TRIBHUVAN UNIVERSITY
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New Baneshwor, Kathmandu

Lab Report of Theory of Computation

Submitted by:

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Symbol No.: 29170
Semester : Fourth

Submitted to:

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Name: Sudip Pradhan	Semester : 4th	Batch :2078	Subject: TOC	Symbol No. : 29170

Program No.	Title of Programs	Date of Submission	Signature
1.	Program to construct a DFA that accepts the language L = {a^n | n >= 1}.		
2.	Program to construct a DFA which accepts the language L = {a^n b^m | n mod 2 = 0, m >= 1}.		
3.	Program to construct a DFA which accepts the language L = {a^n b^m | n mod 2 = 0, m >= 1}.		
4.	Program to construct a DFA that accepts odd number of 0's and odd number of 1's over the characters {0, 1}.		
5.	: Program to construct a NFA that accepts strings containing the substring ‘101’		
6.	Program to construct a NFA that accepts strings ending with ‘01’.		
7.	Program to construct a NFA that accepts strings starting with ‘10’.		
8.	Program to convert NFA to DFA.		
9.	Introduction to Perl Programming Language.		
10.	Perl Programs to accept strings: 1. starting with ‘a’. 2. starting with ‘a’ and ending with ‘b’. 3. having substring ‘101’. 4. of the form $a^n b^n$. 5. of the form $a^n b^{2n}$.		

Lab No.: 1

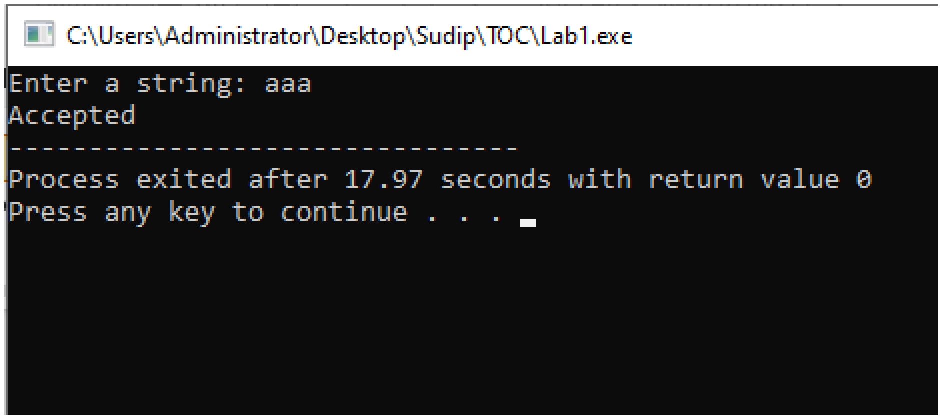
TITLE: WAP TO CONSTRUCT DFA THAT ACCEPTS THE A LANGUAGE L = {A^N | N >= 1}

SOURCE CODE:

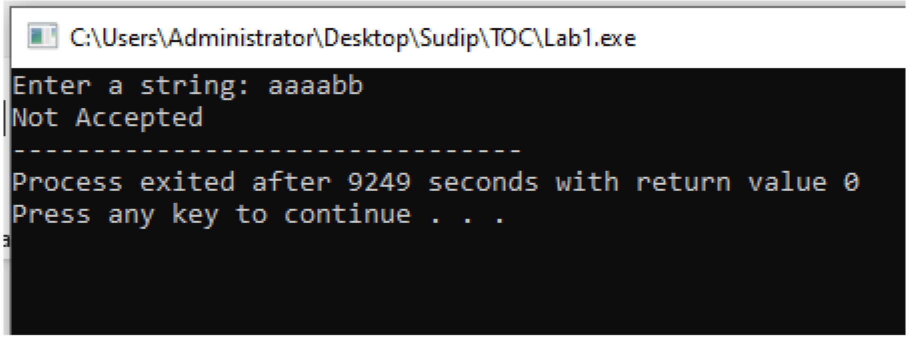
```
#include <stdio.h>
#include <string.h>

#define NUM_STATES 2
#define ALPHABET_SIZE 1

// DFA transition table
int transitionTable[NUM_STATES][ALPHABET_SIZE] = {
    {1},    // From state 0, on input 'a', transition to state 1
    {1}     // From state 1, on input 'a', remain in state 1 (loop)
};
// DFA accepting states
int acceptingStates[] = {1}; // Only state 1 is an accepting state
// DFA accepting function
int isAccepted(char* input) {
    int currentState = 0;
    int i = 0;
    while (input[i] != '\0') {
        int inputIndex = input[i] - 'a'; // Mapping input character to index
        if (inputIndex < 0 || inputIndex >= ALPHABET_SIZE)
            return 0; // Invalid input character
        currentState = transitionTable[currentState][inputIndex];
        i++;
    }
    // Check if the final state is an accepting state
    int j;
    for (j = 0; j < sizeof(acceptingStates) / sizeof(acceptingStates[0]); j++) {
        if (currentState == acceptingStates[j])
            return 1; // Accepted
    }
    return 0; // Not accepted
}
```

```
int main() {
    char input[100];

    printf("Enter a string: ");
    scanf("%s", input);

    if (isAccepted(input))
        printf("Accepted");
    else
        printf("Not Accepted");
    return 0;
}
```

OUTPUT



```
Enter a string: aaa
Accepted
--------------------------------
Process exited after 17.97 seconds with return value 0
Press any key to continue . . .
```



```
Enter a string: aaaabb
Not Accepted
--------------------------------
Process exited after 9249 seconds with return value 0
Press any key to continue . . .
```

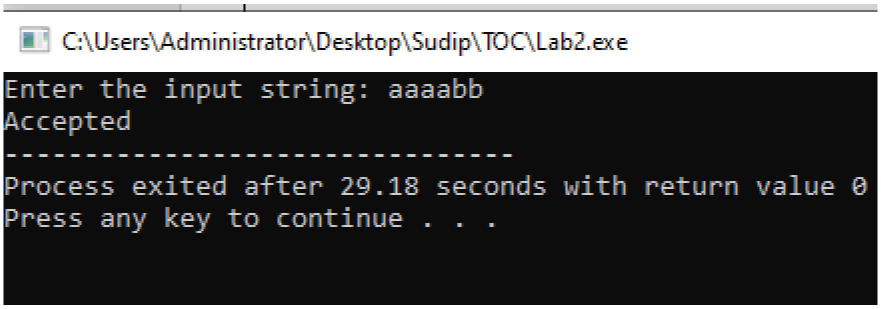
Lab No.: 2

TITLE: PROGRAM TO CONSTRUCT A DFA WHICH ACCEPTS THE LANGUAGE L = {A^NB^M| N MOD 2 = 0, M >=1}

SOURCE CODE:

