1. Odd 1 even 0

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

int main(){
   int i,state=0;
   string str;
   cout<<"Enter a string :";
   cin>>str;
   for(i=0;i<str.length();i++){
      if(state==0 && str[i]=='0')
         state=1;
      else if(state==0 && str[i]=='1')
         state=2;
      else if(state==1 && str[i]=='0')
         state=0;
      else if(state==1 && str[i]=='1')
         state=3;
      else if(state==2 && str[i]=='0')
         state=3;
      else if(state==2 && str[i]=='1')
         state=0;
      else if(state==3 && str[i]=='0')
         state=2;
      else if(state==3 && str[i]=='1')
         state=1;
      else{
         cout<<"Invalid string";
         return 0;
      }
```

```
    }
    if(state==2)
        cout<<"String is accepted";
    else
        cout<<"String is rejected";
    return 0;
}
```

2. Ending with ba

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

int main(){
    int i,state=0;
    string str;
    cout<<"Enter a string :";
    cin>>str;
    for(i=0;i<str.length();i++){
        if(state==0 && str[i]=='a')
            state=0;
        else if(state==0 && str[i]=='b')
            state=1;
        else if(state==1 && str[i]=='a')
            state=2;
        else if(state==1 && str[i]=='b')
            state=1;
        else if(state==2 && str[i]=='a')
            state=0;
        else if(state==2 && str[i]=='b')
```

```
            state=1;
        else{
            cout<<"Invalid string";
            return 0;
        }
    }
    if(state==2)
        cout<<"String is accepted";
    else
        cout<<"String is rejected";
    return 0;
}
```

3. Donot end with ba

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

int main(){
    int i,state=0;
    string str;
    cout<<"Enter a string :";
    cin>>str;
    for(i=0;i<str.length();i++){
        if(state==0 && str[i]=='a')
            state=0;
        else if(state==0 && str[i]=='b')
            state=1;
        else if(state==1 && str[i]=='a')
            state=2;
        else if(state==1 && str[i]=='b')
```

```
            state=1;
        else if(state==2 && str[i]=='a')
            state=0;
        else if(state==2 && str[i]=='b')
            state=1;
        else{
            cout<<"Invalid string";
            return 0;
        }
    }
    if(state==0 || state==1)
        cout<<"String is accepted";
    else
        cout<<"String is rejected";
    return 0;
}
```

4. NFA ending with 01

```
#include <iostream>
#include <vector>
#include<string>
using namespace std;
vector<int> states = {0, 1, 2};
vector<vector<pair<char, int>>> transitions = {
    {{'0', 0}, {'1', 0}, {'0', 1}},
    {{'1', 2}},
    {{}}};
bool simulate_nfa(string input)
{

    vector<int> current_states = {0};
```

```
    for (char c : input)
    {
        vector<int> next_states;
        for (int state : current_states)
        {
            for (auto transition : transitions[state])
            {
                if (transition.first == c)
                {
                    next_states.push_back(transition.second);
                }
            }
        }
        if (next_states.empty())
        {
            return false;
        }
        current_states = next_states;
    }
    for (int state : current_states)
    {
        if (state == 2)
        {
            return true;
        }
    }
    return false;
}

int main()
{
```

```
    string input;
    cout << "Enter a string to check: ";
    cin >> input;

    if (simulate_nfa(input))
    {
        cout << "String ends with 01." << endl;
    }
    else
    {
        cout << "String does not end with 01." << endl;
    }
    return 0;
}
```

5. PDA for $a^n b^n$

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

struct stack{
    char A[10];
    int top=-1;
}S;

void push(char a){
    S.A[++S.top]=a;
}
void pop(){
    S.top--;
}
```

```
int main(){
   string str;
   int len,state=0;
   cout<<"Enter a string :";
   cin>>str;
   len=str.length();
   for(int i=0;i<len;i++){
      if(state==0 && str[i]=='a' &&S.A[S.top]=='a'){
         push('a');
         state=0;}
      else if(state==0 && str[i]=='a' &&S.top==-1){
         push('a');
         state=0;}
      else if(state==0 && str[i]=='b' &&S.A[S.top]=='a'){
         pop();
         state=1;}
      else if(state==1 && str[i]=='b' && S.A[S.top]=='a'){
         pop();
         state=1;}
      else{
         cout<<"String rejected";
         return 0;
      }
      }

   if(S.top==-1)
      cout<<"String accepted";
   else
      cout<<"String rejected";
}
```

