

**CSA1322**  
**THEORY OF COMPUTATION**  
**PRACTICAL SESSION**

**1. To write a C program to simulate a Deterministic Finite Automata**

**PROGRAM:**

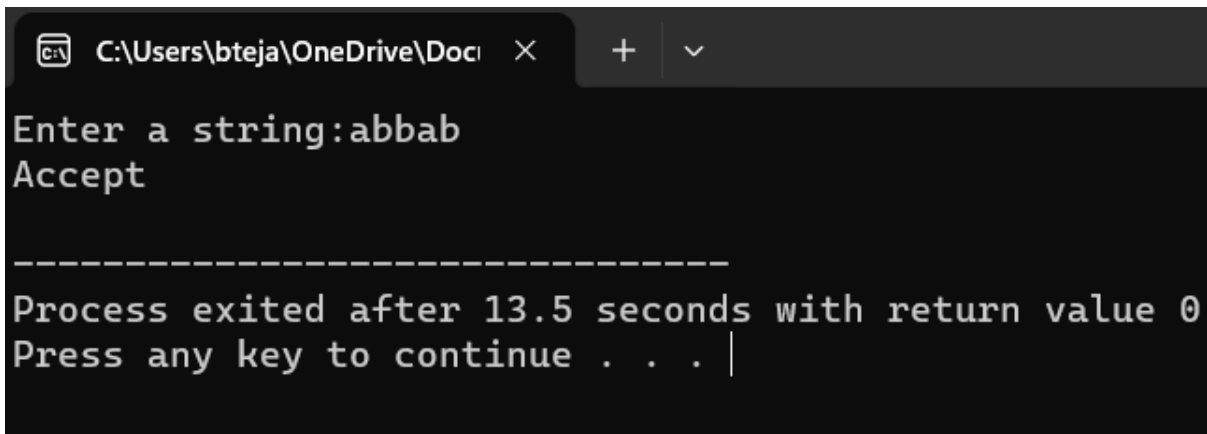
```
#include<stdio.h>
#include<string.h>
#define max 20
int main()
{
    int trans_table[4][2]={{1,3},{1,2},{1,2},{3,3}};
    int final_state=2,i;
    int present_state=0;
    int next_state=0;
    int invalid=0;
    char input_string[max];
    printf("Enter a string:");
    scanf("%s",input_string);
    int l=strlen(input_string);
    for(i=0;i<l;i++)
    {
        if(input_string[i]=='a')
            next_state=trans_table[present_state][0];
        else if(input_string[i]=='b')
            next_state=trans_table[present_state][1];
        invalid=l;
        present_state=next_state;
    }
    if(invalid==l)
    {
```

```

printf("Invalid input");
}
else if(present_state==final_state)
printf("Accept\n");
else
printf("Don't Accept\n");
}

```

## OUTPUT:



```

C:\Users\bteja\OneDrive\Docu >
Enter a string:abbab
Accept

-----
Process exited after 13.5 seconds with return value 0
Press any key to continue . . . |

```

## 2. To write a C program to simulate a Non-Deterministic Finite Automata.

### PROGRAM:

```

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

int main()
{
    int i,j,k,l,m,next_state[20],n,mat[10][10][10],flag,p;
    int num_states,final_state[5],num_symbols,num_final;
    int present_state[20],prev_trans,new_trans;
    char ch,input[20];
    int symbol[5],inp,inp1;
    printf("How many states in the NFA : ");
    scanf("%d",&num_states);

```

```

printf("How many symbols in the input alphabet : ");
scanf("%d",&num_symbols);
for(i=0;i<num_symbols;i++)
{
    printf("Enter the input symbol %d : ",i+1);
    scanf("%d",&symbol[i]);
}
printf("How many final states : ");
scanf("%d",&num_final);
for(i=0;i<num_final;i++)
{
    printf("Enter the final state %d : ",i+1);
    scanf("%d",&final_state[i]);
}
//Initialize all entries with -1 in Transition table
for(i=0;i<10;i++)
{
    for(j=0;j<10;j++)
    {
        for(k=0;k<10;k++)
        {
            mat[i][j][k]=-1;
        }
    }
}
//Get input from the user and fill the 3D transition table
for(i=0;i<num_states;i++)
{
    for(j=0;j<num_symbols;j++)
    {