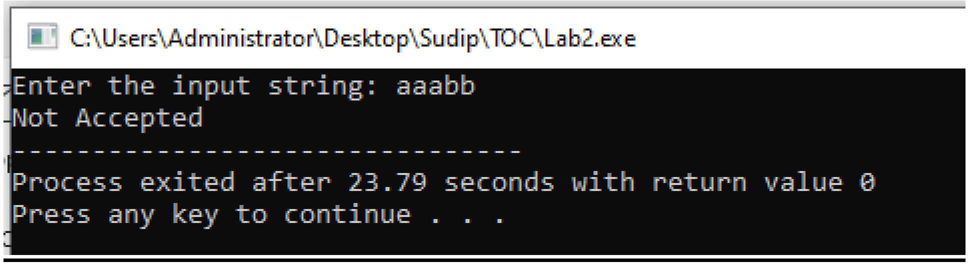
```
#include <stdio.h>
#include <stdbool.h>

// DFA transition function
int transition(int state, char input) {
    switch(state) {
        case 0:
            if (input == 'a') return 1;
            else if (input == 'b') return 2;
            else return -1; // Invalid transition
        case 1:
            if (input == 'a') return 1;
            else if (input == 'b') return 2;
            else return -1; // Invalid transition
        case 2:
            if (input == 'b') return 2;
            else return -1; // Invalid transition
    }
    return -1; // Invalid state
}

// Function to check if the input string is accepted by the DFA
bool isAccepted(char *input) {
    int currentState = 0;
    int aCount = 0;
    int bCount = 0;

    while (*input != '\0') {
        currentState = transition(currentState, *input);
        if (currentState == -1) return false; // Invalid transition
        if (*input == 'a') {
            aCount++;
        } else if (*input == 'b') {
            bCount++;
            // Ensure 'b' does not appear before 'a'
            if (currentState == 0) return false;
        }
        input++;
    }

    // Check if the final state is an accepting state (state 2)
    // and if aCount is even and bCount is at least 1
    return currentState == 2 && (aCount % 2 == 0) && bCount >= 1;
}

int main() {
    char input[100];
    printf("Enter the input string: ");
    scanf("%s", input);

    if (isAccepted(input))
        printf("Accepted");
    else
        printf("Not Accepted");

    return 0;
}
```

OUTPUT



C:\Users\Administrator\Desktop\Sudip\TOC\Lab2.exe

```
Enter the input string: aaaabb
Accepted
--------------------------------
Process exited after 29.18 seconds with return value 0
Press any key to continue . . .
```



C:\Users\Administrator\Desktop\Sudip\TOC\Lab2.exe

```
Enter the input string: aaabb
Not Accepted
--------------------------------
Process exited after 23.79 seconds with return value 0
Press any key to continue . . .
```

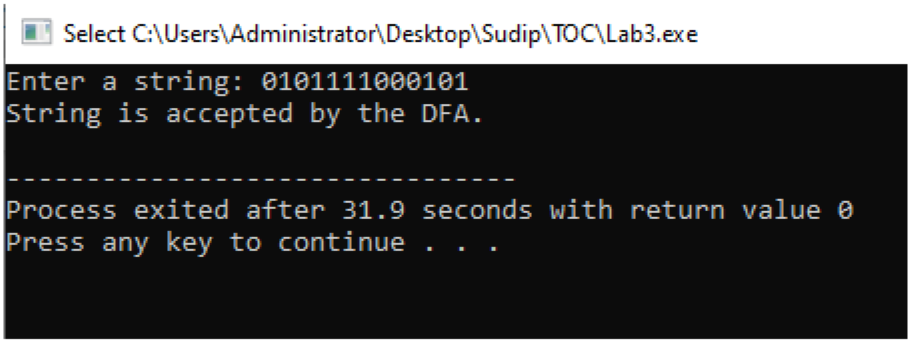
Lab No.: 3

TITLE: WAP TO CONSTRUCT A DFA THAT ACCEPTS THE STRINGS ENDING WITH ‘01’ OVER THE CHARACTERS {0, 1}

SOURCE CODE:

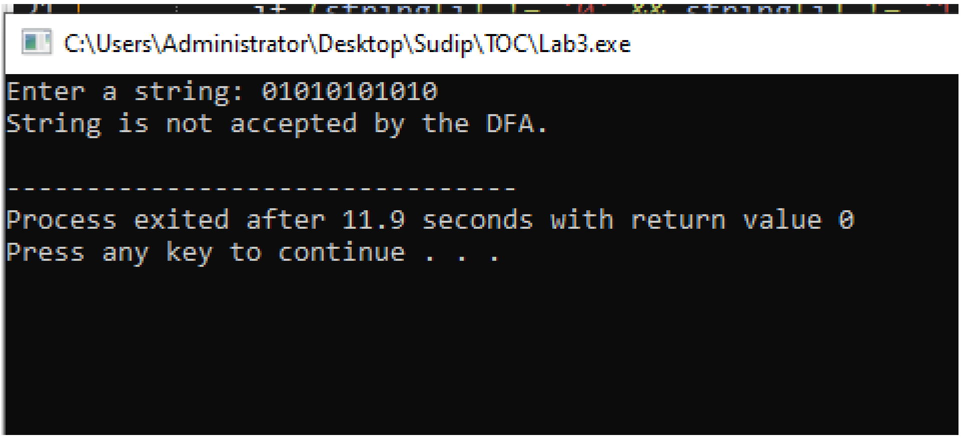
```
#include <stdio.h>
#include <stdbool.h>
#include <string.h>

#define STATES 3
#define ALPHABET 2

// DFA Transition Table
int transitionTable[STATES][ALPHABET] = {
    {1, 0},  // State 0
    {1, 2},  // State 1
    {1, 0}   // State 2 (final state)
};
// Function to check if a given string is accepted by the DFA
bool isAccepted(char *string) {
    int currentState = 0; // Start from the initial state

    int len = strlen(string);
    int i;
    for (i = 0; i < len; i++) {
        if (string[i] != '0' && string[i] != '1') // Check if the input character is valid
            return false;

        int inputSymbol = string[i] - '0'; // Convert char to integer

        currentState = transitionTable[currentState][inputSymbol]; // Move to the next state
based on the input symbol
    }
    // Check if the final state is reached
    return currentState == 2;
}

int main() {
    char string[100];
    printf("Enter a string: ");
    scanf("%s", string);

    if (isAccepted(string))
        printf("String is accepted by the DFA.\n");
    else
        printf("String is not accepted by the DFA.\n");
    return 0;
}
```

OUTPUT



Select C:\Users\Administrator\Desktop\Sudip\TOC\Lab3.exe

```
Enter a string: 0101111000101
String is accepted by the DFA.

--------------------------------
Process exited after 31.9 seconds with return value 0
Press any key to continue . . .
```



C:\Users\Administrator\Desktop\Sudip\TOC\Lab3.exe

```
Enter a string: 01010101010
String is not accepted by the DFA.

--------------------------------
Process exited after 11.9 seconds with return value 0
Press any key to continue . . .
```

.

