MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE, GWALIOR (M.P.)

A

Practical File

On

THEORY OF COMPUTATION-160503

Session – July-Dec (2020)

SUBMITTED TO –

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0901CS181007

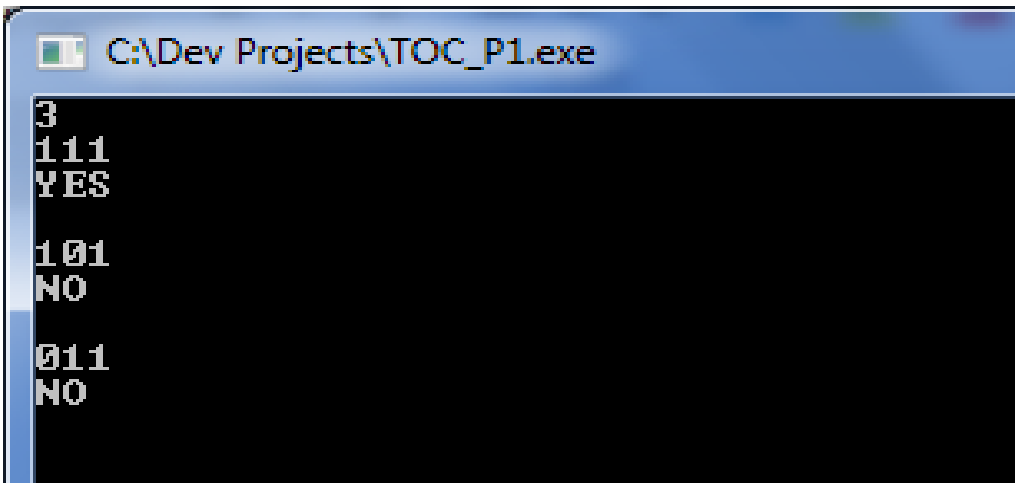
CS - 5 H SEM

P1 – Write a program to implement a machine which accepts 111.

```
#include<iostream>
#include<string.h>
using namespace std;
int main()
{
	int t;
	cin>>t;
	while(t>0)
	{
		string s;
		cin>>s;
		if(s == "111")
		{
			cout<<"YES"<<endl<<endl;
		}
		else
		{
			cout<<"NO"<<endl<<endl;
		}
		t--;

	}
	return 0;
}
```

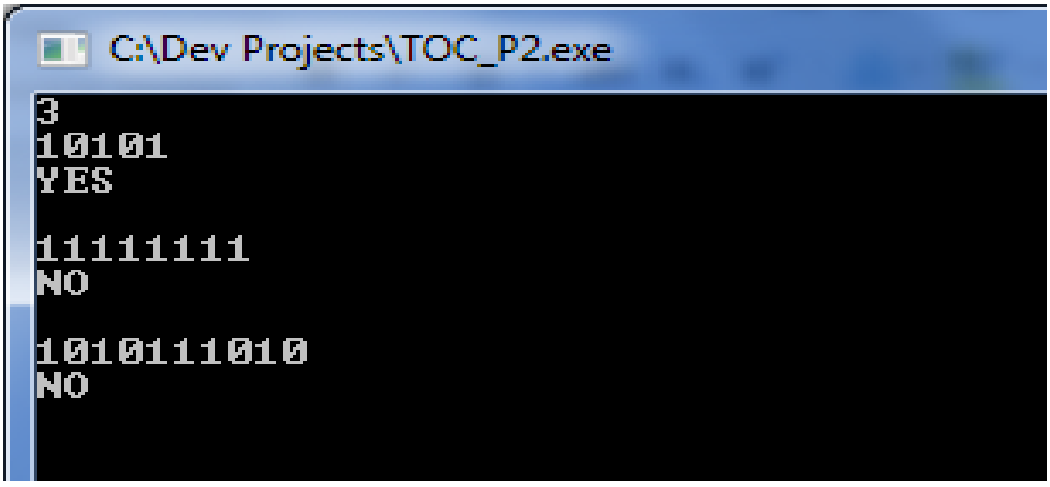
Output –



P2 – Write a program to implement a machine which accepts string that ends with 101.

```
#include<iostream>
#include<string.h>
using namespace std;
int main()
{
	int t;
	cin>>t;
	while(t>0)
	{
		string s;
		cin>>s;
		int len = s.length();
		string str = s.substr(len-3, 3);
		if (str == "101")
			cout<<"YES"<<"\n\n";
		else
			cout<<"NO"<<endl<<endl;
		t--;
	}
	return 0;
}
```