```

```

printf("How many transitions from state %d for the input %d:",i,symbol[j]);
scanf("%d",&n);
for(k=0;k<n;k++)
{
    printf("Enter the transition %d from state %d for the input %d:",k+1,i,symbol[j]);
    scanf("%d",&mat[i][j][k]);
}
}
}
printf("The transitions are stored as shown below\n");
    for(i=0;i<10;i++)
    {
        for(j=0;j<10;j++)
        {
            for(k=0;k<10;k++)
            {
                if(mat[i][j][k]!=-1)
                    printf("mat[%d][%d][%d] = %d\n",i,j,k,mat[i][j][k]);
            }
        }
    }
while(1)
{
    printf("Enter the input string : ");
    scanf("%s",input);
    present_state[0]=0;
    prev_trans=1;
    l=strlen(input);
    for(i=0;i<l;i++)
    {

```

```

    if(input[i]=='0')
        inp1=0;
    else if(input[i]=='1')
        inp1=1;
    else
    {
        printf("Invalid input\n");
        exit(0);
    }
    for(m=0;m<num_symbols;m++)
{
    if(inp1==symbol[m])
    {
        inp=m;
        break;
    }
}
    new_trans=0;
    for(j=0;j<prev_trans;j++)
    {
        k=0;
        p=present_state[j];
        while(mat[p][inp][k]!=-1)
        {
            next_state[new_trans++]=mat[p][inp][k];
            k++;
        }
    }
    for(j=0;j<new_trans;j++)
    {

```

```

    present_state[j]=next_state[j];
}
prev_trans=new_trans;
}
flag=0;
for(i=0;i<prev_trans;i++)
{
    for(j=0;j<num_final;j++)
    {
        if(present_state[i]==final_state[j])
        {
            flag=1;
            break;
        }
    }
}
if(flag==1)
    printf("Accepted\n");
else
    printf("Not accepted\n");
printf("Try with another input\n");
}
}

```

**OUTPUT:**



C:\Users\bteja\OneDrive\Docu



```
How many states in the NFA : 4
How many symbols in the input alphabet : 2
Enter the input symbol 1 : 0
Enter the input symbol 2 : 1
How many final states : 1
Enter the final state 1 : 2
How many transitions from state 0 for the input 0:1
Enter the transition 1 from state 0 for the input 0:1
How many transitions from state 0 for the input 1:1
Enter the transition 1 from state 0 for the input 1:3
How many transitions from state 1 for the input 0:2
Enter the transition 1 from state 1 for the input 0:1
Enter the transition 2 from state 1 for the input 0:2
How many transitions from state 1 for the input 1:1
Enter the transition 1 from state 1 for the input 1:1
How many transitions from state 2 for the input 0:0
How many transitions from state 2 for the input 1:0
How many transitions from state 3 for the input 0:1
Enter the transition 1 from state 3 for the input 0:3
How many transitions from state 3 for the input 1:2
Enter the transition 1 from state 3 for the input 1:2
Enter the transition 2 from state 3 for the input 1:3
The transitions are stored as shown below
mat[0][0][0] = 1
mat[0][1][0] = 3
mat[1][0][0] = 1
mat[1][0][1] = 2
mat[1][1][0] = 1
mat[3][0][0] = 3
mat[3][1][0] = 2
mat[3][1][1] = 3
Enter the input string : 0111010
Accepted
Try with another input
Enter the input string : 011011
Not accepted
Try with another input
Enter the input string : |
```

