**Cycle 1**

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**Question 2**

Write program to convert NFA with ε transition to NFA without ε transition.

**Program**

#include<stdio.h>

#include<stdlib.h>

struct node

{

int st;

struct node \*link;

};

void findclosure(int,int);

void insert\_trantbl(int ,char, int);

int findalpha(char);

void findfinalstate(void);

void unionclosure(int);

void print\_e\_closure(int);

static int set[20],nostate,noalpha,s,notransition,nofinal,start,finalstate[20],c,r,buffer[20];

char alphabet[20];

static int e\_closure[20][20]={0};

struct node \* transition[20][20]={NULL};

void main()

{

int i,j,k,m,t,n;

struct node \*temp;

printf("enter the number of alphabets?\n");

scanf("%d",&noalpha);

getchar();

printf("NOTE:- [ use letter e as epsilon]\n");

printf("NOTE:- [e must be last character ,if it is present]\n");

printf("\nEnter alphabets?\n");

for(i=0;i<noalpha;i++)

{

alphabet[i]=getchar();

getchar();

}

printf("Enter the number of states?\n");

scanf("%d",&nostate);

printf("Enter the start state?\n");

scanf("%d",&start);

printf("Enter the number of final states?\n");

scanf("%d",&nofinal);

printf("Enter the final states?\n");

for(i=0;i<nofinal;i++)

scanf("%d",&finalstate[i]);

printf("Enter no of transition?\n");

scanf("%d",&notransition);

printf("NOTE:- [Transition is in the form--> qno alphabet qno]\n",notransition);

printf("NOTE:- [States number must be greater than zero]\n");

printf("\nEnter transition?\n");

for(i=0;i<notransition;i++)

{

scanf("%d %c%d",&r,&c,&s);

insert\_trantbl(r,c,s);

}

printf("\n");

for(i=1;i<=nostate;i++)

{

c=0;

for(j=0;j<20;j++)

{

buffer[j]=0;

e\_closure[i][j]=0;

}

findclosure(i,i);

}

printf("Equivalent NFA without epsilon\n");

printf("-----------------------------------\n");

printf("start state:");

print\_e\_closure(start);

printf("\nAlphabets:");

for(i=0;i<noalpha;i++)

printf("%c ",alphabet[i]);

printf("\n States :" );

for(i=1;i<=nostate;i++)

print\_e\_closure(i);

printf("\nTnransitions are...:\n");

for(i=1;i<=nostate;i++)

{

for(j=0;j<noalpha-1;j++)

{

for(m=1;m<=nostate;m++)

set[m]=0;

for(k=0;e\_closure[i][k]!=0;k++)

{

t=e\_closure[i][k];

temp=transition[t][j];

while(temp!=NULL)

{

unionclosure(temp->st);

temp=temp->link;

}

}

printf("\n");

print\_e\_closure(i);

printf("%c\t",alphabet[j] );

printf("{");

for(n=1;n<=nostate;n++)

{

if(set[n]!=0)

printf("q%d,",n);

}

printf("}");

}

}

printf("\n Final states:");

findfinalstate();

}

void findclosure(int x,int sta)

{

struct node \*temp;

int i;

if(buffer[x])

return;

e\_closure[sta][c++]=x;

buffer[x]=1;

if(alphabet[noalpha-1]=='e' && transition[x][noalpha-1]!=NULL)

{

temp=transition[x][noalpha-1];

while(temp!=NULL)

{

findclosure(temp->st,sta);

temp=temp->link;

}

}

}

void insert\_trantbl(int r,char c,int s)

{

int j;

struct node \*temp;

j=findalpha(c);

if(j==999)

{

printf("error\n");

exit(0);

}

temp=(struct node \*) malloc(sizeof(struct node));

temp->st=s;

temp->link=transition[r][j];

transition[r][j]=temp;

}

int findalpha(char c)

{

int i;

for(i=0;i<noalpha;i++)

if(alphabet[i]==c)

return i;

return(999);

}

void unionclosure(int i)

{

int j=0,k;

while(e\_closure[i][j]!=0)

{

k=e\_closure[i][j];

set[k]=1;

j++;

}

}

void findfinalstate()

{

int i,j,k,t;

for(i=0;i<nofinal;i++)

{

for(j=1;j<=nostate;j++)

{

for(k=0;e\_closure[j][k]!=0;k++)

{

if(e\_closure[j][k]==finalstate[i])

{

print\_e\_closure(j);

}

}

}

}

}

void print\_e\_closure(int i)

{

int j;

printf("{");

for(j=0;e\_closure[i][j]!=0;j++)

printf("q%d,",e\_closure[i][j]);

printf("}\t");

}

**Output :**

**Text

Description automatically generated**