Output –

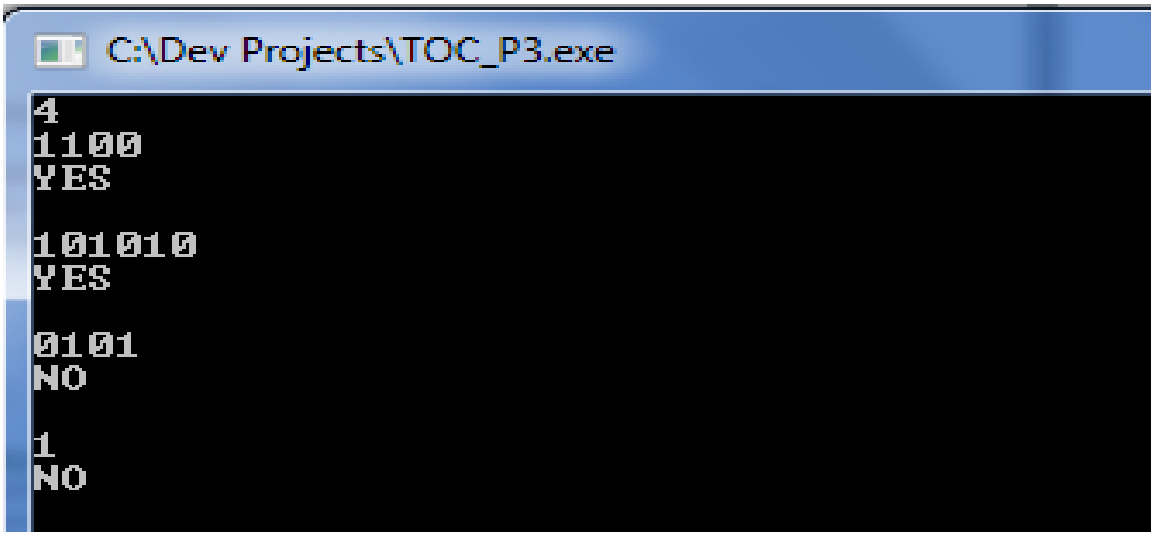


P3 – Write a program to implement a machine for mod 3 in.

```
#include<iostream>
#include<string>
using namespace std;
static int len;
void one(int i);
void two(int i);
static string s;
void zero(int i)
{
	if (i==len)
		cout<<"YES";
	else
	{
		if (s[i]=='1')
			one(i+1);
		else
			zero(i+1);
	}
}
void one(int i)
{
	if (i==len)
		cout<<"NO";
	else
	{
		if (s[i]=='1')
			zero(i+1);
		else
			two(i+1);
	}
}
void two(int i)
{
	if (i==len)
		cout<<"NO";
	else
	{
		if (s[i]=='1')
```

```
                two(i+1);
        else
                one(i+1);
    }
}
int main()
{
    int t;
    cin>>t;
    while(t>0)
    {
        cin>>s;
        len = s.length();
        zero(0);
        t--;
        cout<<endl<<endl;
    }
    return 0;
}
```

Output –



P4 – Write a program to implement a machine for mod 2 in decimal system.

