; i < n; i++) {
            scanf("%d", &nums[i]);
        }
        scanf("%d", &k);
        findNthLargest(nums, n, k);
        free(nums);
        return 0;
    }
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 6_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Jose has an array of N fractional values, represented as double-point numbers. He needs to sort these fractions in increasing order and seeks your help.

Write a program to help Jose sort the array using the merge sort algorithm.

Input Format

The first line of input consists of an integer N, representing the number of fractions to be sorted.

The second line consists of N double-point numbers, separated by spaces, representing the fractions array.

Output Format

The output prints N double-point numbers, sorted in increasing order, and rounded to three decimal places.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4
0.123 0.543 0.321 0.789
Output: 0.123 0.321 0.543 0.789

Answer

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

// You are using GCC
int compare(double a, double b) {
    //Type your code her
    if(a<b)
    return -1;
    else if(a>b)
    return 1;
    else
    return 0;

}
void merge(double arr[], int l, int m, int r) {
    //Type your code here
    int n1=m-l+1;
    int n2=r-m;
    double a[n1],b[n2];
    for(int i=0;i<n1;i++)
        a[i]=arr[l+i];
    for(int j=0;j<n2;j++)
        b[j]=arr[m+1+j];

    int i=0,j=0,k=l;
    while(i<n1&&j<n2){
        if(a[i]<=b[j]){
            arr[k++]=a[i++];
```

```c
        }
        else{
            arr[k++]=b[j++];
        }
    }
    while(i<n1)
        arr[k++]=a[i++];
    while(j<n2)
        arr[k++]=b[j++];

}
void mergeSort(double arr[], int l, int r) {
    //Type your code here
    int mid;
    if(l<r){
        mid=(l+r)/2;
        mergeSort(arr,l,mid);
        mergeSort(arr,mid+1,r);
        merge(arr,l,mid,r);

    }
}

int main() {
    int n;
    scanf("%d", &n);
    double fractions[n];
    for (int i = 0; i < n; i++) {
        scanf("%lf", &fractions[i]);
    }
    mergeSort(fractions, 0, n - 1);
    for (int i = 0; i < n; i++) {
        printf("%.3f ", fractions[i]);
    }
    return 0;
}
```

Status : Correct   *Marks : 10/10*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 7_MCQ_Updated

Attempt : 1
Total Mark : 20
Marks Obtained : 19

Section 1 : MCQ

1. In linear probing, if a collision occurs at index i, what is the next index checked?

Answer

(i + 1) % table_size

Status : Correct   *Marks : 1/1*

2. What is the initial position for a key k in a linear probing hash table?

Answer

k % table_size

Status : Correct   *Marks : 1/1*

3. What would be the result of folding 123456 into three parts and summing: (12 + 34 + 56)?

Answer

102

Status : Correct   *Marks : 1/1*

4. Which of the following statements is TRUE regarding the folding method?

Answer

It divides the key into parts and adds them.

Status : Correct   *Marks : 1/1*

5. Which situation causes clustering in linear probing?

Answer

Sequential key insertion

Status : Wrong   *Marks : 0/1*

6. Which of the following best describes linear probing in hashing?

Answer

Resolving collisions by linearly searching for the next free slot

Status : Correct   *Marks : 1/1*

7. What is the worst-case time complexity for inserting an element in a hash table with linear probing?

Answer

O(n)

Status : Correct   *Marks : 1/1*

8.   Which C statement is correct for finding the next index in linear probing?

Answer

index = (index + 1) % size;

Status : Correct   *Marks : 1/1*

9.   What does a deleted slot in linear probing typically contain?

Answer

A special "deleted" marker

Status : Correct   *Marks : 1/1*

10.   Which of the following values of 'm' is recommended for the division method in hashing?

Answer

A prime number

Status : Correct   *Marks : 1/1*

11.   Which data structure is primarily used in linear probing?

Answer

Array

Status : Correct   *Marks : 1/1*

12.   In the division method of hashing, the hash function is typically written as:

Answer

h(k) = k % m

Status : Correct   *Marks : 1/1*

13. What is the primary disadvantage of linear probing?

Answer

Clustering

Status : Correct   *Marks : 1/1*

14. Which folding method divides the key into equal parts, reverses some of them, and then adds all parts?

Answer

Folding reversal method

Status : Correct   *Marks : 1/1*

15. Which of these hashing methods may result in more uniform distribution with small keys?

Answer

Mid-Square

Status : Correct   *Marks : 1/1*

16. What is the output of the mid-square method for a key k = 123 if the hash table size is 10 and you extract the middle two digits of k * k?

Answer

1

Status : Correct   *Marks : 1/1*

17. In division method, if key = 125 and m = 13, what is the hash index?

Answer

8

Status : Correct   *Marks : 1/1*

18. In the folding method, what is the primary reason for reversing alternate parts before addition?

Answer

To reduce the chance of collisions caused by similar digit patterns

Status : Correct   *Marks : 1/1*

19. In C, how do you calculate the mid-square hash index for a key k, assuming we extract two middle digits and the table size is 100?

Answer

((k * k) / 100) % 100

Status : Correct   *Marks : 1/1*

20. What happens if we do not use modular arithmetic in linear probing?

Answer

Index goes out of bounds

Status : Correct   *Marks : 1/1*

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 7_COD_Question 1

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Ravi is building a basic hash table to manage student roll numbers for quick lookup. He decides to use Linear Probing to handle collisions.

Implement a hash table using linear probing where:

The hash function is: index = roll_number % table_sizeOn collision, check subsequent indexes (i+1, i+2, ...) until an empty slot is found.

You need to:

Insert a list of n student roll numbers into the hash table.Print the final state of the hash table. If a slot is empty, print -1.

Input Format

The first line of the input contains two integers n and table_size, where n is the

number of roll numbers to be inserted, and table_size is the size of the hash table.

The second line contains n space-separated integers — the roll numbers to insert into the hash table.

Output Format

The output should print a single line with table_size space-separated integers representing the final state of the hash table after all insertions.

If any slot remains unoccupied, it should be represented as -1.

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 4 7
50 700 76 85
Output: 700 50 85 -1 -1 -1 76

Answer

