OverView

Deterministic Finite Automata

In DFA, for each input symbol, one can determine the state to which the machine will move. Hence, it is called Deterministic Automaton. As it has a finite number of states, the machine is called Deterministic Finite Machine or Deterministic Finite Automaton.

Formal Definition

A DFA can be represented by a 5-tuple (Q, ∑, δ, q_0, F) where −

- Q is a finite set of states.
- ∑ is a finite set of symbols called the alphabet.
- **δ** is the transition function where δ: Q × ∑ → Q
- q_0 is the initial state from where any input is processed (q_0 ∈ Q).
- F is a set of final state/states of Q (F ⊆ Q).

Graphical Representation of a DFA

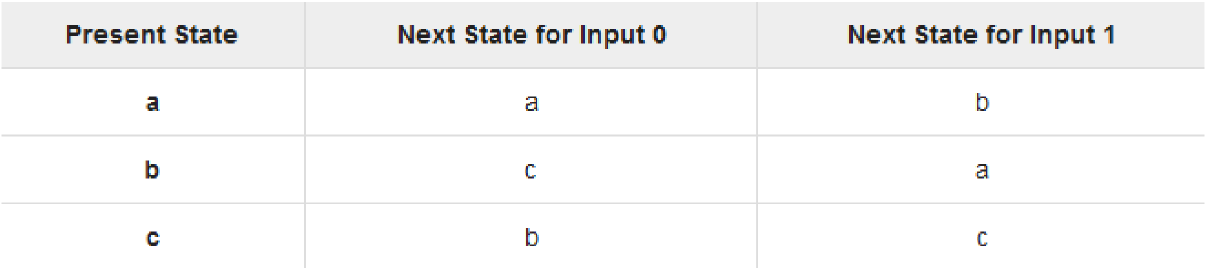
A DFA is represented by digraphs called state diagram.

- The vertices represent the states.
- The arcs labeled with an input alphabet show the transitions.
- The initial state is denoted by an empty single incoming arc.
- The final state is indicated by double circles.

Example

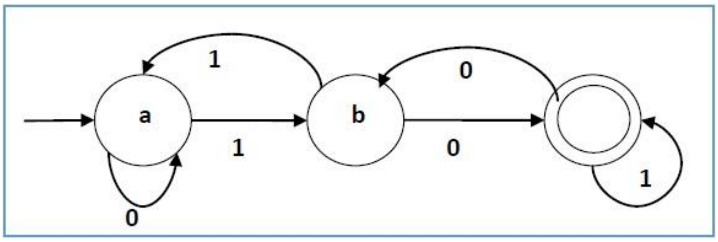
Let a deterministic finite automaton P be
P = (Q, ∑, q_0, F), where Q = {a, b, c}, ∑ = {0, 1}, q_0 = {a}, F = {c}.

Transition function δ as shown by the following table



Present State	Next State for Input 0	Next State for Input 1
a	a	b
b	c	a
c	b	c

Its graphical representation would be as follows

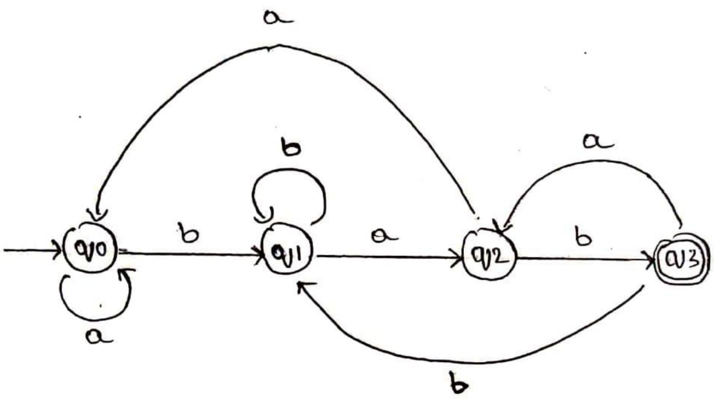


Deterministic Finite Automaton To Accept Strings Ending With bab

State diagram for a Deterministic Finite Automaton designed to accept strings ending with bab is as follows:

Present State	Input	Next State
q0	b	q1
q0	a	q0
q1	b	q1
q1	a	q2
q2	b	q3
q2	a	q0
q3	a	q2
q3	b	q1

Transition Diagram



Source Code

```
#include<stdlib.h>
#include<stdio.h>
#include<string.h>
int dfa = 0;
void q0(char c){
    if(c == 'b')
        dfa = 1;
    else if(c == 'a')
        dfa = 0;
    else
        dfa = -1;
}
void q1(char c){
    if(c == 'b')
        dfa = 1;
    else if(c == 'a')
        dfa = 2;
    else
        dfa = -1;
}
void q2(char c){
    if(c == 'b')
        dfa = 3;
    else if(c == 'a')
        dfa = 0;
    else
        dfa = -1;
}
void q3(char c){
    if(c == 'b')
        dfa = 1;
    else if(c == 'a')
        dfa = 2;
    else
        dfa = -1;
}
int isAccepted(char str[]){
    int i, len = strlen(str);
    for (i = 0; i < len; i++){
        if (dfa == 0)
            q0(str[i]);
        else if (dfa == 1)
            q1(str[i]);
        else if (dfa == 2)
            q2(str[i]);
        else if (dfa == 3)
            q3(str[i]);
        else
```

Source Code

```
            return 0;
    }
    if(dfa == 3)
        return 1;
    else
        return 0;
}
int main(){
    char *str;
    int size, option;
    printf("Automata To Accept Strings Ending With bab\n\n");
    while(1){
        printf("1. Check New String\n2. Exit\n");
        printf("Enter Option\n");
        scanf("%d", &option);
        switch(option){
            case 1:{
                printf("\nEnter Size of String:\n");
                scanf("%d", &size);
                str = (char*)malloc(sizeof(char));
                printf("Enter String:\n");
                scanf("%s", str);
                if(isAccepted(str))
                    printf("ACCEPTED\n");
                else
                    printf("NOT ACCEPTED\n");
                printf("*************\n\n");
                free(str);
                break;
            }
            case 2:{
                exit(0);
            }
            default:{}
        }
    }
    return 0;
}
```

Output

```
pi@raspberrypi:~/TOCproject $ gcc -o automata automata.c
pi@raspberrypi:~/TOCproject $ ./automata
Automata To Accept Strings Ending With bab
1. Check New String
2. Exit
Enter Option
1
Enter Size of String:
3
Enter String:
bab
ACCEPTED
*************
1. Check New String
2. Exit
Enter Option
1
Enter Size of String:
4
Enter String:
aabb
NOT ACCEPTED
*************
1. Check New String
2. Exit
Enter Option
1
Enter Size of String:
5
Enter String:
aabab
ACCEPTED
```

Output

```
ACCEPTED

*************


1. Check New String

2. Exit

Enter Option

2
```

References

https://www.geeksforgeeks.org/program-to-construct-a-dfa-which-accept-the-language-l-anbm-n-mod-20-m1/

Project Repository

https://github.com/aksharsramesh/TOCproject