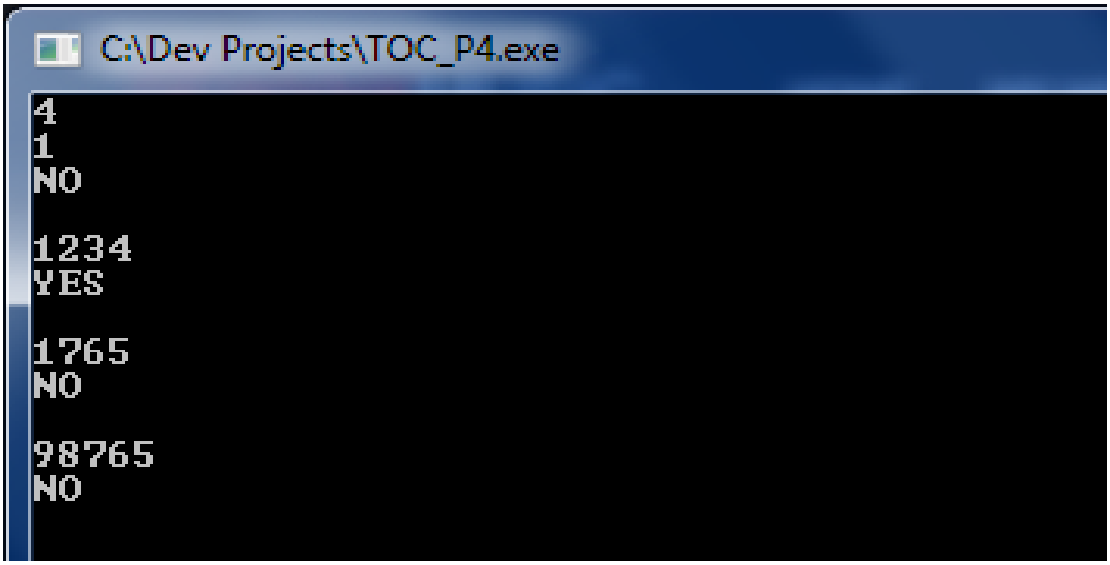
```
#include<iostream>
#include<string>
using namespace std;
static int len;
void one(int i);
static string s;

void zero(int i)
{
	if (i==len)
		cout<<"YES";
	else
	{
		if (s[i]=='1' || s[i]=='3' || s[i]=='5' || s[i]=='7' || s[i]=='9')
			one(i+1);
		else
			zero(i+1);
	}
}
void one(int i)
{
	if (i==len)
		cout<<"NO";
	else
	{
		if (s[i]=='0' || s[i]=='2' || s[i]=='4' || s[i]=='6' || s[i]=='8')
			zero(i+1);
		else
			one(i+1);
	}
}

int main()
{
	int t;
	cin>>t;
	while(t>0)
```

```
	{
		cin>>s;
		len = s.length();
		zero(0);
		cout<<"\n\n";
		t--;
	}
	return 0;
}
```