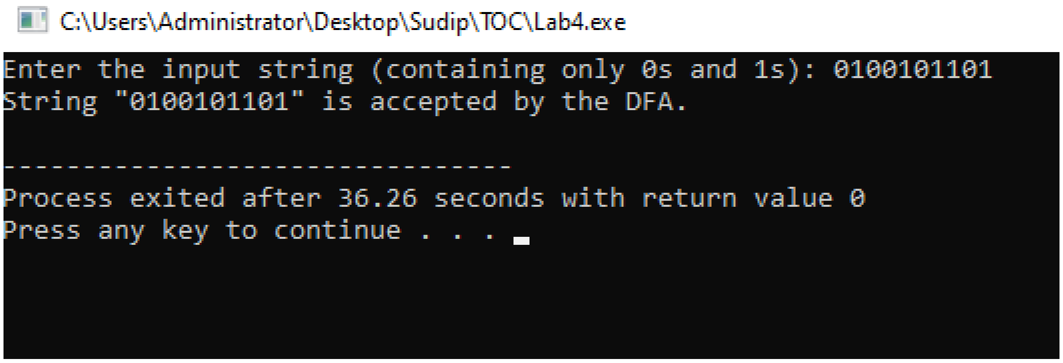
Lab No.: 4

WAP TO CONSTRUCT A DFA THAT ACCEPT ODD NUMBER OF ‘0’S AND ODD NUMBERS OF 1’S OVER THE CHARACTERS {0, 1}

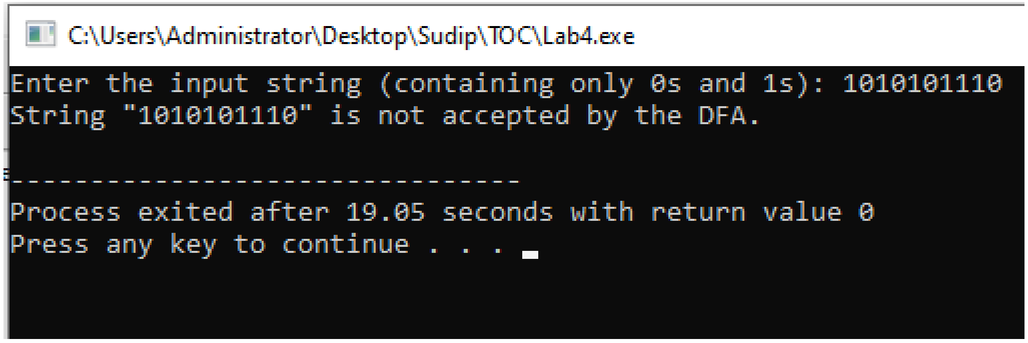
SOURCE CODE

```
#include <stdio.h>
#include <stdbool.h>

#define STATES 3 // Number of states
#define ALPHABET_SIZE 2 // Alphabet size

// DFA transition table
int transitionTable[STATES][ALPHABET_SIZE] = {
    {1, 2}, // State 0
    {0, 2}, // State 1
    {2, 1}  // State 2 (final state)
};

// Function to check if the string is accepted by the DFA
bool isAccepted(char *input) {
    int currentState = 0;
    int count0 = 0, count1 = 0;
    int i = 0;

    // Iterate through the input string
    while (input[i] != '\0') {
        // Get the input symbol
        char symbol = input[i] - '0';

        // Update the count of 0's and 1's
        if (symbol == 0) {
            count0++;
        } else {
            count1++;
        }

        // Update the current state using the transition table
        currentState = transitionTable[currentState][symbol];
        // Move to the next symbol in the input string
        i++;
    }

    // Check if the final state is reached and it's an accepting state
    return currentState == 2 && count0 % 2 == 1 && count1 % 2 == 1;
}

int main() {
    char input[100];

    printf("Enter the input string (containing only 0s and 1s): ");
    scanf("%s", input);

    // Check if the input string is accepted
    if (isAccepted(input)) {
        printf("String \"%s\" is accepted by the DFA.\n", input);
    } else {
        printf("String \"%s\" is not accepted by the DFA.\n", input);
    }

    return 0;
}
```

<u>OUTPUT</u>



```
Enter the input string (containing only 0s and 1s): 0100101101
String "0100101101" is accepted by the DFA.

--------------------------------
Process exited after 36.26 seconds with return value 0
Press any key to continue . . .
```



```
Enter the input string (containing only 0s and 1s): 1010101110
String "1010101110" is not accepted by the DFA.

--------------------------------
Process exited after 19.05 seconds with return value 0
Press any key to continue . . .
```

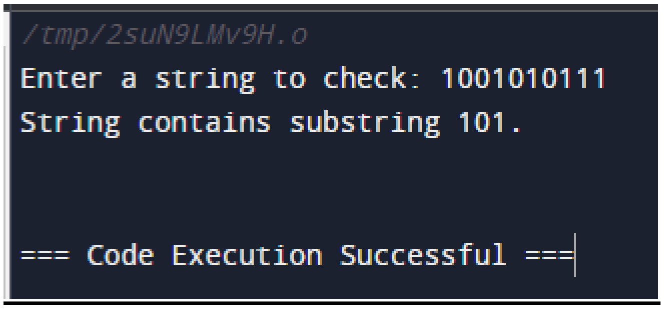
Lab No.: 5

TITLE: PROGRAM TO CONSTRUCT A NFA THAT ACCEPTS STRINGS CONTAINING THE SUBSTRING '101'.

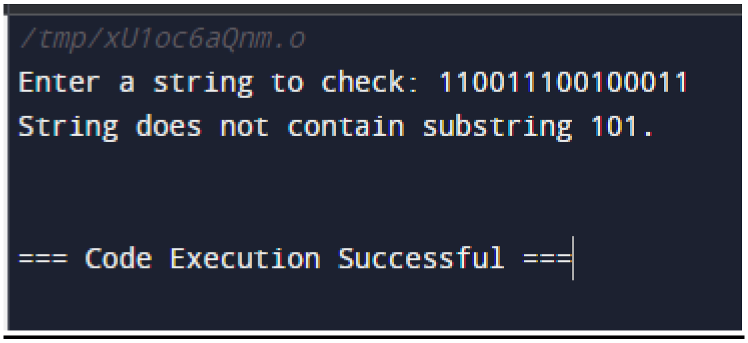
SOURCE CODE:

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

// Define the NFA as a set of states and transitions
vector<int> states = {0, 1, 2, 3}; // States are represented by integers (0, 1, 2, ...)
vector<vector<pair<char, int>>> transitions = {
    {{'0', 0}, {'1', 0}, {'1', 1}},
    {{'0', 2}},
    {{'1', 3}},
    {{'0', 3}, {'1', 3}}}; // Transitions are represented by pairs of characters and states
(character, state)

// Define a function to simulate the NFA on a given string
bool simulate_nfa(string input)
{
    // Start at the initial state (state 0)
    vector<int> current_states = {0};

    // Loop through each character in the input string
    for (char c : input)
    {
        // Find all possible transitions from the current states for the current character
        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 there are no possible transitions, the input string is not accepted
        if (next_states.empty())
        {
            return false;
        }
        // Update the current states to the next states
        current_states = next_states;
    }
    // If the final state is an accepting state, the input string is accepted
    for (int state : current_states)
    {
        if (state == 3)
        {
            return true;
        }
    }
    return false;
}

// Define the main function to run the program
int main()
{
    // Get input from the user
    string input;
    cout << "Enter a string to check: ";
    cin >> input;

    // Simulate the NFA on the input string and output the result
    if (simulate_nfa(input))
    {
        cout << "String contains substring 101." << endl;
    }
    else
    {
        cout << "String does not contain substring 101." << endl;
    }

    return 0;
}
```

OUTPUT



```
/tmp/2suN9LMv9H.o
Enter a string to check: 1001010111
String contains substring 101.


=== Code Execution Successful ===
```



```
/tmp/xU1oc6aQnm.o
Enter a string to check: 110011100100011
String does not contain substring 101.


