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Chapter 1

Compiler Design Programs

1.1 Implement Linear Search using C language

Source Code :

```
//Implement Linear Search using C language
```

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

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

```
#define size 20
```

```
int main (int argc, char *argv[]) {
```

```
    int arr[size], num, i, n, found = 0, pos = -1;
```

```
    printf ("\n Enter the number of elements in the array: ");
```

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

```
    printf ("\n Enter the elements: ");
```

```
    for (i = 0; i < n; i++)
```

```
        scanf ("%d", &arr[i]);
```

```
    printf ("\n Enter the number that has to be searched: ");
```

```
    scanf ("%d", &num);
```

```
    for (i = 0; i < n; i++) {
```

```
        if (arr[i] == num) {
```

```
            found = 1;
```

```
            pos = i;
```

```
            printf ("\n %d is found in the array at position = %d",
```

```
                    num, i+1);
```

```
            break;
```

```
        }
```

```
    }
```

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

```
    if (found == 0)
```

```
        printf ("\n %d does not exist in the array", num);  
    return 0;  
  
}
```

Program Output :

```
→ gcc Q01.c && ./a.out  
  
Enter the number of elements in the array: 6  
Enter the elements: 12 69 87 2 45 96  
Enter the number that has to be searched: 69  
69 is found in the array at position = 2
```

1.2 Implement Binary Search using C language

Source Code :

//Implement Binary Search using C language

```
#include <stdio.h>  
int binarySearch(int arr[], int l, int r, int x)  
{  
    if (r >= l) {  
        int mid = l + (r - l) / 2;  
        if (arr[mid] == x)  
            return mid;  
  
        if (arr[mid] > x)  
            return binarySearch(arr, l, mid - 1, x);  
  
        return binarySearch(arr, mid + 1, r, x);  
    }  
  
    return -1;  
}  
  
int main(void)  
{  
    int arr[] = { 2, 3, 4, 10, 40 };
```

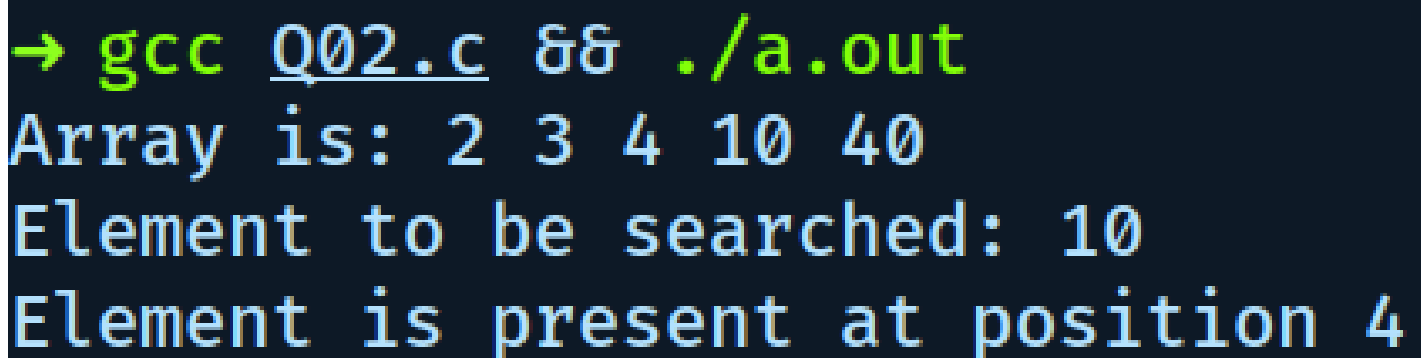
```

printf ("Array is: ");
for (int i = 0; i < 5; i++)
    printf ("%d ", arr[i]);
printf ("\n");
    int n = sizeof(arr) / sizeof(arr[0]);
    int x = 10;

printf ("Element to be searched: 10\n");
    int result = binarySearch(arr, 0, n - 1, x);
    (result == -1)
        ? printf("Element is not present in array")
        : printf("Element is present at position %d",
            ↪ result+1);
printf ("\n");
    return 0;
}

```

Program Output :



```

→ gcc Q02.c && ./a.out
Array is: 2 3 4 10 40
Element to be searched: 10
Element is present at position 4