Output –



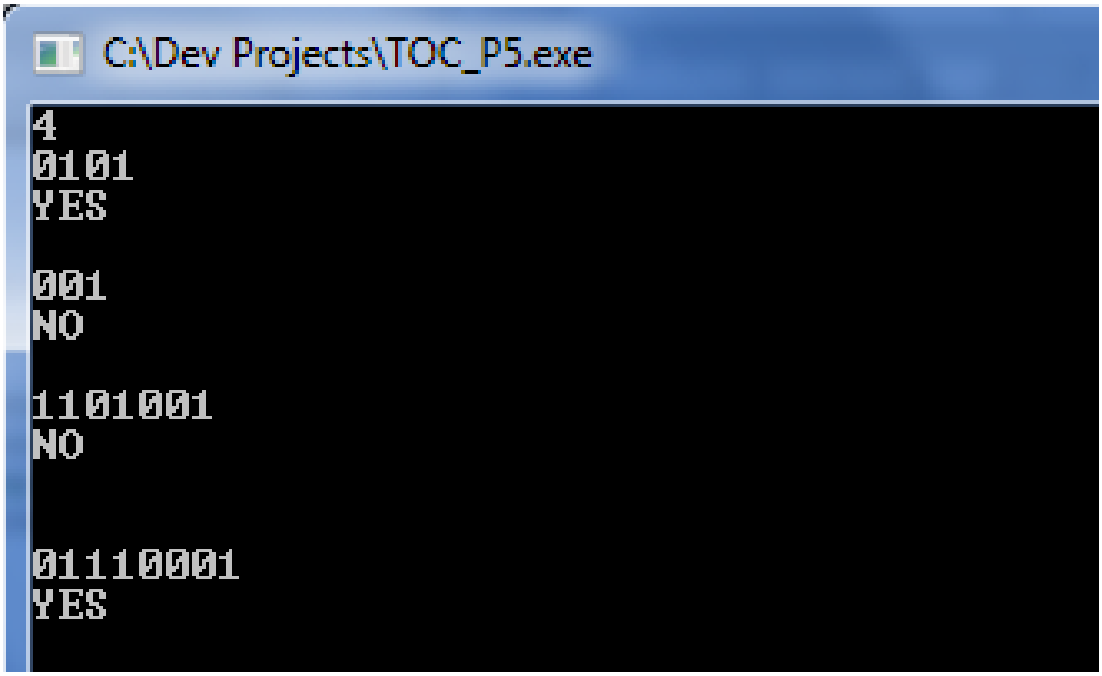
P5 – Write a program to implement a machine which accepts string with even number of zeros and ones.

```
#include<iostream>
#include<string>
using namespace std;
static int len;
void bo(int i);
void oe(int i);
void ze(int i);
static string s;

void be(int i)
{
	if (i==len)
		cout<<"YES";
	else
	{
		if (s[i]=='1')
			ze(i+1);
		else
			oe(i+1);
	}
}
void oe(int i)
{
	if (i==len)
		cout<<"NO";
	else
	{
		if (s[i]=='1')
			bo(i+1);
		else
			be(i+1);
	}
}
void ze(int i)
{
	if (i==len)
		cout<<"NO";
```

```
	else
	{
		if (s[i]=='1')
			be(i+1);
		else
			bo(i+1);
	}
}
void bo(int i)
{
	if (i==len)
		cout<<"NO";
	else
	{
		if (s[i]=='1')
			oe(i+1);
		else
			ze(i+1);
	}
}
int main()
{
	int t;
	cin>>t;
	while(t>0)
	{
		cin>>s;
		len = s.length();
		be(0);
		cout<<"\n\n";
		t--;
	}
	return 0;
}
```

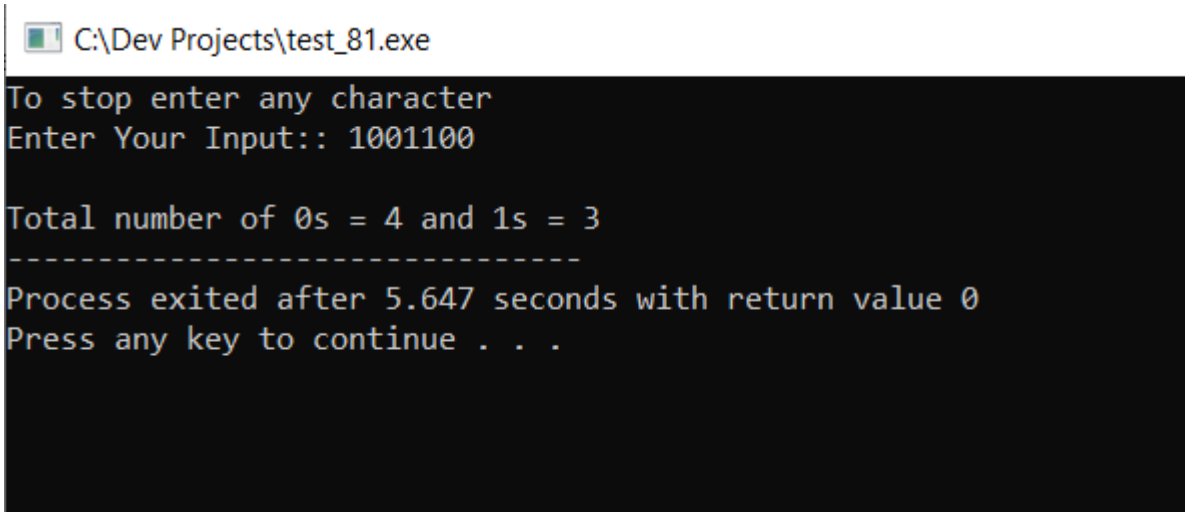
Output –


C:\Dev Projects\TOC_P5.exe
4
0101
YES
001
NO
1101001
NO
01110001
YES

P6 – Write a program to implement a machine which counts the number of 0s and 1s

```
#include <iostream>
#include<string.h>
using namespace std;
int main()
{
   string input;
   int count_0 = 0,count_1=0;
   cout << "To stop enter any character";
   cout << "\nEnter Your Input:: ";
   cin>>input;
   for (int i=0;i<input.size();i++){
        if(input[i]=='1')      count_1++;
   elsecount_0++;
        }
   cout<<endl<<"Total number of 0s = "<<count_0<<" and 1s = "<<count_1;
   return 0;
}
```