### 3. To write a C program to find $\epsilon$ -closure of a Non-Deterministic Finite Automata with $\epsilon$ -moves

#### PROGRAM:

```
#include<stdio.h>
#include<string.h>
int trans_table[10][5][3];
char symbol[5],a;
int e_closure[10][10],ptr,state;
void find_e_closure(int x);
int main()
{
    int i,j,k,n,num_states,num_symbols;
    for(i=0;i<10;i++)
    {
        for(j=0;j<5;j++)
        {
            for(k=0;k<3;k++)
            {
                trans_table[i][j][k]=-1;
            }
        }
    }
    printf("How may states in the NFA with e-moves:");
    scanf("%d",&num_states);
    printf("How many symbols in the input alphabet including e :");
    scanf("%d",&num_symbols);
    printf("Enter the symbols without space. Give 'e' first:");
    scanf("%s",symbol);
    for(i=0;i<num_states;i++)
    {
        for(j=0;j<num_symbols;j++)
```



```

{
printf("How many transitions from state %d for the input %c:",i,symbol[j]);
scanf("%d",&n);
for(k=0;k<n;k++)
{
printf("Enter the transitions %d from state %d for the input %c :", k+1,i,symbol[j]);
scanf("%d",&trans_table[i][j][k]);
}
}
}
for(i=0;i<10;i++)
{
for(j=0;j<10;j++)
{
e_closure[i][j]=-1;
}
}
for(i=0;i<num_states;i++)
e_closure[i][0]=i;
for(i=0;i<num_states;i++)
{

if(trans_table[i][0][0]==-1)
continue;
else
{
state=i;
ptr=1;
find_e_closure(i);

```

```

    }
}
for(i=0;i<num_states;i++)
{
    printf("e-closure(%d)= {" ,i);
    for(j=0;j<num_states;j++)
    {
        if(e_closure[i][j]!=-1)
        {
            printf("%d, ",e_closure[i][j]);
        }
    }
    printf("}\n");
}
}

void find_e_closure(int x)
{
    int i,j,y[10],num_trans;
    i=0;
    while(trans_table[x][0][i]!=-1)
    {
        y[i]=trans_table[x][0][i];
        i=i+1;
    }
    num_trans=i;
    for(j=0;j<num_trans;j++)
    {
        e_closure[state][ptr]=y[j];
        ptr++;
        find_e_closure(y[j]);
    }
}

```

}  
}

## OUTPUT:

```
C:\Users\bteja\OneDrive\Docu × + v
How may states in the NFA with e-moves:3
How many symbols in the input alphabet including e :3
Enter the symbols without space. Give 'e' first:001
How many transitions from state 0 for the input 0:1
Enter the transitions 1 from state 0 for the input 0 :1
How many transitions from state 0 for the input 0:1
Enter the transitions 1 from state 0 for the input 0 :1
How many transitions from state 0 for the input 1:1
Enter the transitions 1 from state 0 for the input 1 :1
How many transitions from state 1 for the input 0:1
Enter the transitions 1 from state 1 for the input 0 :2
How many transitions from state 1 for the input 0:2
Enter the transitions 1 from state 1 for the input 0 :0
Enter the transitions 2 from state 1 for the input 0 :1
How many transitions from state 1 for the input 1:0
How many transitions from state 2 for the input 0:0
How many transitions from state 2 for the input 0:0
How many transitions from state 2 for the input 1:0
e-closure(0)= {0, 1, 2, }
e-closure(1)= {1, 2, }
e-closure(2)= {2, }

-----
Process exited after 54.6 seconds with return value 0
Press any key to continue . . . |
```

#### 4. CHECKING WHETHER A STRING BELONGS TO A GRAMMAR

4(a). To write a C program to check whether a string belongs to the grammar

$S \rightarrow 0 A 1$

$A \rightarrow 0 A \mid 1 A \mid \epsilon$

##### PROGRAM:

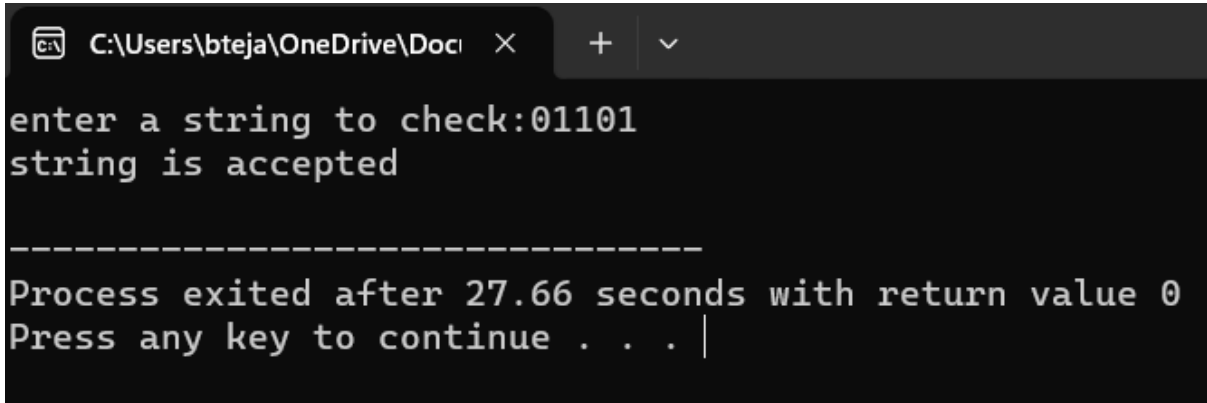
```
#include<stdio.h>
#include<string.h>
int main(){
char s[100];
int i,flag;
int l;
printf("enter a string to check:");
scanf("%s",s);
l=strlen(s);
flag=1;
for(i=0;i<l;i++)
{
if(s[i]!='0' && s[i]!='1')
{
flag=0;
}
}
if(flag!=1)
printf("string is Not Valid\n");
if(flag==1)
{
if (s[0]=='0'&&s[l-1]=='1')
printf("string is accepted\n");
else
```

```

printf("string is Not accepted\n");
}
}

