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EXP NO : 3

FINDING ε-CLOSURE FOR NFA WITH ε-MOVES

AIM :

To write a C program to find ε-closure of a Non-Deterministic Finite

Automata with ε-moves

ALGORTIHM :

1. Get the following as input from the user.

i. Number of states in the NFA

ii. Number of symbols in the input alphabet including ε

iii. Input symbols

iv. Number of final states and their names

2. Declare a 3-dimensional matrix to store the transitions and initialize

all the entries with -1

3. Get the transitions from every state for every input symbol from the

user and store it in the matrix.

For example, consider the NFA shown below.

There are 3 states 0, 1, and 2

There are three input symbols ε, 0 and 1. As the array index always

starts with 0, we assume 0th symbol is ε, 1st symbol is 0 and 2nd

symbol is 1.

The transitions will be stored in the matrix as follows:

From state 0, for input ε, there is one transition to state 1, which can

be stored in the matrix as

m[0][0][0]=1

From state 0, for input 0, there is no transition.

From state 0, for input 1, there is one transition to state 1, whichcan

be stored in the matrix as

m[0][2][0]=1

Similarly, the other transitions can be stored as follows:

m[1][0][0]=2 (From state 1, for input ε, the transition is to state 2)

m[1][1][0]=1 (From state 1, for input 0, the transition is to state 1)

All the other entries in the matrix will be -1 indicating no moves

4. Initialize a two-dimensional matrix e_closure with -1 in all the

entries.

5. ε-closure of a state q is defined as the set of all states that can be

reached from state q using only ε-transitions.

Example:

Consider the NFA with ε-transitions given below:

ε-closure(0)={0,1,2)

ε-closure(1)={1,2}

ε-closure(2)={2}

Here, we see that ε-closure of every state contains that state first. So

initialize the first entry of the array e_closure with the same state.

e_closure(0,0)=0;

e_closure(1,0)=1;

e_closure(2,0)=2;

6. For every state i, find ε-closure as follows:

If there is an ε-transition from state i to state j, add j to the matrix

e_closure[i]. Call the recursive function find_e_closure(j) and add

the other states that are reachable from i using ε

7. For every state, print the ε-closure values

The function find_e_closure(i)

This function finds ε-closure of a state recursively by tracing all the εtransitions

PROGRAM :

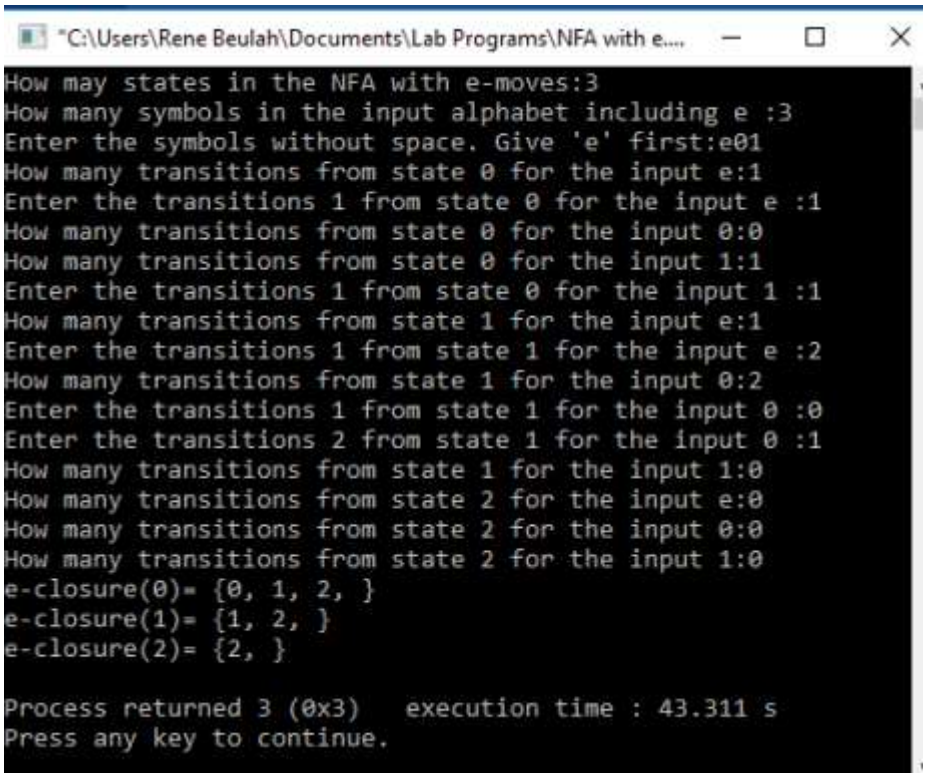
```
#include<stdio.h>
#include<string.h>
int trans_table[10][5][3];
char symbol[5],a;
int e_closure[10][10],ptr,state;
void find_e_closure(int x);
int main()
{
int i,j,k,n,num_states,num_symbols;
for(i=0;i<10;i++)
{
for(j=0;j<5;j++)
{
for(k=0;k<3;k++)
{
trans_table[i][j][k]=-1;
}
}
}
printf("How may 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:



RESULT: Therefore finding the epsilon closure of a non deterministic finite automata with epsilon moves.