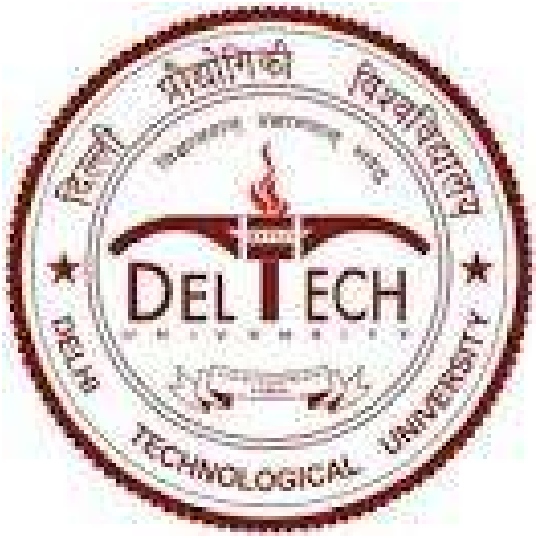
Delhi Technological University

Department of Software Engineering



Data Structures (SE-203)

LAB FILE

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23/SE/009

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1.	Explore the Linux terminal. Check all basic commands for file handling, compiling c programs, debugging. Install a Linux OS either on a virtual machine or dual partition. Write a small program in C to reverse an array, compile using c and generate a valid output file.	21/08/24	
2.	Create a menu driver program that will take input from the user to: 1. Enter elements in a one-dimensional array. 2. Delete element in a one-dimensional array (have all conditions, beginning, last, middle index). 3. Find the largest element. 4. Find the smallest element.	04/09/24	
3.	Write a menu driven program to l. Merge two strings 2 reverse strings Find a substring and replace it with another string. All inputs to be taken from the user.	09/10/24	
4.	Write a program to implement character stack using an array Push Popup function using boundry condition Also write paranthesis correctness in a string array.	16/10/24	
5.	Write a program to display, insert and delete element and remove duplicates to a circular queue using menu driven program. Also check for overflow and underflow condition.	16/10/24	
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8.			

Experiment-1

Aim: Explore the Linux terminal. Check all basic commands for file handling, compiling c programs, debugging. Install a Linux OS either on a virtual machine or dual partition.
Write a small program in C to reverse an array, compile using c and generate a valid output file.

Code:

```
#include<stdio.h>
// Q1   :   Reverse an array
void main(){
   int arr[] = {1,23,34,2,112,10,21};
   int size=sizeof(arr)/sizeof(arr[0]);
   for(int i=0;i<size/2;i++){
      int temp=arr[i];
      arr[i]=arr[size-i-1];
      arr[size-i-1]=temp;
   }
   for(int i=0;i<size;i++){
      printf("%d,",arr[i]);
   }
}
```

Output:

```
PS C:\aditya\Programming_Languages\DTU\SE_203_DS_lab\Git_> .\exp1
21,10,112,2,34,23,1,
PS C:\aditya\Programming_Languages\DTU\SE_203_DS_lab\Git_>
```

Experiment-2

Aim: Create a menu driver program that will take input from the user to :

1. Enter elements in a one dimensional array.
2. Delete element in a one dimensional array (have all conditions, beginning, last, middle index).
3. Find the largest element .
4. Find the smallest element .

Code:

```
#include<stdio.h>
void main(){
   printf("Please Enter len of array\n");
   int len;
   scanf("%d",&len);
   int arr[len+1];
   int size=0;
   int flag=1;
   while(flag){
      printf("Please Select an input \n");
      printf("1. Enter elements in a one dimensional array \n");
      printf("2. delete element in a one dimensional array (have all conditions, beginning, last,
middle index)  \n");
      printf("3, Find the largest element \n");
      printf("4. Find the smallest element \n");
      printf("5. To exit \n");
      int a;
      scanf("%d",&a);
      if(a==1){
      printf("Please Enter idx \n");
      int idx,num;
      scanf("%d",&idx);
      printf("Please Enter num \n");
      scanf("%d",&num);
      for(int i=0;i<size+1;i++){
         if(i>=idx){
            int temp=arr[i];
            arr[i]=num;
```

```
            num=temp;
        }
    }
    size++;
    }
    else if(a==2){
        printf("Please Enter idx \n");
        int idx;
        scanf("%d",&idx);
        for(int i=0;i<size-1;i++){
            if(i>=idx){
                arr[i]=arr[i+1];
            }
        }
        size--;
    }
    else if(a==3){
        int max=-1e7;
        for(int i=0;i<size;i++){
            if(arr[i]>max) max=arr[i];
        }
        printf("Max = %d\n",max);
    }
    else if(a==4){
        int min=1e7;
        for(int i=0;i<size;i++){
            if(arr[i]<min) min=arr[i];
        }
        printf("Min = %d",min);
    }
    else{
        flag=0;
    }
    for(int i=0;i<size;i++){
        printf("%d,",arr[i]);
    }
    printf("\n");
  }
}
```

