Compiler Design Practical 3

NFA To DFA

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Section: M2

Experiment 3- NFA to DFA

Aim

Write a program to covert Non-Deterministic Finite Automata to Deterministic Finite Automata.

Algorithm

- Get the input from the user
- Set the only state in SDFA to “unmarked”.
- While SDFA contains an unmarked state do:
    - Let T be that unmarked state
    - for each a in % do S = e-Closure(MoveNFA(T,a))
    - if S is not in SDFA already then, add S to SDFA (as an “unmarked” state)
    - Set MoveDFA(T,a) to S
- For each S in SDFA if any s & S is a final state in the NFA then, mark S an a final
- state in the DFA
- Print the result.

Program

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

struct node
{
 int st;
 struct node *link;
};
struct node1
{

 int nst[20];
};

void insert(int ,char, int);
int findalpha(char);
void findfinalstate(void);
int insertdfastate(struct node1);
int compare(struct node1,struct node1);
void printnewstate(struct node1);

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

```c
int complete=-1;
char alphabet[20];
static int eclosure[20][20]={0};
struct node1 hash[20];
struct node * transition[20][20]={NULL};

int main()
{
    int i,j,k,m,t,n,l;
    struct node *temp;
    struct node1 newstate={0},tmpstate={0};


    printf("\nEnter No of alphabets and alphabets?\n");
    scanf("%d",&noalpha);
    getchar();
    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(r,c,s);

    }
    for(i=0;i<20;i++)
```

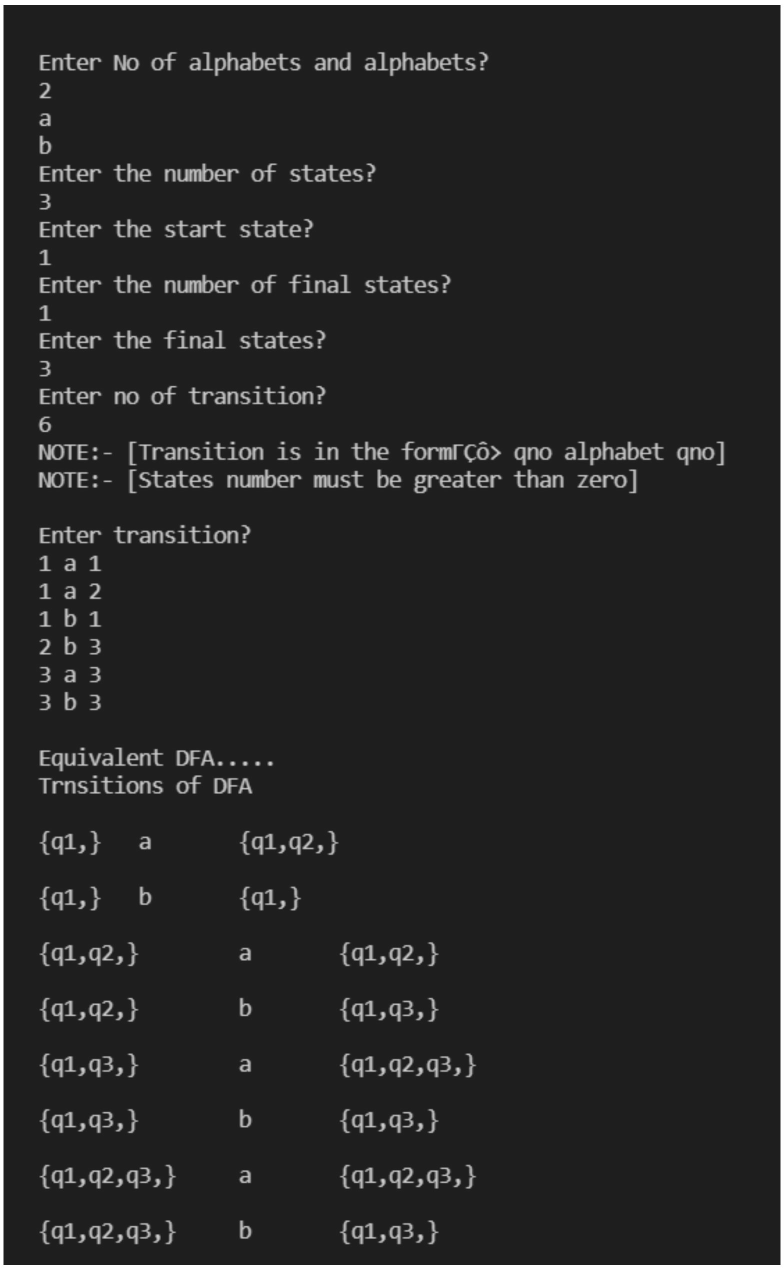
```
{
for(j=0;j<20;j++)
hash[i].nst[j]=0;
}
complete=-1;
i=-1;
printf("\nEquivalent DFA.....\n");
printf("Trnsitions of DFA\n");

newstate.nst[start]=start;
insertdfastate(newstate);
while(i!=complete)
{
i++;
newstate=hash[i];
for(k=0;k<noalpha;k++)
{
c=0;
for(j=1;j<=nostate;j++)
set[j]=0;
for(j=1;j<=nostate;j++)
{
    l=newstate.nst[j];
    if(l!=0)
    {
    temp=transition[l][k];
    while(temp!=NULL)
    {
    if(set[temp->st]==0)
    {
    c++;
    set[temp->st]=temp->st;
    }
    temp=temp->link;


    }
    }
}
printf("\n");
if(c!=0)
{
    for(m=1;m<=nostate;m++)
    tmpstate.nst[m]=set[m];

    insertdfastate(tmpstate);

    printnewstate(newstate);
    printf("%c\t",alphabet[k]);
```

```
        printnewstate(tmpstate);
        printf("\n");
    }
    else
    {
        printnewstate(newstate);
        printf("%c\t", alphabet[k]);
        printf("NULL\n");
    }

    }
    }
    printf("\nStates of DFA:\n");
    for(i=0;i<=complete;i++)
    printnewstate(hash[i]);
    printf("\n Alphabets:\n");
    for(i=0;i<noalpha;i++)
    printf("%c\t",alphabet[i]);
    printf("\n Start State:\n");
    printf("q%d",start);
    printf("\nFinal states:\n");
    findfinalstate();

     return 0;

}
int insertdfastate(struct node1 newstate)
{
 int i;
 for(i=0;i<=complete;i++)
 {
  if(compare(hash[i],newstate))
   return 0;
 }
 complete++;
 hash[complete]=newstate;
 return 1;
}
int compare(struct node1 a,struct node1 b)
{
 int i;


  for(i=1;i<=nostate;i++)
  {
   if(a.nst[i]!=b.nst[i])
    return 0;
  }
  return 1;
```