```

### OUTPUT:



```

C:\Users\bteja\OneDrive\Docu × + v
enter a string to check:01101
string is accepted

-----
Process exited after 27.66 seconds with return value 0
Press any key to continue . . . |

```

**4(b). To write a C program to check whether a string belongs to the grammar**

$S \rightarrow 0 S 0 \mid 1 S 1 \mid 0 \mid 1 \mid \epsilon$

### PROGRAM:

```

#include<stdio.h>
#include<string.h>
int main()
{
char s[100];
int i,flag,flag1,a,b;
int l;
printf("enter a string to check:");
scanf("%s",s);
l=strlen(s);
flag=1;
for(i=0;i<l;i++)
{
if(s[i]!='0' && s[i]!='1')
{

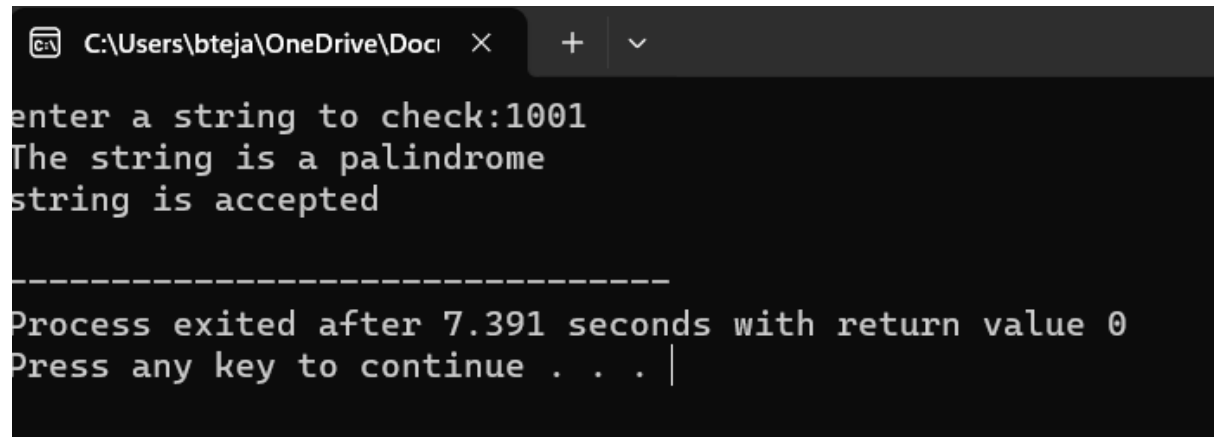
```

```

    flag=0;
}
}
if(flag!=1)
printf("string is Not Valid\n");
if(flag==1)
{
    flag1=1;
    a=0;b=1-1;
    while(a!=(l/2))
    {
        if(s[a]!=s[b])
        {
            flag1=0;
        }
        a=a+1;
        b=b-1;
    }
    if (flag1==1)
    {
        printf("The string is a palindrome\n");
        printf("string is accepted\n");
    }
    else
    {
        printf("The string is not a palindrome\n");
        printf("string is Not accepted\n");
    }
}
}
}

```

## OUTPUT:



```
C:\Users\bteja\OneDrive\Docu > enter a string to check:1001
The string is a palindrome
string is accepted

-----
Process exited after 7.391 seconds with return value 0
Press any key to continue . . . |
```