Output –

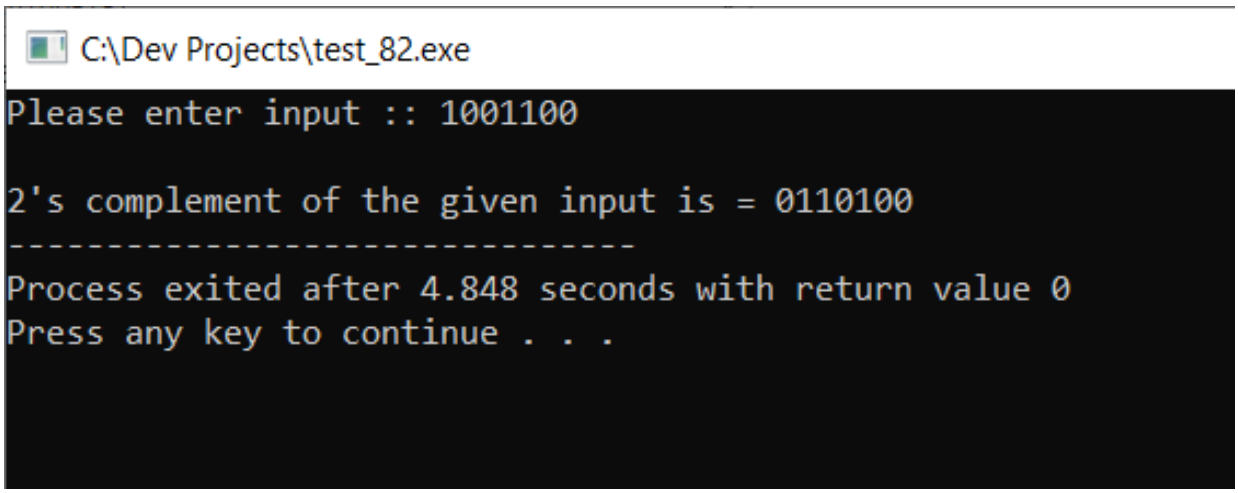


P7 – Write a program to 2's complement of a given binary number.

```
#include<iostream>
#include<string>
using namespace std;
static string input;
string answer,zero="0", one="1";
void b(int);
void a(int i)
{
	if (i<0)	return;
	if (input[i]=='0')
	{
		answer.append(zero);
		a(i-1);
	}
	else
	{
		answer.append(one);
		b(i-1);
	}
	return;
}
void b(int i)
{
	if (i<0)	return;
	if (input[i]=='0')
	{	answer.append(one);
```

```
            b(i-1);
        }
        else
        {       answer.append(zero);
                b(i-1);
        }
        return;
}
int main()
{
        cout<<"Please enter input :: ";
        cin>>input;
        a(input.size()-1);
        cout<<endl<<"2's complement of the given input is = ";
        for(int i=input.size()-1;i>=0;i--)   cout<<answer[i];
        return 0;
}
```

Output –

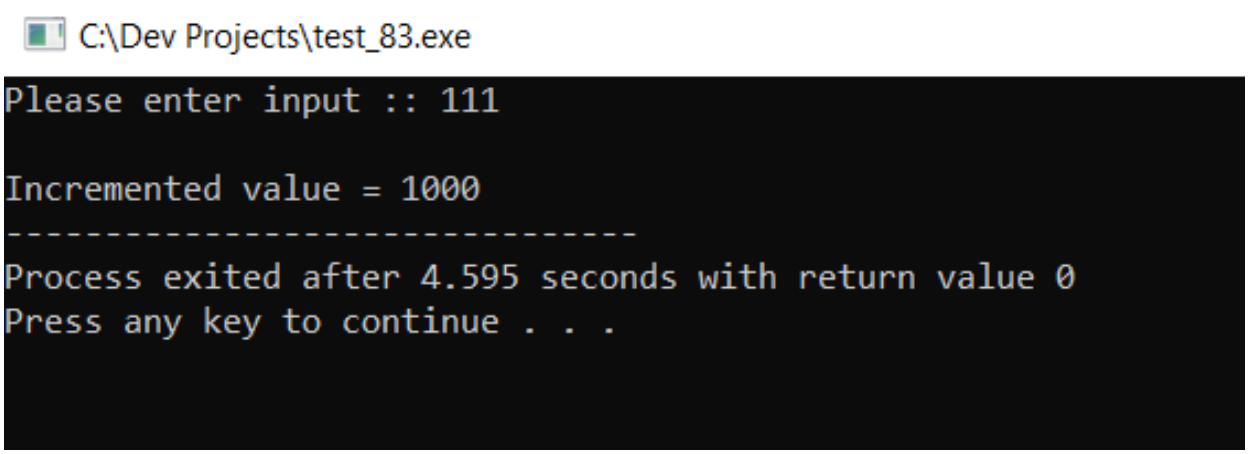


P8 – Design a program which will increment the given binary number by 1.

```
#include<iostream>
#include<string>
using namespace std;
static string input;
string answer,zero="0", one="1";
void b(int);
void a(int i)
{
	if (i<0)
	{	answer.append(one);
		return;
		}
	if (input[i]=='0'){
		answer.append(one);
		b(i-1);
	}
	else{
		answer.append(zero);
		a(i-1);
	}
}
void b(int i)
{
	if (i<0)	return;
	if (input[i]=='0'){
```

```
            answer.append(zero);
            b(i-1);
        }
        else{
            answer.append(one);
            b(i-1);
        }
}
int main()
{
        cout<<"Please enter input :: ";
        cin>>input;
        a(input.size()-1);
        cout<<endl<<"Incremented value = ";
        for(int i=answer.size()-1;i>=0;i--)        cout<<answer[i];
        return 0;
}
```

Output –



P9 – Write a program to convert NDFA to DFA

```
#include<iostream>
#include<string>
#include<algorithm>
#include<vector>
#include<queue>
using namespace std;

vector<vector <string> > state_table;
vector<string>state;
queue<string> q;
int states=0;

bool check(string s)
{
	for (int i=0;i<state_table.size();i++)
	{
		if (s==state_table[i][0])    return true;
	}
	return false;
}

string clean(string s)
{
	if (s.size()==0){
		s+="#";
		return s;
```

```
	}
	string res;
	res=s[0];
	for(int i=1;i<s.size();i++)
	{
		if(s[i]!=s[i-1])		res+=s[i];
	}
	return res;
}
void fill_table(string s)
{
	if (s!="#" && !check(s)){
		string zero, one;
		for(int i=0;i<s.size();i++)
		{
			string temp(1,s[i]);
			for(int p=0;p<states;p++)
			{
				if (temp==state_table[p][0])
				{
					if (state_table[p][1]!="#")
	zero.append(state_table[p][1]);
					if (state_table[p][2]!="#")
	one.append(state_table[p][2]);
					break;
				}
			}
		}
		sort(zero.begin(), zero.end());
```

```
                sort(one.begin(), one.end());
                zero = clean(zero);
                one =clean(one);
                vector<string> row;
                row.push_back(s);
                row.push_back(zero);
                row.push_back(one);
                state_table.push_back(row);
                if(one!="#" && !check(one))             q.push(one);
                if(zero!="#" && !check(zero))   q.push(zero);
        }
        return;
}

void convert(){
        int i=0;
   for (i = 0; i < states; i++)
   {
      if(state_table[i][1]!="#" && !check(state_table[i][1]))
        q.push(state_table[i][1]);
                if(state_table[i][2]!="#" && !check(state_table[i][2]))
        q.push(state_table[i][2]);
                for (int j = 0; j<3; j++)
      {
         cout << state_table[i][j] << "\t";
      }
      cout << endl;
   }
   while(!q.empty())
```

```
    {
        fill_table(q.front());
        q.pop();
        for (int j = 0; j<3; j++)                cout << state_table[i][j] << "\t";
        i++;
      cout << endl;
    }

}

int main()
{
        cout<<"Enter number of states - ";
        cin>>states;
        cout<<"Enter space seprated values of state table for two inputs (for phi
input enter '#') - \n";
        for(int j=0;j<states;j++){
                vector<string> row;
                for(int i=0;i<3;i++){
                        string temp;
                        cin>>temp;
                        row.push_back(temp);
                        }
                state_table.push_back(row);
        }
        cout<<endl<<endl<<"Equivalent DFA - \n";
        convert();
        return 0;
}
```

Output –


C:\Dev Projects\test_84.exe
Enter number of states - 5
Enter space seprated values of state table for two inputs (for phi input enter '#') -
a abcde de
b c e
c # b
d e #
e # #
Equivalent DFA -
a abcde de
b c e
c # b
d e #
e # #
abcde abcde bde
de e #
bde ce e
ce # b
Process exited after 32.12 seconds with return value 0
Press any key to continue . . .

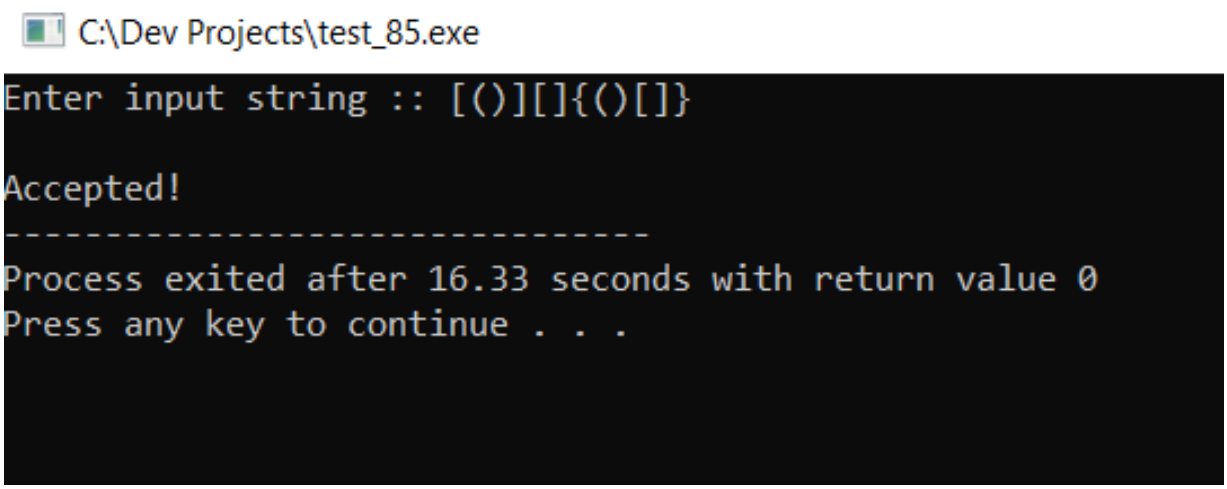
P10 – Write a program to implement a PDA machine which accepts a well-formed parenthesis.

```
#include<iostream>
#include<stack>
using namespace std;
stack<string> st;

int main()
{
	cout<<"Enter input string :: ";
	string t;
	cin>>t;
	for(int i=0;i<t.size();i++)
	{
		string temp(1,t[i]);
		if (temp=="{" || temp=="(" || temp=="[")    st.push(temp);
		else if(temp=="}"){
			if(st.top()=="{")		st.pop();
			else
			{
				cout<<endl<<"Not Accepted!";
				return 0;
			}
		}
		else if(temp=="]"){
			if(st.top()=="[")		st.pop();
			else
```

```
                {
                        cout<<endl<<"Not Accepted!";
                        return 0;
                }
        }
        else if(temp==")"){
                if(st.top()=="("                st.pop();
                else
                {
                        cout<<endl<<"Not Accepted!";
                        return 0;
                }
        }
    }
    if (st.empty())     cout<<endl<<"Accepted!";
    else    cout<<endl<<"Not Accepted";
    return 0;
}
```

Output –



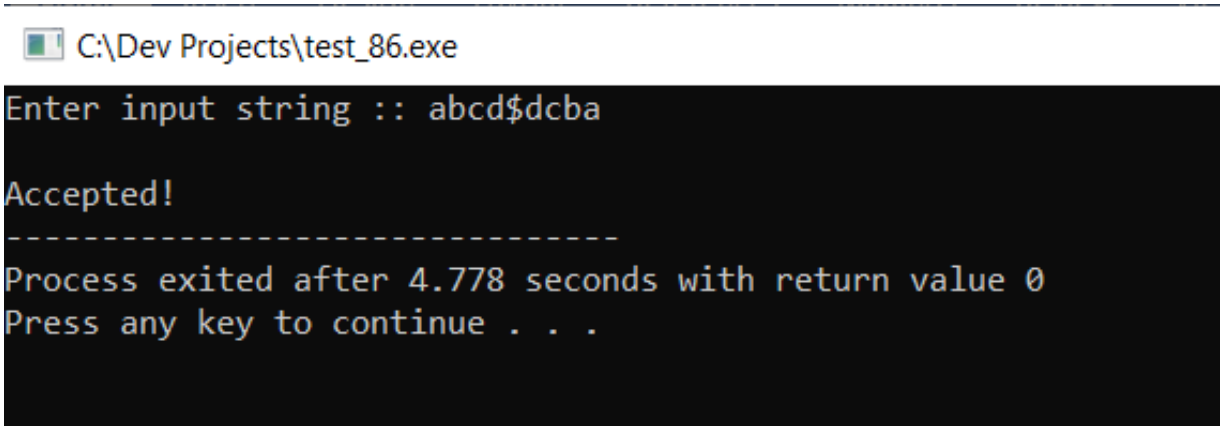
P11 – Write a program to implement a PDA machine which accepts WCW^r where W is any string and W^r is reverse of W and C is a special character.

```
#include<iostream>
#include<conio.h>
#include<stack>
using namespace std;
stack<string> st;

int main()
{
	cout<<"Enter input string :: ";
	string t;
	cin>>t;
	int i=0;
	while(true)
	{
		string temp(1,t[i++]);
		if(temp=="$")	break;
		st.push(temp);
	}
	for(;i<t.size();i++)
	{
		string temp(1,t[i]);
		if(st.empty() || temp!=st.top()){
			cout<<endl<<"Not Accepted!";
			return 0;
		}
```

```
            st.pop();
        }
        if (st.empty())                 cout<<endl<<"Accepted!";
        else            cout<<endl<<"Not Accepted";
        return 0;
}
```

Output –



P12 – Design a Turing machine that accepts the following language- $a^n b^n c^n$ where n>0

```
#include<iostream>
#include<string>
#include<stdio.h>
#include<stack>
using namespace std;
static string input;
int a_count=0, b_count=0, c_count=0, i=0;

using namespace std;

void c()
{
	c_count++;
	while(i<input.size()-1 && input[i++]=='c')		c_count++;
	if (input[i]=='#')	return;
	else
	{
		cout<<endl<<"Not Accepted!";
		exit(0);
	}
}

void b()
{
	b_count++;
```

```
        while(i<input.size() && input[i++]=='b')                b_count++;
        if (input[i]=='c')      c();
        else
        {
                cout<<endl<<"Not Accepted!";
                exit(0);
        }
}

void a()
{
        while(i<input.size() && input[i++]=='a')                a_count++;
        if (input[i]=='b')      b();
        else
        {
                cout<<endl<<"Not Accepted!";
                exit(0);
        }
}
int main()
{
        cout<<"Enter input string :: ";
        cin>>input;
        input+="#";
        a();
        if(a_count==b_count && b_count==c_count)
        {
                cout<<endl<<"Accepted!";
```

```
        return 0;
    }
    else
    {
        cout<<endl<<"Not Accepted!";
        return 0;
    }
    return 0;
}
```

Output –