Output:

```
PS C:\aditya\Programming_Languages\DTU\SE_203_DS_lab\Git_> .\exp2
Please Enter len of array
4
Please Select an input
1. Enter elements in a one dimensional array
2. delete element in a one dimensional array (have all conditions, beginning, last, middle index)
3, Find the largest element
4. Find the smallest element
5. To exit
1
Please Enter idx
0
Please Enter num
23
23,
Please Select an input
1. Enter elements in a one dimensional array
2. delete element in a one dimensional array (have all conditions, beginning, last, middle index)
3, Find the largest element
4. Find the smallest element
5. To exit
1
Please Enter idx
1
Please Enter num
34
23,34,
Please Select an input
1. Enter elements in a one dimensional array
2. delete element in a one dimensional array (have all conditions, beginning, last, middle index)
3, Find the largest element
4. Find the smallest element
5. To exit
1
Please Enter idx
1
Please Enter num
28
23,28,34,
Please Select an input
1. Enter elements in a one dimensional array
2. delete element in a one dimensional array (have all conditions, beginning, last, middle index)
3, Find the largest element
4. Find the smallest element
5. To exit
3
Max = 34
23,28,34,
Please Select an input
1. Enter elements in a one dimensional array
2. delete element in a one dimensional array (have all conditions, beginning, last, middle index)
3, Find the largest element
4. Find the smallest element
5. To exit
4
Min = 2323,28,34,
Please Select an input
1. Enter elements in a one dimensional array
2. delete element in a one dimensional array (have all conditions, beginning, last, middle index)
3, Find the largest element
4. Find the smallest element
5. To exit
2
Please Enter idx
2
23,28,
Please Select an input
1. Enter elements in a one dimensional array
2. delete element in a one dimensional array (have all conditions, beginning, last, middle index)
3, Find the largest element
4. Find the smallest element
5. To exit
5
23,28,
```

Experiment-3

Aim: Write a menu driven program to
l. Merge two strings
2 reverse strings
Find a substring and replace it with another string.
All inputs to be taken from the user.

Code:

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

char* merge(char* str1, char* str2) {
    char* result = (char*)malloc(strlen(str1) + strlen(str2) + 1);
    strcpy(result, str1);
    strcat(result, str2);
    return result;
}
char* reverse(char* str) {
    int len = strlen(str);
    for (int i = 0; i < len / 2; i++) {
        char temp = str[i];
        str[i] = str[len - i - 1];
        str[len - i - 1] = temp;
    }
    return str;
}
char* substring(char* str, char* substr, char* new_substr) {
    static char buffer[1024];
    char* pos;

    if (!(pos = strstr(str, substr))) {
        return str;
    }
    strncpy(buffer, str, pos - str);
    buffer[pos - str] = '\0';
    strcat(buffer, new_substr);
```

```
    strcat(buffer, pos + strlen(substr));
    strcpy(str, buffer);
    return str;
}
int main() {
    int flag = 1;
    char str1[100], str2[100], str3[100];
    while (flag) {
        printf("Please Select an option \n");
        printf("1. Merge Two strings \n");
        printf("2. Reverse strings\n");
        printf("3. Find a substring and replace it with another string\n");
        printf("4. Exit \n");
        int a;
        scanf("%d", &a);
        getchar();
        printf("\n");
        if (a == 1) {
            printf("Enter String-1: ");
            fgets(str1, sizeof(str1), stdin);
            str1[strcspn(str1, "\n")] = 0;

            printf("Enter String-2: ");
            fgets(str2, sizeof(str2), stdin);
            str2[strcspn(str2, "\n")] = 0;