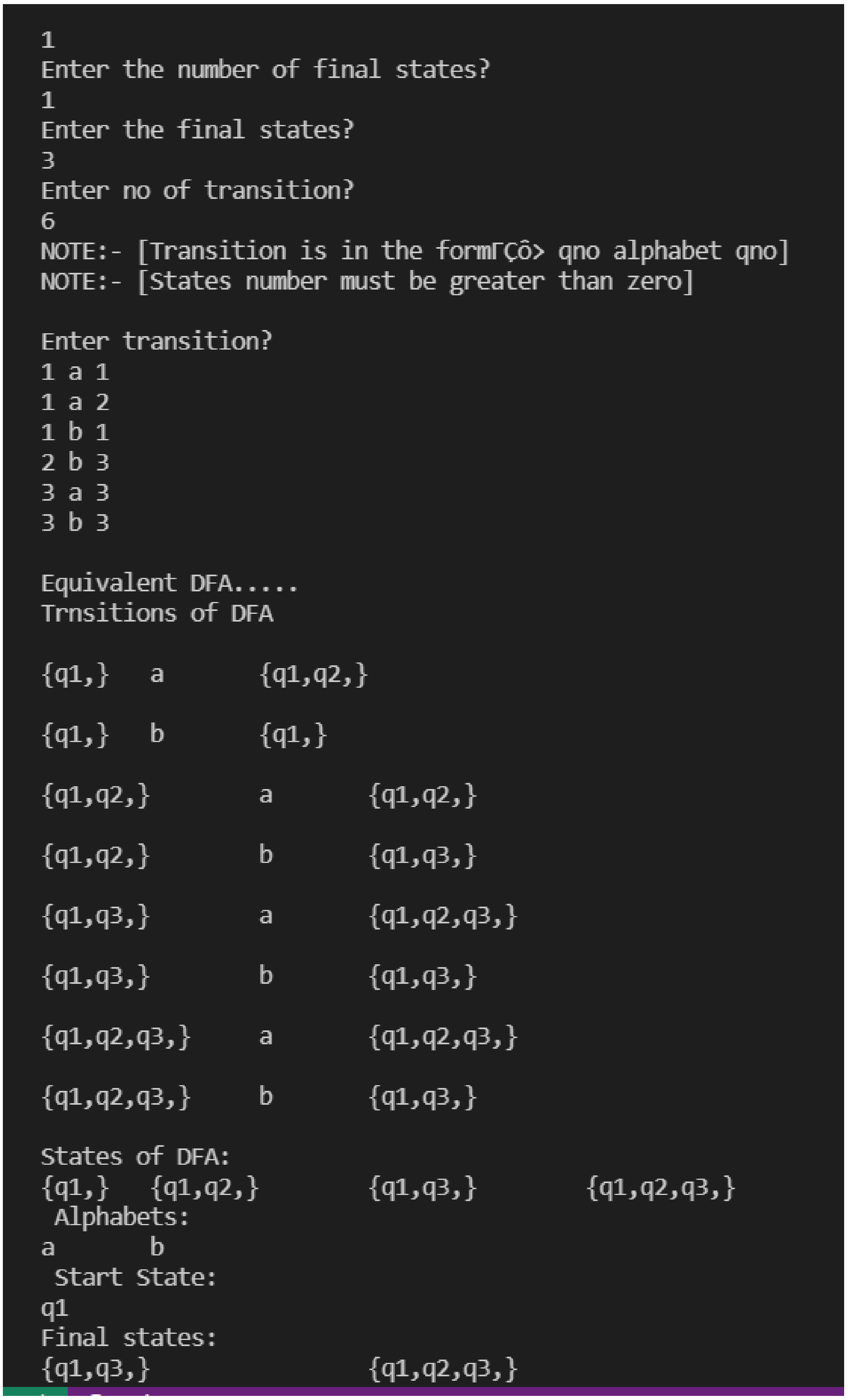
```c
}

void insert(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 findfinalstate()
{
 int i,j,k,t;

 for(i=0;i<=complete;i++)
 {
  for(j=1;j<=nostate;j++)
  {
   for(k=0;k<nofinal;k++)
   {
    if(hash[i].nst[j]==finalstate[k])
    {
     printnewstate(hash[i]);
     printf("\t");
     j=nostate;
     break;
    }}}}}
```

```c
void printnewstate(struct node1 state)
{
 int j;
 printf("{");
  for(j=1;j<=nostate;j++)
  {
   if(state.nst[j]!=0)
    printf("q%d,",state.nst[j]);
  }
  printf("}\t");

}
```

Output



```
Enter No of alphabets and alphabets?
2
a
b
Enter the number of states?
3
Enter the start state?
1
Enter the number of final states?
1
Enter the final states?
3
Enter no of transition?
6
NOTE:- [Transition is in the formΓÇô> qno alphabet qno]
NOTE:- [States number must be greater than zero]

Enter transition?
1 a 1
1 a 2
1 b 1
2 b 3
3 a 3
3 b 3

Equivalent DFA.....
Trnsitions of DFA

{q1,}   a       {q1,q2,}

{q1,}   b       {q1,}

{q1,q2,}        a       {q1,q2,}

{q1,q2,}        b       {q1,q3,}

{q1,q3,}        a       {q1,q2,q3,}

{q1,q3,}        b       {q1,q3,}

{q1,q2,q3,}     a       {q1,q2,q3,}

{q1,q2,q3,}     b       {q1,q3,}
```



```
1
Enter the number of final states?
1
Enter the final states?
3
Enter no of transition?
6
NOTE:- [Transition is in the formΓÇô> qno alphabet qno]
NOTE:- [States number must be greater than zero]

Enter transition?
1 a 1
1 a 2
1 b 1
2 b 3
3 a 3
3 b 3

Equivalent DFA.....
Trnsitions of DFA

{q1,}   a       {q1,q2,}

{q1,}   b       {q1,}

{q1,q2,}        a       {q1,q2,}

{q1,q2,}        b       {q1,q3,}

{q1,q3,}        a       {q1,q2,q3,}

{q1,q3,}        b       {q1,q3,}

{q1,q2,q3,}     a       {q1,q2,q3,}

{q1,q2,q3,}     b       {q1,q3,}

States of DFA:
{q1,}   {q1,q2,}        {q1,q3,}        {q1,q2,q3,}
 Alphabets:
a       b
 Start State:
q1
Final states:
{q1,q3,}                {q1,q2,q3,}
```