```c
#include <stdio.h>

#define MAX 100
// You are using GCC
void initializeTable(int table[], int size) {
    //Type your code here
    for(int i=0;i<size;i++){
        table[i]=-1;
    }
}

int linearProbe(int table[], int size, int num) {
    //Type your code here
    int index=(num+size%size)%size;
    int start=index;
    while(table[index] != -1){
        index=(index + 1)%size;
        if(start==index)
```

```c
        return -1;
    }
    return index;
}

void insertIntoHashTable(int table[], int size, int arr[], int n) {
    //Type your code here
    for(int i=0;i<n;i++){
        int pos=linearProbe(table,size,arr[i]);
        if(pos != -1){
            table[pos]=arr[i];
        }
        else{
            printf("hash table is full",arr[i]);
        }
    }

}

void printTable(int table[], int size) {
    //Type your code here
    for(int i=0;i<size;i++){
        printf("%d",table[i]);
        if(i != size - 1)printf(" ");
    }
}
int main() {
    int n, table_size;
    scanf("%d %d", &n, &table_size);

    int arr[MAX];
    int table[MAX];

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

    initializeTable(table, table_size);
    insertIntoHashTable(table, table_size, arr, n);
    printTable(table, table_size);

    return 0;
}
```

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 7_COD_Question 2

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Priya is developing a simple student management system. She wants to store roll numbers in a hash table using Linear Probing, and later search for specific roll numbers to check if they exist.

Implement a hash table using linear probing with the following operations:

Insert all roll numbers into the hash table.For a list of query roll numbers, print "Value x: Found" or "Value x: Not Found" depending on whether it exists in the table.

Input Format

The first line contains two integers, n and table_size — the number of roll numbers to insert and the size of the hash table.

The second line contains n space-separated integers — the roll numbers to insert.

The third line contains an integer q — the number of queries.

The fourth line contains q space-separated integers — the roll numbers to search for.

Output Format

The output print q lines — for each query value x, print: "Value x: Found" or "Value x: Not Found"

Refer to the sample output for formatting specifications.

Sample Test Case

Input: 5 10
21 31 41 51 61
3
31 60 51

Output: Value 31: Found
Value 60: Not Found
Value 51: Found

Answer

```c
#include <stdio.h>

#define MAX 100

// You are using GCC
void initializeTable(int table[], int size) {
    //Type your code here
    for(int i=0;i<size;i++){
        table[i]=-1;
    }
}

int linearProbe(int table[], int size, int num) {
    //Type your code here
    int index = num%size;
```

```c
        int start = index;
        while(table[index] != -1){
            index=(index + 1)%size;
            if(index==start){
                return -1;
            }
        }
    }
    return index;
}

void insertIntoHashTable(int table[], int size, int arr[], int n) {
    //Type your code here
    for(int i=0;i<n;i++){
        int pos = linearProbe(table, size, arr[i]);
        if(pos != -1){
            table[pos]=arr[i];
        }
    }
}

int searchInHashTable(int table[], int size, int num){
    //Type your code here
    for(int i=0;i<size;i++){
        if(table[i]==num){
            return 1;
        }
    }
    return 0;
}

int main() {
    int n, table_size;
    scanf("%d %d", &n, &table_size);

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

    initializeTable(table, table_size);
    insertIntoHashTable(table, table_size, arr, n);

    int q, x;
    scanf("%d", &q);
```

```
for (int i = 0; i < q; i++) {
    scanf("%d", &x);
    if (searchInHashTable(table, table_size, x))
        printf("Value %d: Found\n", x);
    else
        printf("Value %d: Not Found\n", x);
}

    return 0;
}
```

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

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 7_COD_Question 3

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

In a messaging application, users maintain a contact list with names and corresponding phone numbers. Develop a program to manage this contact list using a dictionary implemented with hashing.

The program allows users to add contacts, delete contacts, and check if a specific contact exists. Additionally, it provides an option to print the contact list in the order of insertion.

Input Format

The first line consists of an integer n, representing the number of contact pairs to be inserted.

Each of the next n lines consists of two strings separated by a space: the name of the contact (key) and the corresponding phone number (value).

The last line contains a string k, representing the contact to be checked or removed.

Output Format

If the given contact exists in the dictionary:

1. The first line prints "The given key is removed!" after removing it.
2. The next n - 1 lines print the updated contact list in the format: "Key: X; Value: Y" where X represents the contact's name and Y represents the phone number.

If the given contact does not exist in the dictionary:

1. The first line prints "The given key is not found!".
2. The next n lines print the original contact list in the format: "Key: X; Value: Y" where X represents the contact's name and Y represents the phone number.

Refer to the sample outputs for the formatting specifications.

Sample Test Case

Input: 3
Alice 1234567890
Bob 9876543210
Charlie 4567890123
Bob

Output: The given key is removed!
Key: Alice; Value: 1234567890
Key: Charlie; Value: 4567890123

Answer

```
// You are using GCC
void insertKeyValuePair(Dictionary *dict, const char *key, const char *value) {
    //Type your code here
    if(dict->size==dict->capacity){
        dict->capacity*=2;
        dict->pairs=(KeyValuePair *)realloc(dict->pairs,dict->capacity*sizeof(KeyValuePair));
```