            char* result = merge(str1, str2);
            printf("The merged string: %s\n", result);
            free(result);
        } else if (a == 2) {
            printf("Enter string to be reversed: ");
            fgets(str3, sizeof(str3), stdin);
            str3[strcspn(str3, "\n")] = 0;
            printf("Reversed string: %s\n", reverse(str3));
        } else if (a == 3) {
            printf("Enter the main string: ");
            fgets(str1, sizeof(str1), stdin);
            str1[strcspn(str1, "\n")] = 0;

            printf("Enter the substring to find: ");
```

```
            fgets(str2, sizeof(str2), stdin);
            str2[strcspn(str2, "\n")] = 0;

            printf("Enter the replacement string: ");
            fgets(str3, sizeof(str3), stdin);
            str3[strcspn(str3, "\n")] = 0;

            printf("The new string: %s\n", substring(str1, str2, str3));
        } else {
            flag = 0;
        }
    }
}
```

Output:

```
PS C:\aditya\Programming_Languages\DTU\SE_203_DS_lab\Git_> .\exp3
Please Select an option
1. Merge Two strings
2. Reverse strings
3. Find a substring and replace it with another string
4. Exit
1

Enter String-1: Hello
Enter String-2: World
The merged string: Hello World
Please Select an option
1. Merge Two strings
2. Reverse strings
3. Find a substring and replace it with another string
4. Exit
2

Enter string to be reversed: Hello World
Reversed string: dlroW olleH
Please Select an option
1. Merge Two strings
2. Reverse strings
3. Find a substring and replace it with another string
4. Exit
3

Enter the main string: Hello World
Enter the substring to find: or
Enter the replacement string: ii
The new string: Hello Wiild
Please Select an option
1. Merge Two strings
2. Reverse strings
3. Find a substring and replace it with another string
4. Exit
4
```

Experiment-4

Aim: Write a program to implement character stack using an array
Push
Pop functions using boundry condition
Also write paranthesis correctness in a string array.

Code:

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

#define MAX 100  // Define maximum size of stack

// Stack structure
struct Stack {
   char arr[MAX];  // Stack array to store characters
   int top;        // Stack top to keep track of the top index
};

// Function to initialize the stack
void initStack(struct Stack* stack) {
   stack->top = -1;
}

// Function to check if the stack is full
bool isFull(struct Stack* stack) {
   return stack->top == MAX - 1;
}

// Function to check if the stack is empty
bool isEmpty(struct Stack* stack) {
   return stack->top == -1;
}

// Function to push a character onto the stack
void push(struct Stack* stack, char ch) {
   if (isFull(stack)) {
      printf("Stack overflow! Cannot push %c\n", ch);
```

```
        return;
    }
    stack->arr[++stack->top] = ch;
}

// Function to pop a character from the stack
char pop(struct Stack* stack) {
    if (isEmpty(stack)) {
        printf("Stack underflow! Cannot pop\n");
        return '\0';  // Return null character if stack is empty
    }
    return stack->arr[stack->top--];
}

// Function to check for matching parentheses
bool isMatchingPair(char left, char right) {
    if (left == '(' && right == ')') return true;
    if (left == '{' && right == '}') return true;
    if (left == '[' && right == ']') return true;
    return false;
}

// Function to check if parentheses in a string are balanced
bool checkParentheses(char str[]) {
    struct Stack stack;
    initStack(&stack);

    for (int i = 0; str[i] != '\0'; i++) {
        char ch = str[i];

        // If opening bracket, push it to stack
        if (ch == '(' || ch == '{' || ch == '[') {
            push(&stack, ch);
        }
        // If closing bracket, check for matching opening bracket
        else if (ch == ')' || ch == '}' || ch == ']') {
            if (isEmpty(&stack) || !isMatchingPair(pop(&stack), ch)) {
                return false;  // Unmatched parentheses
            }
        }
```

```
    }

    // If stack is empty, all parentheses are matched
    return isEmpty(&stack);
}

// Main function
int main() {
     struct Stack stack;
     initStack(&stack);
     for(int i=65;i<=69;i++){
        push(&stack,(char)i);
     }
     while(!isEmpty(&stack)){
        printf("%c , ",pop(&stack));
     }
    printf("\n");
    char str[MAX];
    printf("Enter a string with parentheses: ");
    scanf("%s", str);

    if (checkParentheses(str)) {
        printf("Parentheses are balanced.\n");
    } else {
        printf("Parentheses are not balanced.\n");
    }

    return 0;
}
```

Output:

```
PS C:\aditya\Programming_Languages\DTU\SE_203_DS_lab\Git_> .\exp4
E , D , C , B , A ,
Enter a string with parentheses: (){}[])
Parentheses are balanced.
PS C:\aditya\Programming_Languages\DTU\SE_203_DS_lab\Git_> .\exp4
E , D , C , B , A ,
Enter a string with parentheses: [)
Parentheses are not balanced.
PS C:\aditya\Programming_Languages\DTU\SE_203_DS_lab\Git_>
```

Experiment-5

Aim: Write a program to display, insert and delete element and remove duplicates to a circular queue using menu driven program. Also check for overflow and underflow condition.