```

1.3 Implement Insertion Sort using C language

Source Code :

```
//Implement Insertion Sort using C language
```

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

```

void printArray(int array[], int size) {
    for (int i = 0; i < size; i++) {
        printf("%d ", array[i]);
    }
    printf("\n");
}

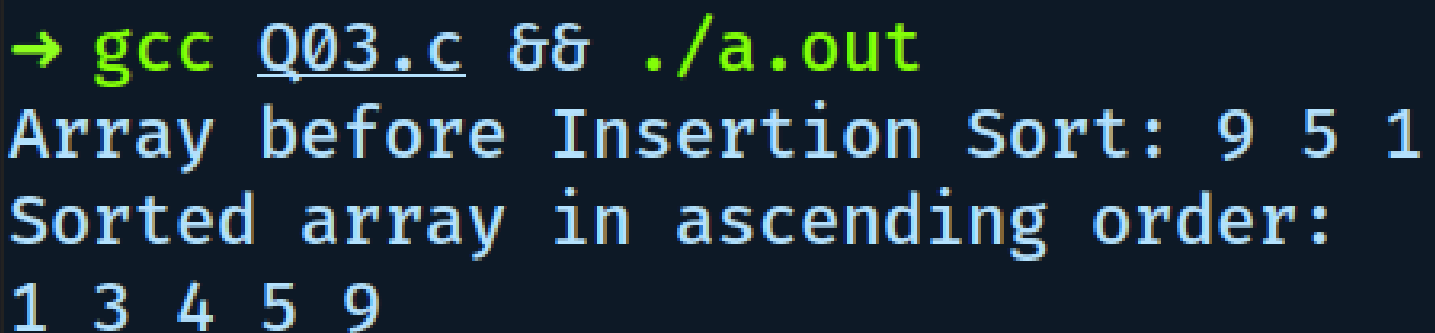
```

```
void insertionSort(int array[], int size) {
    for (int step = 1; step < size; step++) {
        int key = array[step];
        int j = step - 1;
        while (key < array[j] && j >= 0) {
            array[j + 1] = array[j];
            --j;
        }
        array[j + 1] = key;
    }
}

int main() {
    int data[] = {9, 5, 1, 4, 3};
    printf ("Array before Insertion Sort: ");
    for (int i = 0; i < 5; i++)
        printf ("%d ", data[i]);
    printf ("\n");

    int size = sizeof(data) / sizeof(data[0]);
    insertionSort(data, size);
    printf("Sorted array in ascending order:\n");
    printArray(data, size);
}
```

Program Output :



```
→ gcc Q03.c && ./a.out
Array before Insertion Sort: 9 5 1 4 3
Sorted array in ascending order:
1 3 4 5 9
```

1.4 Implement Shell Sort using C language

Source Code :

```
//Implement Shell Sort using C language
```

```
#include <stdio.h>

void shellSort(int array[], int n) {
    for (int interval = n / 2; interval > 0; interval /= 2) {
        for (int i = interval; i < n; i += 1) {
            int temp = array[i];
            int j;
            for (j = i; j >= interval && array[j - interval] > temp; j -=
                interval) {
                array[j] = array[j - interval];
            }
            array[j] = temp;
        }
    }
}

void printArray(int array[], int size) {
    for (int i = 0; i < size; ++i) {
        printf("%d ", array[i]);
    }
    printf("\n");
}

int main() {
    int data[] = {9, 8, 3, 7, 5, 6, 4, 1};
    printf ("Array before Shell Sort: ");
    for (int i = 0; i < 8; i++)
        printf ("%d ", data[i]);
    printf ("\n");

    int size = sizeof(data) / sizeof(data[0]);
    shellSort(data, size);
    printf("Sorted array: \n");
    printArray(data, size);
}
```

Program Output :

```
→ gcc Q04.c && ./a.out
```

```
Array before Shell Sort: 9 8 3 7 5 6
```

```
Sorted array:
```

```
1 3 4 5 6 7 8 9
```

1.5 Write a program to check balance parenthesis of a program.[a+(b*c) Balanced parenthesis ,Using Stack]

Source Code :

```
//Write a program to check balance parenthesis of a program.  
//[ a+(b*c) Balanced parenthesis ,Using Stack]
```

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

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

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

```
#define MAX 30
```

```
int top=-1;
```

```
int stack[MAX];
```

```
void push(char);
```

```
char pop();
```

```
int match(char a,char b);
```

```
int check(char []);
```

```
int main()
```

```
{
```

```
    char exp[MAX];
```

```
    int valid;
```

```
    printf("Enter an algebraic expression : ");
```

```
    gets(exp);
```

```
    valid=check(exp);
```

```
    if(valid==1)
```

```
        printf("Valid expression\n");
```

```
    else
```

```
        printf("Invalid expression\n");
```



```
        return 0;
    }
    int check(char exp[] )
    {
        int i;
        char temp;
        for(i=0;i<strlen(exp);i++)
        {
            if(exp[i]=='(' || exp[i]=='{' || exp[i]=='[')
                push(exp[i]);
            if(exp[i]==')' || exp[i]=='}' || exp[i]==']')
                if(top== -1) /*stack empty*/
                {
                    printf("Right parentheses are more
                        ↪ than left parentheses\n");
                    return 0;
                }
            else
            {
                temp=pop();
                if(!match(temp, exp[i]))
                {
                    printf("Mismatched
                        ↪ parentheses are : ");
                    printf("%c and
                        ↪ %c\n",temp,exp[i]);
                    return 0;
                }
            }
        }
        if(top== -1) /*stack empty*/
        {
            printf("Balanced Parentheses\n");
            return 1;
        }
        else
        {
            printf("Left parentheses more than right
                ↪ parentheses\n");
            return 0;
        }
    }
}
```

```
/*End of main()*/
int match(char a,char b)
{
    if(a=='[' && b==']')
        return 1;
    if(a=='{' && b=='}')
        return 1;
    if(a=='(' && b==')')
        return 1;
    return 0;
}/*End of match()*/

void push(char item)
{
    if(top==(MAX-1))
    {
        printf("Stack Overflow\n");
        return;
    }
    top=top+1;
    stack[top]=item;
}/*End of push()*/

char pop()
{
    if(top== -1)
    {
        printf("Stack Underflow\n");
        exit(1);
    }
    return(stack[top--]);
}/*End of pop()*/
```

Program Output :

```
Enter an algebraic expression : (  
Balanced Parentheses  
Valid expression
```