6. PDA for equal number of a followed by equal number of b

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

struct stack{
   char A[10];
   int top=-1;
}S;

void push(char a){
   S.A[++S.top]=a;
}
void pop(){
   S.top--;
}

int main(){
   string str;
   int len,state=0;
   cout<<"Enter a string :";
   cin>>str;
   len=str.length();
   for(int i=0;i<len;i++){
      if(state==0 && str[i]=='a' &&S.A[S.top]=='a'){
         push('a');
         state=0;}
```

```
    else if(state==0 && str[i]=='a' &&S.top==-1){
        push('a');
        state=0;}
    else if(state==0 && str[i]=='b' &&S.A[S.top]=='a'){
        pop();
        state=1;}
    else if(state==1 && str[i]=='b' && S.A[S.top]=='a'){
        pop();
        state=1;}
    else{
        cout<<"String rejected";
        return 0;
    }
    }

  if(S.top==-1)
    cout<<"String accepted";
  else
    cout<<"String rejected";
}
```

7. TM for equal number of b followed by equal number of a

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

int head=0;

void right(){
  head++;
}
```

```
void left(){
    head--;
}

int main(){
    string A;
    int state=0;
    cout<<"Enter a string :";
    cin>>A;
    while(true){
        if(state==0 && A[head]=='b'){
            A[head]='X';
            right();
            state=1;
        }
        else if(state==0 && A[head]=='Y'){
            right();
            break;
        }

        else if(state==1 && (A[head]=='b'||A[head]=='Y')){
            right();
        }
        else if(state==1 && A[head]=='a'){
            A[head]='Y';
            state=2;
            left();
        }
        else if(state==2 && A[head]=='Y'||A[head]=='b'){
            left();
```

```
        }
        else if(state==2 && A[head]=='X'){
            state=0;
            right();
        }
        else{
            cout<<"String rejected";
            return 0;
        }
    }
    for(int i=head;i<A.length();i++){
        if(A[i]!='Y'){
            cout<<"String rejected";
            return 0;
        }
    }
    cout<<"String accepted";
    return 0;
}
```

8. TM for $a^n cb^n$

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

int head=0;

void right(){
    head++;
}
```

```
void left(){
    head--;
}

int main(){
    string A;
    int state=0,len;
    cout<<"Enter a string :";
    cin>>A;
    len=A.length();
    len--;
    while(true){
        if(state==0 && A[head]=='a'){
            A[head]='X';
            right();
            state=1;
        }
        else if(state==0 && A[head]=='c'){
            A[head]='X';
            state=3;
            right();
        }
        else if(state==1&&(A[head]=='a'||A[head]=='c'||A[head]=='Y')){
            right();
        }
        else if(state==1 && A[head]=='b'){
            A[head]='Y';
            left();
            state=2;
        }
        else if(state==2 && (A[head]=='a'||A[head]=='c'||A[head]=='Y')){
```

```
            left();
        }
        else if(state==2 && A[head]=='X'){
            right();
            state=0;
        }
        else if(state==3 && A[head]=='Y'){
            right();
            break;
        }
        else{
            cout<<"String rejected";
            return 0;
        }
    }
    for(int i=head;i<A.length();i++){
        if(A[i]!='Y'){
            cout<<"String rejected";
            return 0;
        }
    }
    cout<<"String accepted";
    return 0;
}
```