Code:

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

#define MAX 5  // Define maximum size of the circular queue

// Circular Queue Structure
struct CircularQueue {
    int arr[MAX];
    int front;
    int rear;
};

// Function to initialize the queue
void initQueue(struct CircularQueue* queue) {
    queue->front = -1;
    queue->rear = -1;
}

// Function to check if the queue is full
bool isFull(struct CircularQueue* queue) {
    return (queue->front == (queue->rear + 1) % MAX);
}

// Function to check if the queue is empty
bool isEmpty(struct CircularQueue* queue) {
    return (queue->front == -1);
}

// Function to insert an element into the circular queue
void insert(struct CircularQueue* queue, int value) {
    if (isFull(queue)) {
        printf("Queue overflow! Cannot insert %d\n", value);
```

```
        return;
    }

    if (isEmpty(queue)) {
        queue->front = 0;
    }

    queue->rear = (queue->rear + 1) % MAX;
    queue->arr[queue->rear] = value;
    printf("%d inserted into the queue.\n", value);
}

// Function to delete an element from the circular queue
int delete(struct CircularQueue* queue) {
    if (isEmpty(queue)) {
        printf("Queue underflow! Cannot delete\n");
        return -1;
    }

    int value = queue->arr[queue->front];

    if (queue->front == queue->rear) {
        // Queue has only one element
        queue->front = queue->rear = -1;
    } else {
        queue->front = (queue->front + 1) % MAX;
    }

    printf("%d deleted from the queue.\n", value);
    return value;
}

// Function to display the queue elements
void display(struct CircularQueue* queue) {
    if (isEmpty(queue)) {
        printf("Queue is empty.\n");
        return;
    }

    printf("Queue elements: ");
```

```
    int i = queue->front;
    while (i != queue->rear) {
        printf("%d ", queue->arr[i]);
        i = (i + 1) % MAX;
    }
    printf("%d\n", queue->arr[i]);  // Display the rear element
}

// Function to remove duplicates from the queue
void removeDuplicates(struct CircularQueue* queue) {
    if (isEmpty(queue)) {
        printf("Queue is empty. No duplicates to remove.\n");
        return;
    }

    int i = queue->front;
    while (i != queue->rear) {
        int j = (i + 1) % MAX;
        while (j != queue->rear + 1) {
            if (queue->arr[i] == queue->arr[j]) {
                printf("Removing duplicate element %d\n", queue->arr[j]);
                // Shift elements to the left to remove duplicate
                int k = j;
                while (k != queue->rear) {
                    queue->arr[k] = queue->arr[(k + 1) % MAX];
                    k = (k + 1) % MAX;
                }
                queue->rear = (queue->rear - 1 + MAX) % MAX;
            } else {
                j = (j + 1) % MAX;
            }
        }
        i = (i + 1) % MAX;
    }

    printf("Duplicates removed.\n");
}

// Menu-driven program
int main() {
```

```
struct CircularQueue queue;
initQueue(&queue);

int choice, value;

while (1) {
    printf("\n*** Circular Queue Menu ***\n");
    printf("1. Insert\n");
    printf("2. Delete\n");
    printf("3. Display\n");
    printf("4. Remove Duplicates\n");
    printf("5. Exit\n");
    printf("Enter your choice: ");
    scanf("%d", &choice);

    switch (choice) {
        case 1:
            printf("Enter value to insert: ");
            scanf("%d", &value);
            insert(&queue, value);
            break;

        case 2:
            delete(&queue);
            break;

        case 3:
            display(&queue);
            break;

        case 4:
            removeDuplicates(&queue);
            break;

        case 5:
            printf("Exiting program.\n");
            return 0;

        default:
            printf("Invalid choice! Please try again.\n");
```

```
            }
        }

        return 0;
    }
```

Output: