CSA1354 – Theory of Computation with Productions

Lab Experiments – Slot A

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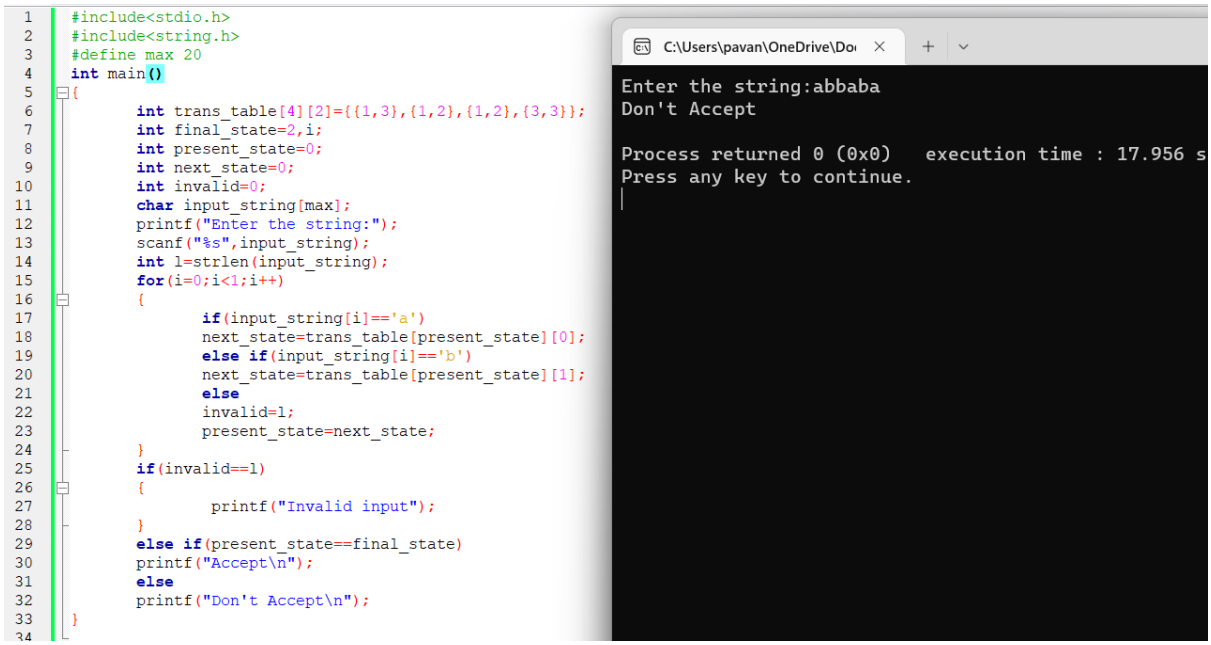
1.Write a C program to simulate a Deterministic Finite Automata (DFA) for the given language representing strings that start with a and end with a.

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 the string:");
    scanf("%s",input_string);
    int l=strlen(input_string);
    for(i=0;i<1;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];
        else
```

```
        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 :-



2.Write a C program to simulate a Deterministic Finite Automata (DFA) for the given language representing strings that start with 0 and end with 1.

Program :-

```
#include<stdio.h>
#include<string.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]);
}
for(i=0;i<10;i++)
{
for(j=0;j<10;j++)
{
for(k=0;k<10;k++)
{
mat[i][j][k]=-1;
```

```
}
}
}
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;
```

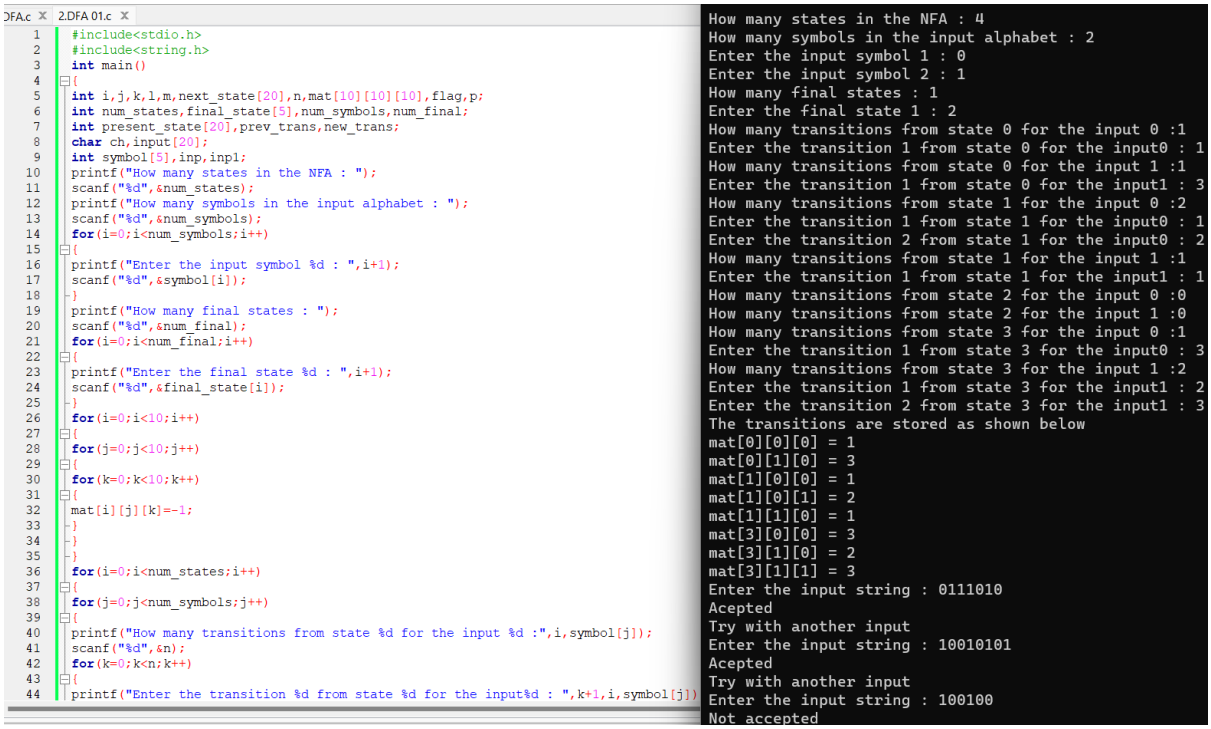
```
p=present_state[j];
while(mat[p][inp][k]!=-1)
{
next_state[new_trans++]=mat[p][inp][k];
k++;
}
}
for(j=0;j<new_trans;j++)
{
present_state[j]=next_state[j];
}
prev_trans=new_trans;
}
flag=0;
for(i=0;i<prev_trans;i++)
{
for(j=0;j<num_final;j++)
{
if(present_state[i]==final_state[j])
{
flag=1;
break;
}
}
}
if(flag==1)
printf("Acepted\n");
else
printf("Not accepted\n");
```

printf("Try with another input\n");

}

}

Output :-



```c
#include<stdio.h>
#include<string.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]);
}
for(i=0;i<10;i++)
{
for(j=0;j<10;j++)
{
for(k=0;k<10;k++)
{
mat[i][j][k]=-1;
}
}
}
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])
```

```
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 input0 : 1
How many transitions from state 0 for the input 1 :1
Enter the transition 1 from state 0 for the input1 : 3
How many transitions from state 1 for the input 0 :2
Enter the transition 1 from state 1 for the input0 : 1
Enter the transition 2 from state 1 for the input0 : 2
How many transitions from state 1 for the input 1 :1
Enter the transition 1 from state 1 for the input1 : 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 input0 : 3
How many transitions from state 3 for the input 1 :2
Enter the transition 1 from state 3 for the input1 : 2
Enter the transition 2 from state 3 for the input1 : 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
Acepted
Try with another input
Enter the input string : 10010101
Acepted
Try with another input
Enter the input string : 100100
Not accepted
```

3.Write a C program to simulate a Non-Deterministic Finite Automata (NFA) for the given language representing strings that start with b and end with a.

Program :-

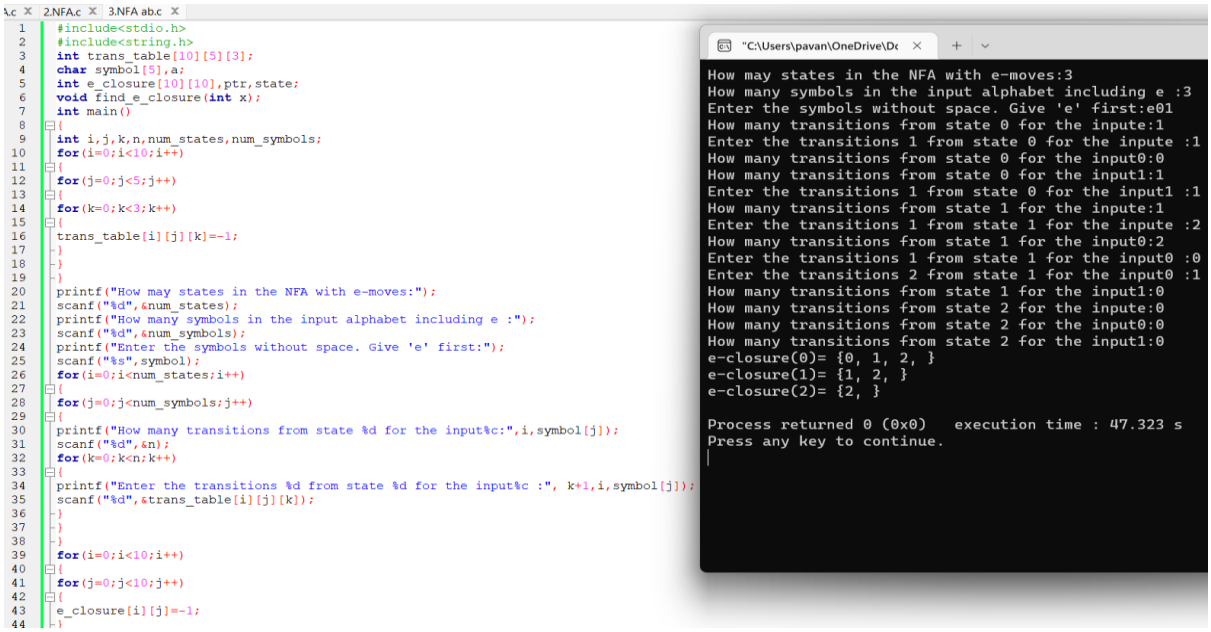
```c
#include<stdio.h>

#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 :-



```
#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;
}
```

```
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:e01
How many transitions from state 0 for the inpute:1
Enter the transitions 1 from state 0 for the inpute :1
How many transitions from state 0 for the input0:0
How many transitions from state 0 for the input1:1
Enter the transitions 1 from state 0 for the input1 :1
How many transitions from state 1 for the inpute:1
Enter the transitions 1 from state 1 for the inpute :2
How many transitions from state 1 for the input0:2
Enter the transitions 1 from state 1 for the input0 :0
Enter the transitions 2 from state 1 for the input0 :1
How many transitions from state 1 for the input1:0
How many transitions from state 2 for the inpute:0
How many transitions from state 2 for the input0:0
How many transitions from state 2 for the input1:0
e-closure(0)= {0, 1, 2, }
e-closure(1)= {1, 2, }
e-closure(2)= {2, }

Process returned 0 (0x0)   execution time : 47.323 s
Press any key to continue.
```

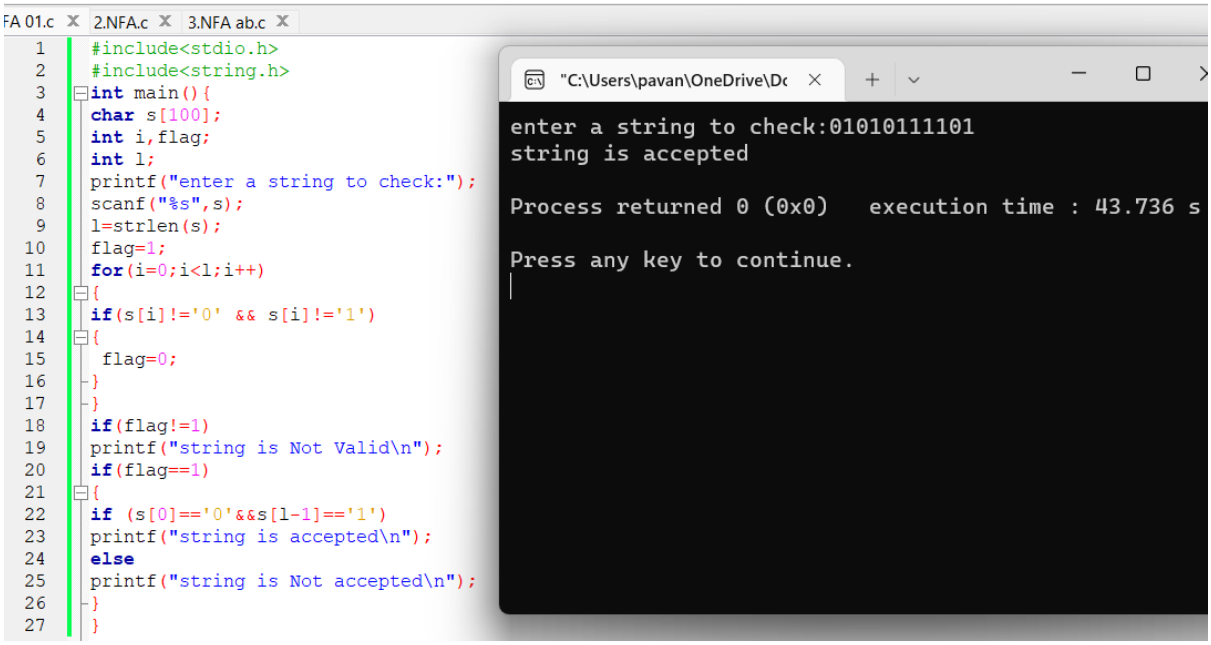
4.Write a C program to simulate a Non-Deterministic Finite Automata (NFA) for the given language representing strings that start with o and end with 1.

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 :-



5. To write a C program to check whether a string belongs to the grammar S -> 0 S 0 | 1 S 1 | 0 | 1 | ε.

Program :-

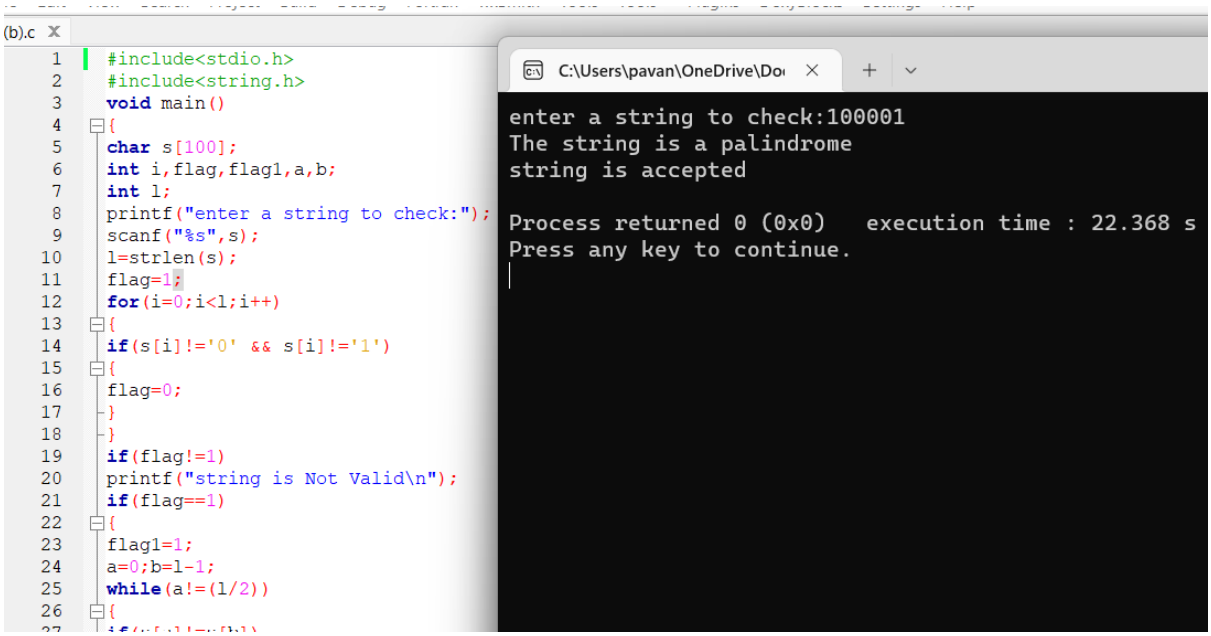
```
#include<stdio.h>

#include<string.h>

void 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=l-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 :-



6. To write a C program to check whether a string belongs to the grammar S -> 0 S 0 | A A -> 1 A | ε.

Program :-

#include<stdio.h>

#include<string.h>

void main()

{

char s[100];

int i,flag,flag1,a,b;

int l,count1,count2;

printf("enter a string to check:");

scanf("%s",s);

l=strlen(s);

flag=1;

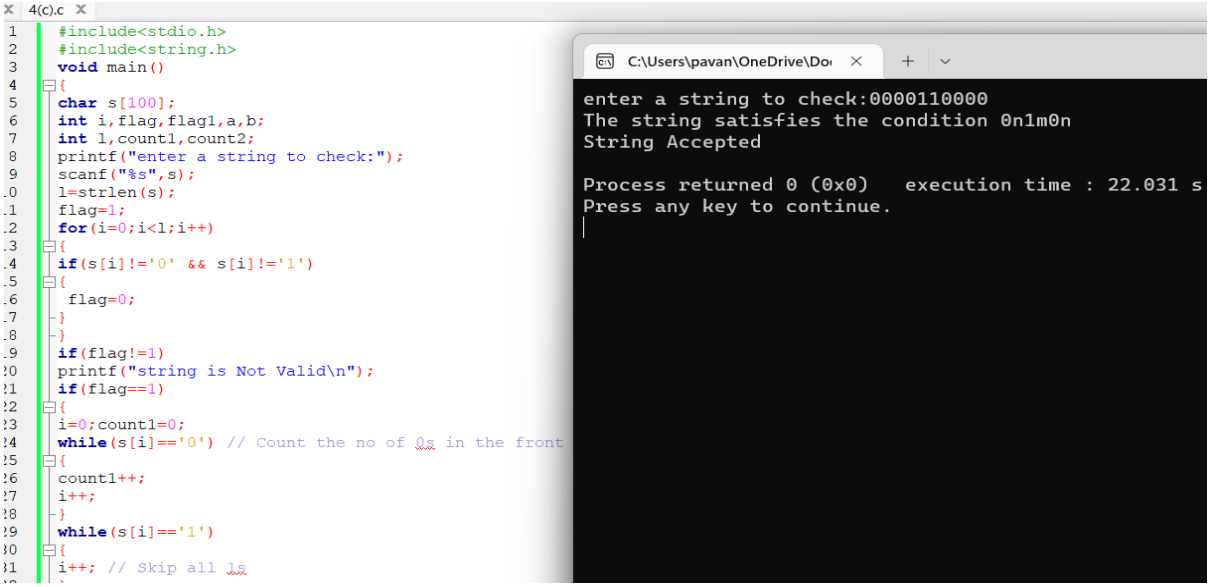
for(i=0;i<l;i++)

{

```
if(s[i]!='0' && s[i]!='1')
{
 flag=0;
}
}
if(flag!=1)
printf("string is Not Valid\n");
if(flag==1)
{
i=0;count1=0;
while(s[i]=='0') // Count the no of 0s in the front
{
count1++;
i++;
}
while(s[i]=='1')
{
i++; // Skip all 1s
}
flag1=1;
count2=0;
while(i<l)
{
if(s[i]=='0')// Count the no of 0s at the end
{
count2++;
}
else
{
```

```
flag1=0;
}
i++;
}
if(flag1==1)
{
if(count1==count2)
 {
 printf("The string satisfies the condition 0n1m0n\n");
 printf("String Accepted\n");
 }
 else
 {
 printf("The string does not satisfy the condition 0n1m0n\n");
 printf("String Not Accepted\n");
 }
}
else
 {
 printf("The string does not satisfy the condition 0n1m0n\n");
 printf("String Not Accepted\n");
}
}
}
```

Output :-



7. To write a C program to check whether a string belongs to the grammar S -> 0 S 1 | ε.

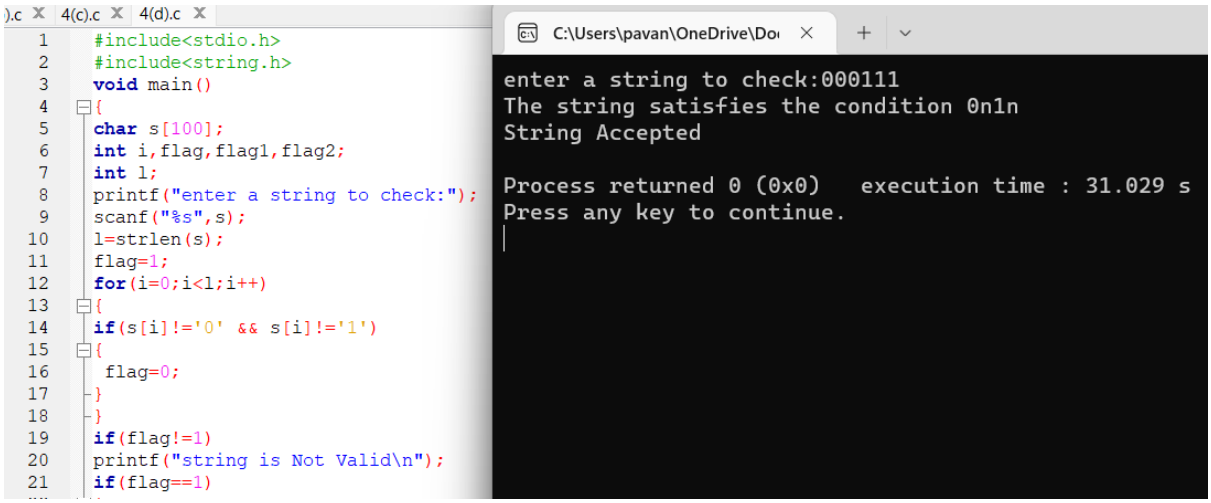
Program :-

```
#include<stdio.h>

#include<string.h>

void main()

{

char s[100];

int i,flag,flag1,flag2;

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(l%2!=0) // If string length is odd
 {
 printf("The string does not satisfy the condition 0n1n\n");
 printf("String Not Accepted\n");
 }
else
{
// To check first half contains 0s
flag1=1;
for(i=0;i<(l/2);i++)
{
if(s[i]!='0')
{
flag1=0;
}
}
// To check second half contains 1s
flag2=1;
for(i=l/2;i<l;i++)
{
if(s[i]!='1')
{
flag2=0;
}
}
```

```
if(flag1==1 && flag2==1)
 {
 printf("The string satisfies the condition 0n1n\n");
 printf("String Accepted\n");
 }
else
 {
 printf("The string does not satisfy the condition 0n1n\n");
 printf("String Not Accepted\n");
 }
}
}
}
```

Output :-



8 . To write a C program to check whether a string belongs to the grammar S -> A 1 0 1 A A -> 0 A | 1 A | ε.

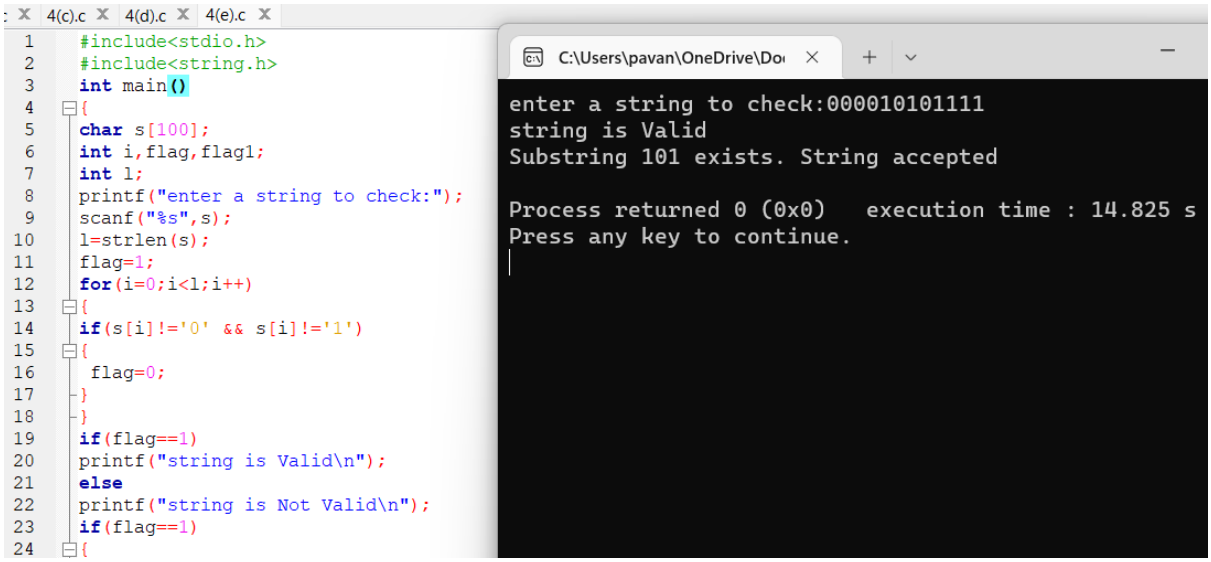
Program :-

```
#include<stdio.h>
#include<string.h>
int main()
{
```

```
char s[100];
int i,flag,flag1;
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 Valid\n");
else
printf("string is Not Valid\n");
if(flag==1)
{
flag1=0;
for(i=0;i<l-2;i++)
{
if(s[i]=='1')
{
if(s[i+1]=='0' && s[i+2]=='1')
{
flag1=1;
printf("Substring 101 exists. String accepted\n");
```

```
break;
}
}
}
if(flag1==0)
printf("Substring 101 does not exist. String not accepted\n");
}
}
```

Output :-



9. To write a C program to simulate a PDA for the language L={ 0n 1n | n>=1 } in which equal number of 0's are followed by equal number of 1's.

Program :-

```
#include<stdio.h>
#include<string.h>
char stack[20];
int top;
void push()
{
 top=top+1;
 stack[top]='0';
```

```
 stack[top+1]='\0';
}
int pop()
{
 if(top<1)
 return(0);
 else
 {
 stack[top]='\0';
 top=top-1;
 return(1);
 }
}
void main()
{
 int m,i,j,k,l,a,len;
 char input[20],rem_input[20];
 printf("Simulation of Pushdown Automata for 0n1n\n");
 printf("Enter a string : ");
 scanf("%s",input);
 l=strlen(input);
 j=0;stack[0]='Z';top=0;
 printf("Stack\tInput\n");
 printf("%s\t%s\n",stack,input);
 while(1)
 {
 len=strlen(input);
 while(len>0)
 {
```

```
if(input[0]=='0')
{
push();
m=0;
for(k=1;k<len;k++)
{
rem_input[m]=input[k];
m=m+1;
}
rem_input[m]='\0';
strcpy(input,rem_input);
printf("%s\t%s\n",stack,input);
}
if(input[0]=='1')
{
a=pop();
if(a==0)
{
printf("String not accepted");
goto b;
}
else
{
m=0;
for(k=1;k<len;k++)
{
rem_input[m]=input[k];
m=m+1;
}
```

```
rem_input[m]='\0';
strcpy(input,rem_input);
printf("%s\t%s\n",stack,input);
}
}
break;
}
j=j+1;
if(j==(l))
{
break;
}
}
if(top>=1)
{
printf("String not accepted");
}
else
{
printf("String accepted");
}
b:
printf(".............");
}
```

Output :-

).c 4(c).c 4(d).c 4(e).c 5.Pda.c

```c
#include<stdio.h>
#include<string.h>
char stack[20];
int top;
void push()
{
 top=top+1;
 stack[top]='0';
 stack[top+1]='\0';
}
int pop()
{
 if(top<1)
 return(0);
 else
 {
 stack[top]='\0';
 top=top-1;
 return(1);
 }
}
void main()
{
```

C:\Users\pavan\OneDrive\Do

```
Simulation of Pushdown Automata for 0n1n
Enter a string : 00001111
Stack   Input
Z       00001111
Z0      0001111
Z00     001111
Z000    01111
Z0000   1111
Z000    111
Z00     11
Z0      1
Z
String accepted.............
Process returned 13 (0xD)   execution time : 15.286 s
Press any key to continue.
```