=== Code Execution Successful ===
```

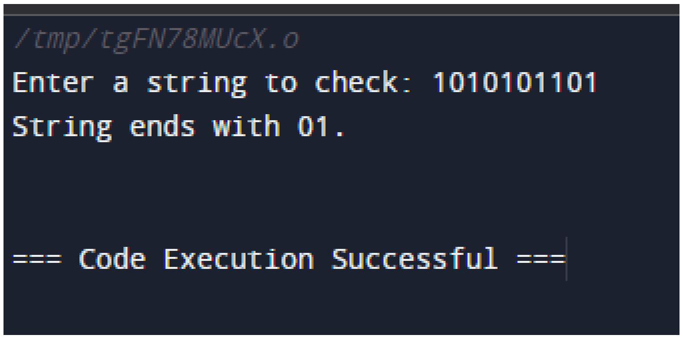
Lab No.: 6

TITLE: WRITE A PROGRAM TO CONSTRUCT NFA THAT ACCEPTS STRING ENDING WITH ‘01’

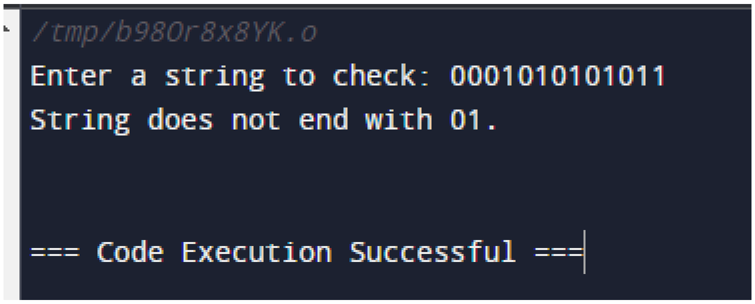
SOURCE CODE:

```
#include <iostream>
#include <vector>

using namespace std;

// Define the NFA as a set of states and transitions
vector<int> states = {0, 1, 2}; // States are represented by integers (0, 1, 2, ...)
vector<vector<pair<char, int>>> transitions = {
    {{'0', 0}, {'1', 0}, {'0', 1}},
    {{'1', 2}},
    {{}}}; // Transitions are represented by pairs of characters and states (character, state)

// Define a function to simulate the NFA on a given string
bool simulate_nfa(string input)
{
    // Start at the initial state (state 0)
    vector<int> current_states = {0};

    // Loop through each character in the input string
    for (char c : input)
    {
        // Find all possible transitions from the current states for the current character
        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 there are no possible transitions, the input string is not accepted
        if (next_states.empty())
        {
            return false;
        }
        // Update the current states to the next states
        current_states = next_states;
    }
    // If the final state is an accepting state, the input string is accepted
    for (int state : current_states)
    {
        if (state == 2)
        {
            return true;
        }
    }
    return false;
}

// Define the main function to run the program
int main()
{
    // Get input from the user
    string input;
    cout << "Enter a string to check: ";
    cin >> input;

    // Simulate the NFA on the input string and output the result
    if (simulate_nfa(input))
    {
        cout << "String ends with 01." << endl;
    }
    else
    {
        cout << "String does not end with 01." << endl;
    }

    return 0;
}
```

OUTPUT



```
/tmp/tgFN78MUcX.o
Enter a string to check: 1010101101
String ends with 01.


=== Code Execution Successful ===
```



```
/tmp/b98Or8x8YK.o
Enter a string to check: 0001010101011
String does not end with 01.


=== Code Execution Successful ===
```

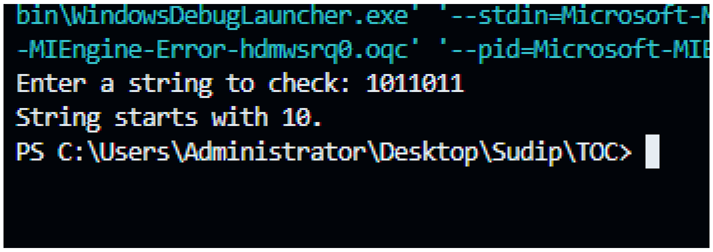
Lab No.: 7

TITLE: WAP TO CONSTRUCT A NFA THAT ACCEPTS STRINGS STARTING WITH ‘10’.

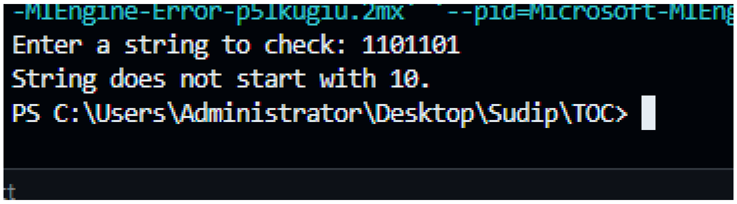
SOURCE CODE:

```
#include <iostream>
#include <vector>

using namespace std;

// Define the NFA as a set of states and transitions
vector<int> states = {0, 1, 2}; // States are represented by integers (0, 1, 2, 3, ...)
vector<vector<pair<char, int>>> transitions = {
    {{'1', 1}},
    {{'0', 2}},
    {{'0', 2}, {'1', 2}},
    {{}}}; // Transitions are represented by pairs of characters and states (character, state)

I
bool simulate_nfa(string input)
{
    // Start at the initial state (state 0)
    vector<int> current_states = {0};

    // Loop through each character in the input string
    for (char c : input)
    {
        // Find all possible transitions from the current states for the current character
        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 there are no possible transitions, the input string is not accepted
        if (next_states.empty())
        {
            return false;
        }
        // Update the current states to the next states
        current_states = next_states;
    }
    // If the final state is an accepting state, the input string is accepted
    for (int state : current_states)
    {
        if (state == 2)
        {
            return true;
        }
    }
    return false;
}

// Define the main function to run the program
int main()
{
    // Get input from the user
    string input;
    cout << "Enter a string to check: ";
    cin >> input;

    // Simulate the NFA on the input string and output the result
    if (simulate_nfa(input))
    {
        cout << "String starts with 10." << endl;
    }
    else
    {
        cout << "String does not start with 10." << endl;
    }

    return 0;
}
```

OUTPUT



```
bin\WindowsDebugLauncher.exe' '--stdin=Microsoft-M
-MIEngine-Error-hdmwsrq0.oqc' '--pid=Microsoft-MIE
Enter a string to check: 1011011
String starts with 10.
PS C:\Users\Administrator\Desktop\Sudip\TOC>
```