```c
        }
        strcpy(dict->pairs[dict->size].key,key);
        strcpy(dict->pairs[dict->size].value,value);
        dict->size++;
    }
    void removeKeyValuePair(Dictionary *dict, const char *key) {
        //Type your code here
        for(int i=0;i<dict->size;i++){
            if(strcmp(dict->pairs[i].key,key)==0){
                for(int j=i;j<dict->size;j++){
                    dict->pairs[j]=dict->pairs[j + 1];
                }
                dict->size--;
                return;
            }
        }
    }
    int doesKeyExist(Dictionary *dict, const char *key) {
        //Type your code here
        for(int i=0;i<dict->size;i++){
            if(strcmp(dict->pairs[i].key,key)==0){
                return 1;
            }
        }
        return 0;
    }
    void printDictionary(Dictionary *dict) {
    //Type your code here
    for(int i=0;i<dict->size;i++){
        printf("key: %s; Value: %s\n",dict->pairs[i].key,dict->pairs[i].value);
    }
}
```

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

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

Scan to verify results

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 7_COD_Question 4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Develop a program using hashing to manage a fruit contest where each fruit is assigned a unique name and a corresponding score. The program should allow the organizer to input the number of fruits and their names with scores.

Then, it should enable them to check if a specific fruit, identified by its name, is part of the contest. If the fruit is registered, the program should display its score; otherwise, it should indicate that it is not included in the contest.

Input Format

The first line consists of an integer N, representing the number of fruits in the contest.

The following N lines contain a string K and an integer V, separated by a space, representing the name and score of each fruit in the contest.

The last line consists of a string T, representing the name of the fruit to search for.

Output Format

If T exists in the dictionary, print "Key "T" exists in the dictionary.".

If T does not exist in the dictionary, print "Key "T" does not exist in the dictionary.".

Refer to the sample outputs for the formatting specifications.

Sample Test Case

Input: 2
banana 2
apple 1
Banana

Output: Key "Banana" does not exist in the dictionary.

Answer

```
// You are using GCC
int keyExists(KeyValuePair* dictionary, int size, const char* key) {
    //Type your code here
    for(int i=0;i<size;i++){
        if(strcmp(dictionary[i].key,key)==0){
            size--;
            return 1;
        }
    }
    return 0;
}
```

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

Rajalakshmi Engineering College

Name: Kaushika T
Email: 240701239@rajalakshmi.edu.in
Roll no: 240701239
Phone: 6381820352
Branch: REC
Department: I CSE FC
Batch: 2028
Degree: B.E - CSE

NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 7_COD_Question 5

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

You are provided with a collection of numbers, each represented by an array of integers. However, there's a unique scenario: within this array, one element occurs an odd number of times, while all other elements occur an even number of times. Your objective is to identify and return the element that occurs an odd number of times in this arrangement.

Utilize mid-square hashing by squaring elements and extracting middle digits for hash codes. Implement a hash table for efficient integer occurrence tracking.

Note: Hash function: squared = key * key.

Example

Input:

7

2 2 3 3 4 4 5

Output:

5

Explanation

The hash function and the calculated hash indices for each element are as follows:

2 -> hash(2*2) % 100 = 4

3 -> hash(3*3) % 100 = 9

4 -> hash(4*4) % 100 = 16

5 -> hash(5*5) % 100 = 25

The hash table records the occurrence of each element's hash index:

Index 4: 2 occurrences

Index 9: 2 occurrences

Index 16: 2 occurrences

Index 25: 1 occurrence

Among the elements, the integer 5 occurs an odd number of times (1 occurrence) and satisfies the condition of the problem. Therefore, the program outputs 5.

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 element that occurs an odd

number of times.

If no such element exists, print -1.

Refer to the sample output for the formatting specifications.

Sample Test Case

Input: 7
2 2 3 3 4 4 5
Output: 5

Answer

```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <stdbool.h>

#define MAX_SIZE 100

// You are using GCC
unsigned int hash(int key, int tablesize) {
    //Type your code here
    int sq=key*key;
    return (sq%100)%tablesize;

}

int getOddOccurrence(int arr[], int size) {
    //Type your code here
    int hashtable[MAX_SIZE]={0};
    int original[MAX_SIZE]={0};
    for(int i=0;i<size;i++){
        int key=arr[i];
        int index=hash(key,MAX_SIZE);
        while(hashtable[index] != 0 && original[index] != key){
            index=(index + 1)%MAX_SIZE;
        }
        hashtable[index]+=1;
        original[index]=key;
```

```c
    }
    for(int i=0;i<MAX_SIZE;i++){
        if(hashtable[i]%2==1){
            return original[i];
        }
    }
    return -1;
}

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

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

    printf("%d\n", getOddOccurrence(arr, n));

    return 0;
}
```

Status : Correct   *Marks : 10/10*