```
-MIEngine-Error-p5lkugiu.2mx' '--pid=Microsoft-MIEng
Enter a string to check: 1101101
String does not start with 10.
PS C:\Users\Administrator\Desktop\Sudip\TOC>
```

Lab No.: 8

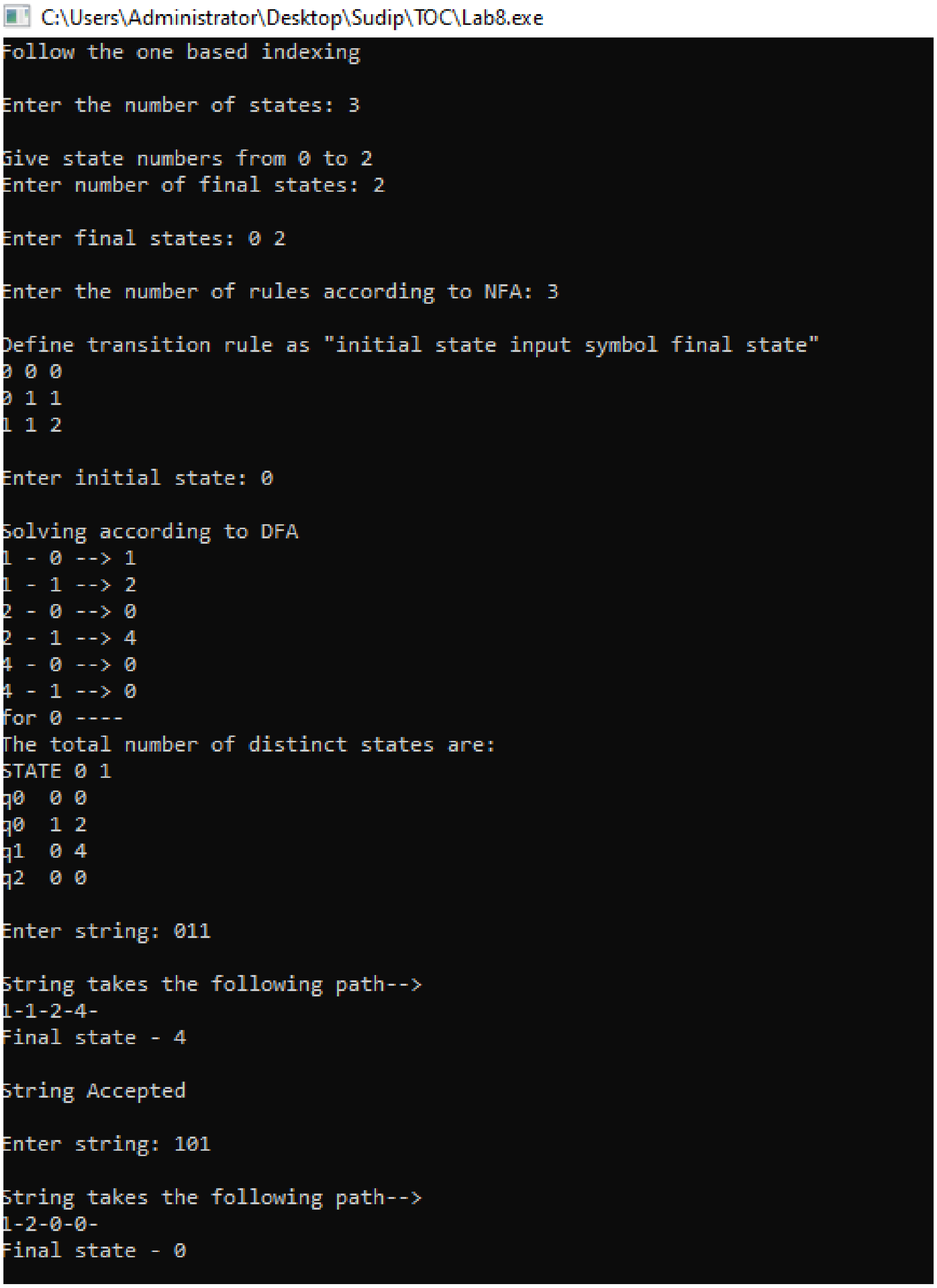
TITLE: PROGRAM TO CONVERT NFA TO DFA

PROGRAM CODE:

```
#include<stdio.h>
#include<string.h>
#include<math.h>

int ninputs;
int dfa[100][2][100] = {0};
int state[10000] = {0};
char ch[10], str[1000];
int go[10000][2] = {0};
int arr[10000] = {0};

int main() {
    int st, fin, in;
    int f[10];
    int i,j=3,s=0,final=0,flag=0,curr1,curr2,k,l;
    int c;
    printf("Follow the one based indexing\n");
    printf("\nEnter the number of states: ");
    scanf("%d", &st);
    printf("\nGive state numbers from 0 to %d", st - 1);
    for(i = 0; i < st; i++)
        state[(int)(pow(2, i))] = 1;

    printf("\nEnter number of final states: ");
    scanf("%d", &fin);

    printf("\nEnter final states: ");
    for(i = 0; i < fin; i++) {
        scanf("%d", &f[i]);
    }

    int p, q, r, rel;

    printf("\nEnter the number of rules according to NFA: ");
```

```
scanf("%d", &rel);
printf("\nDefine transition rule as \"initial state input symbol final state\"\n");

for(i = 0; i < rel; i++) {
    scanf("%d %d %d", &p, &q, &r);
    if (q == 0)
        dfa[p][0][r] = 1;
    else
        dfa[p][1][r] = 1;
}
printf("\nEnter initial state: ");
scanf("%d", &in);

in = pow(2, in);

i = 0;
printf("\nSolving according to DFA\n");
int x = 0;
for(i = 0; i < st; i++) {
    for(j = 0; j < 2; j++) {
        int stf = 0;
        for(k = 0; k < st; k++) {
            if(dfa[i][j][k] == 1)
                stf = stf + pow(2, k);
        }

        go[(int)(pow(2, i))][j] = stf;
        printf("%d - %d --> %d\n", (int)(pow(2, i)), j, stf);
        if(state[stf] == 0)
            arr[x++] = stf;
        state[stf] = 1;
    }
}
//for new states
for(i = 0; i < x; i++) {
    printf("for %d ---- ", arr[x]);
    for(j = 0; j < 2; j++) {
        int new = 0;
        for(k = 0; k < st; k++) {
            if(arr[i] & (1 << k)) {
                int h = pow(2, k);
                if(new == 0)
                    new = go[h][j];
                new = new | (go[h][j]);
            }
        }
        if(state[new] == 0) {
            arr[x++] = new;
            state[new] = 1;
        }
    }
}
printf("\nThe total number of distinct states are:\n");

printf("STATE 0 1\n");
for(i = 0; i < 10000; i++) {
    if(state[i] == 1) {
        int y = 0;
        if(i == 0)
            printf("q0 ");
        else
            for(j = 0; j < st; j++) {
                int x = 1 << j;
                if(x & i) {
                    printf("q%d ", j);
                    y = y + pow(2, j);
                }
            }
        printf(" %d %d", go[y][0], go[y][1]);
        printf("\n");
    }
}
j = 3;
while(j--) {
    printf("\nEnter string: ");
    scanf("%s", str);
    l = strlen(str);
    curr1 = in;
    flag = 0;
    printf("\nString takes the following path-->\n");
    printf("%d-", curr1);

    for(i = 0; i < l; i++) {
        curr1 = go[curr1][str[i] - '0'];
        printf("%d-", curr1);
    }
    printf("\nFinal state - %d\n", curr1);
    for(i = 0; i < fin; i++) {
        if(curr1 & (1 << f[i])) {
            flag = 1;
            break;
        }
        }
        if(flag)
            printf("\nString Accepted\n");
        else
            printf("\nString Rejected\n");
    }
    return 0;
}
```

OUTPUT



C:\Users\Administrator\Desktop\Sudip\TOC\Lab8.exe

```
Follow the one based indexing

Enter the number of states: 3

Give state numbers from 0 to 2
Enter number of final states: 2

Enter final states: 0 2

Enter the number of rules according to NFA: 3

Define transition rule as "initial state input symbol final state"
0 0 0
0 1 1
1 1 2

Enter initial state: 0

Solving according to DFA
1 - 0 --> 1
1 - 1 --> 2
2 - 0 --> 0
2 - 1 --> 4
4 - 0 --> 0
4 - 1 --> 0
for 0 ----
The total number of distinct states are:
STATE 0 1
q0  0 0
q0  1 2
q1  0 4
q2  0 0

Enter string: 011

String takes the following path-->
1-1-2-4-
Final state - 4

String Accepted

Enter string: 101

String takes the following path-->
1-2-0-0-
Final state - 0
```

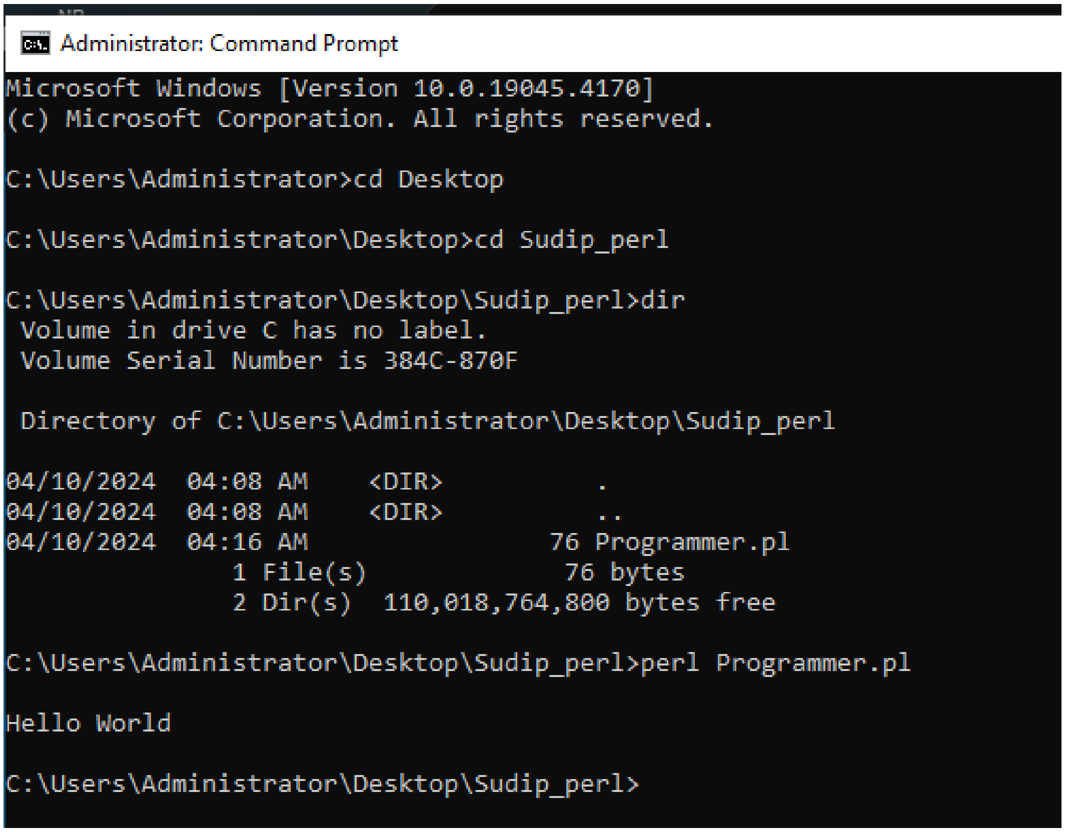
Lab No.: 9

TITLE:INTRODUCTION TO PERL PROGRAMMING LANGUAGE

INTRODUCTIONS:

Perl is a highly capable and feature-rich programming language that has been developed for over 36 years. It is a general-purpose language that supports both procedural and object-oriented programming paradigms. Perl is known for its extensive library of over 25,000 extension modules and a large developer community. It is widely used for a variety of tasks, including system administration, web development, network programming, and more.

```
# my first program
print "\nHello World\n";
```



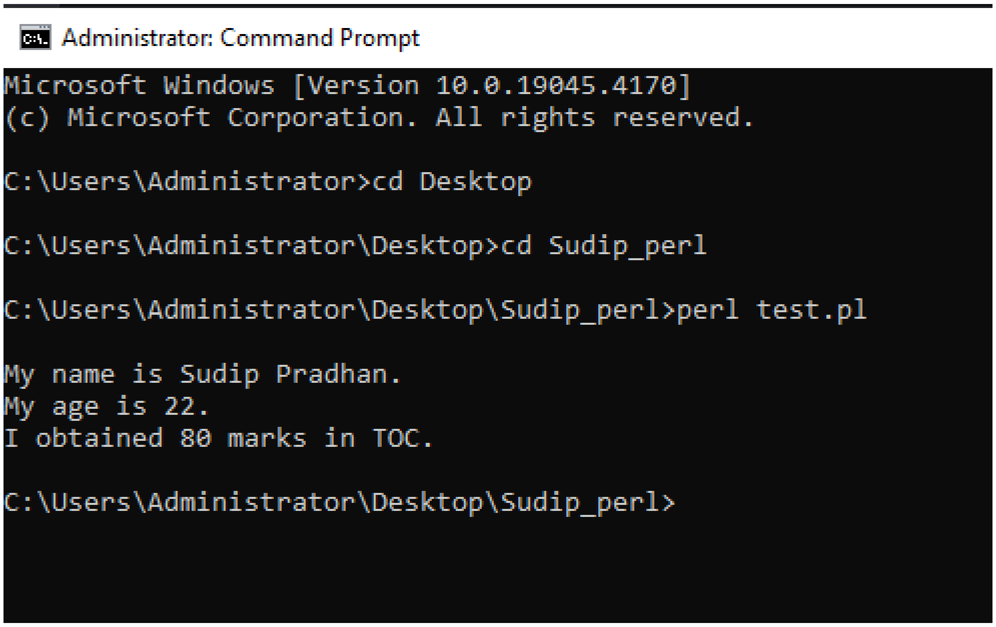
Administrator: Command Prompt

```
Microsoft Windows [Version 10.0.19045.4170]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Administrator>cd Desktop

C:\Users\Administrator\Desktop>cd Sudip_perl

C:\Users\Administrator\Desktop\Sudip_perl>dir
 Volume in drive C has no label.
 Volume Serial Number is 384C-870F

 Directory of C:\Users\Administrator\Desktop\Sudip_perl

04/10/2024  04:08 AM    <DIR>          .
04/10/2024  04:08 AM    <DIR>          ..
04/10/2024  04:16 AM                76 Programmer.pl
               1 File(s)             76 bytes
               2 Dir(s)  110,018,764,800 bytes free

C:\Users\Administrator\Desktop\Sudip_perl>perl Programmer.pl

Hello World

C:\Users\Administrator\Desktop\Sudip_perl>
```

# variables in Perl

```
my $age = 22;                  # integer
my $name = "Sudip Pradhan";        # string
my $marks = 80;                     # floating point

print "\nMy name is $name.\n";
print "My age is $age.\n";
print "I obtained $marks marks in TOC.\n";
```

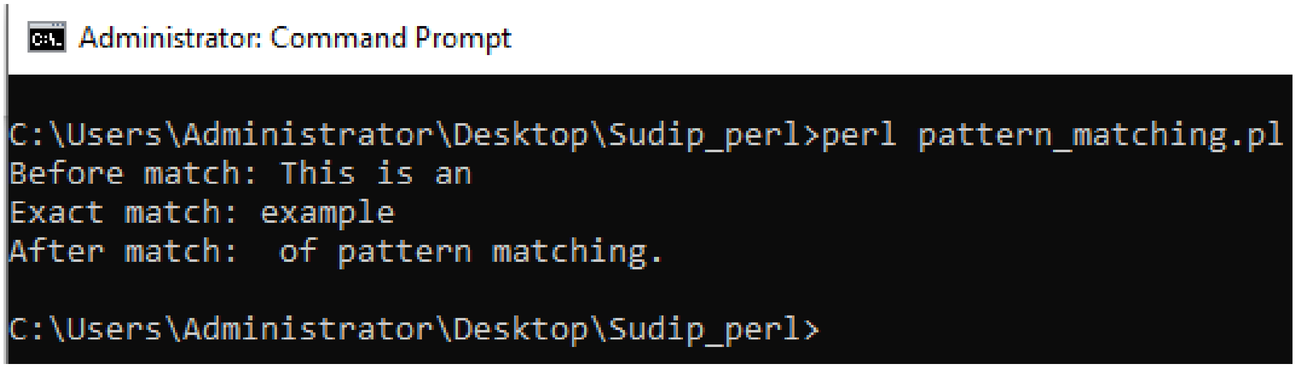
<u>OUTPUT:</u>



```
Microsoft Windows [Version 10.0.19045.4170]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Administrator>cd Desktop

C:\Users\Administrator\Desktop>cd Sudip_perl

C:\Users\Administrator\Desktop\Sudip_perl>perl test.pl

My name is Sudip Pradhan.
My age is 22.
I obtained 80 marks in TOC.

C:\Users\Administrator\Desktop\Sudip_perl>
```

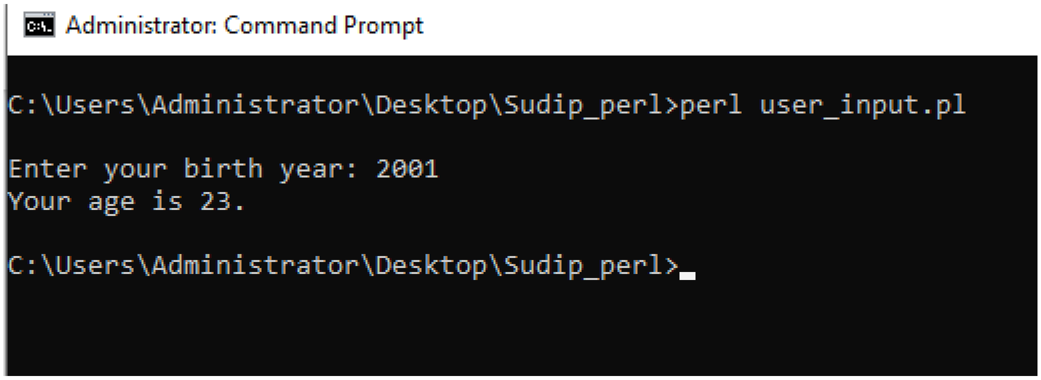
# example of pattern matching

```
$string = "This is an example of pattern matching.";
$string =~ m/example/; # binding operator

print "Before match: $`\n"; # string preceding a successful pattern match
print "Exact match: $&\n"; # substring that matched the pattern
print "After match: $'\n" # string after the successful pattern match
```



```
C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_matching.pl
Before match: This is an
Exact match: example
After match:  of pattern matching.

C:\Users\Administrator\Desktop\Sudip_perl>
```

```
# example of user input

print "\nEnter your birth year: ";
$year = <STDIN>;
$age = 2024 - $year;

print "Your age is $age.\n"
```



```
C:\Users\Administrator\Desktop\Sudip_perl>perl user_input.pl

Enter your birth year: 2001
Your age is 23.

C:\Users\Administrator\Desktop\Sudip_perl>
```

Lab No.: 10

TITLE: USE LIBRARY TOOLS LIKE NLTK TO SPLIT THE WORDS OF A SENTENCE

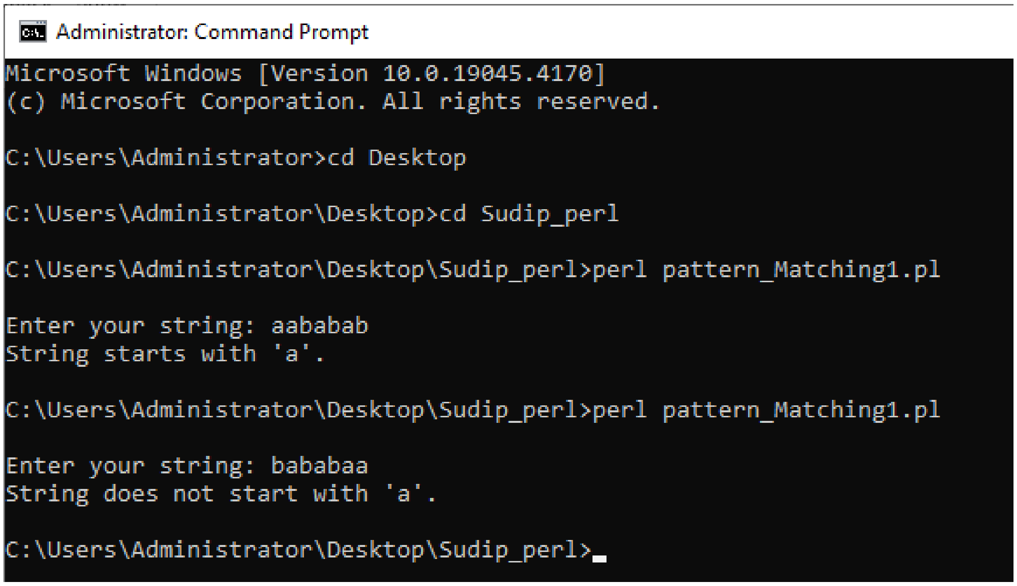
. LAB 10: Perl Programs to accept strings:

6. **starting with ‘a’.**
7. **starting with ‘a’ and ending with ‘b’.**
8. **having substring ‘101’.**
9. **of the form $a^n b^n$.**
10. **of the form $a^n b^{2n}$.**

1. starting with ‘a’.

```
# accept strings starting with a

print "\nEnter your string: ";
$string = <STDIN>;
if($string =~ /^a/){
        print "String starts with 'a'.\n"
} else {
        print "String does not start with 'a'.\n"
}
```

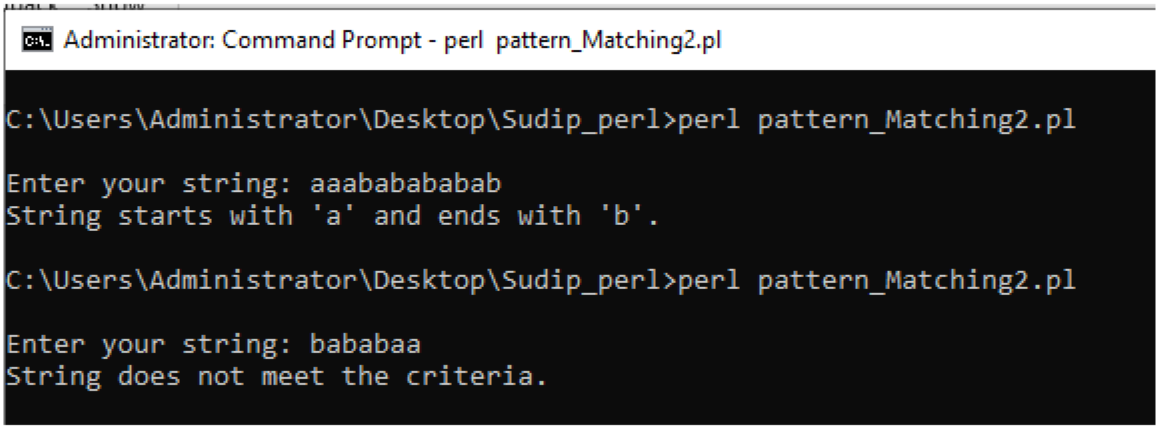
OUTPUT



```
Microsoft Windows [Version 10.0.19045.4170]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Administrator>cd Desktop

C:\Users\Administrator\Desktop>cd Sudip_perl

C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching1.pl

Enter your string: aababab
String starts with 'a'.

C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching1.pl

Enter your string: bababaa
String does not start with 'a'.

C:\Users\Administrator\Desktop\Sudip_perl>_
```

2. starting with ‘a’ and ending with ‘b’.

```
# accept strings starting with a and ending with b
print "\nEnter your string: ";
$string = <STDIN>;
if($string =~ /^a.*b/){
        print "String starts with 'a' and ends with 'b'.\n"
} else {
        print "String does not meet the criteria.\n"
}
```

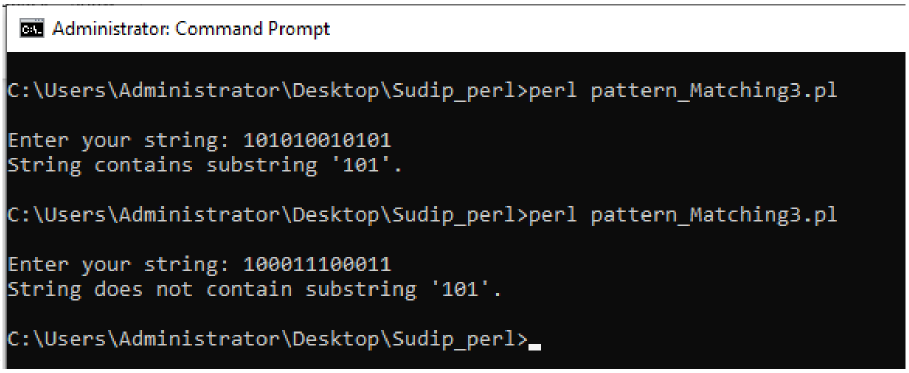


Administrator: Command Prompt - perl pattern_Matching2.pl

```
C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching2.pl

Enter your string: aaabababab
String starts with 'a' and ends with 'b'.

C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching2.pl

Enter your string: bababaa
String does not meet the criteria.
```

3. having substring ‘101’.

```
# accept strings having substring 101
print "\nEnter your string: ";
$string = <STDIN>;
if($string =~ /.*101.*/){
        print "String contains substring '101'.\n"
} else {
        print "String does not contain substring '101'.\n"
```



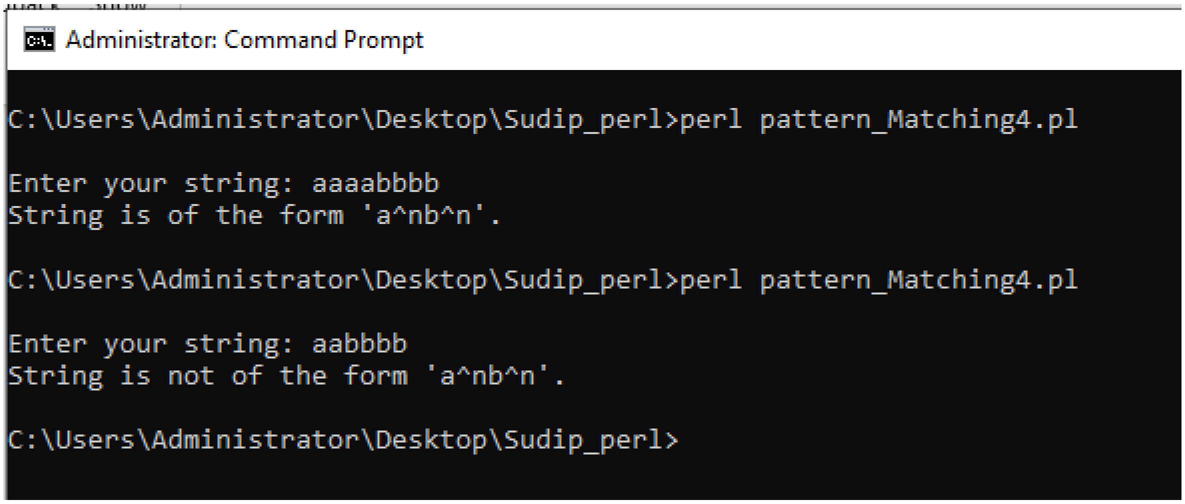
Administrator: Command Prompt

```
C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching3.pl

Enter your string: 101010010101
String contains substring '101'.

C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching3.pl

Enter your string: 100011100011
String does not contain substring '101'.

C:\Users\Administrator\Desktop\Sudip_perl>
```

```
}
```

4. of the form $a^n b^n$.

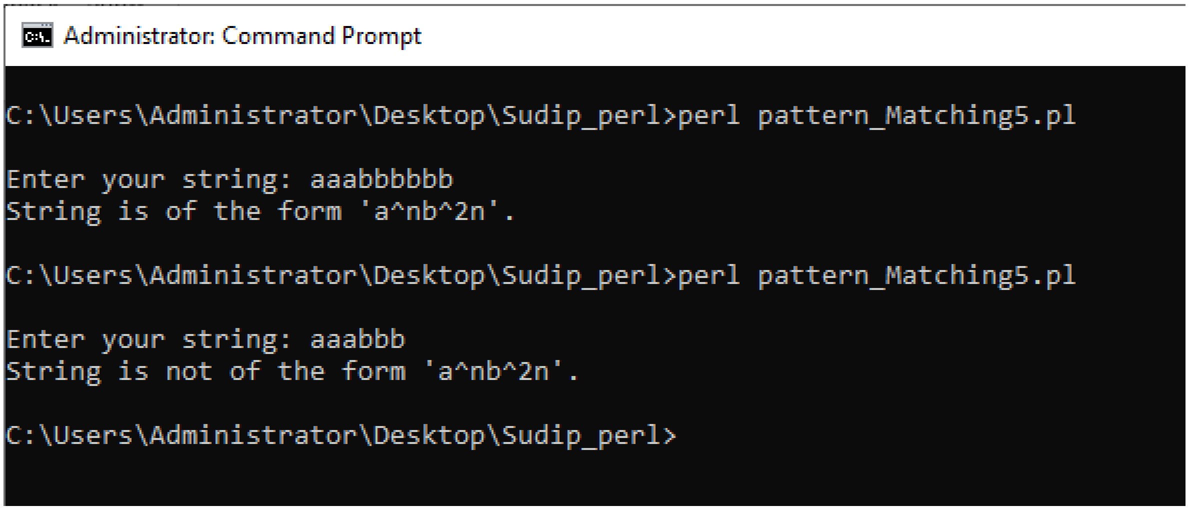
```
# accept strings of the form a^nb^n

print "\nEnter your string: ";
$string = <STDIN>;
if($string =~ /^(a(?1)?b)$/){
        print "String is of the form 'a^nb^n'.\n"
} else {
        print "String is not of the form 'a^nb^n'.\n"
}
```



```
C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching4.pl

Enter your string: aaaabbbb
String is of the form 'a^nb^n'.

C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching4.pl

Enter your string: aabbbb
String is not of the form 'a^nb^n'.

C:\Users\Administrator\Desktop\Sudip_perl>
```

5. of the form $a^n b^{2n}$.

```
# accept strings of the form a^nb^2n

print "\nEnter your string: ";
$string = <STDIN>;
if($string =~ /^(a(?1)?bb)$/){
        print "String is of the form 'a^nb^2n'.\n"
} else {
        print "String is not of the form 'a^nb^2n'.\n"
}
```



```
C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching5.pl

Enter your string: aaabbbbbb
String is of the form 'a^nb^2n'.

C:\Users\Administrator\Desktop\Sudip_perl>perl pattern_Matching5.pl

Enter your string: aaabbb
String is not of the form 'a^nb^2n'.

C:\Users\Administrator\Desktop\Sudip_perl>
```

THE END