# Cycle 1

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## Question 2

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

## Program

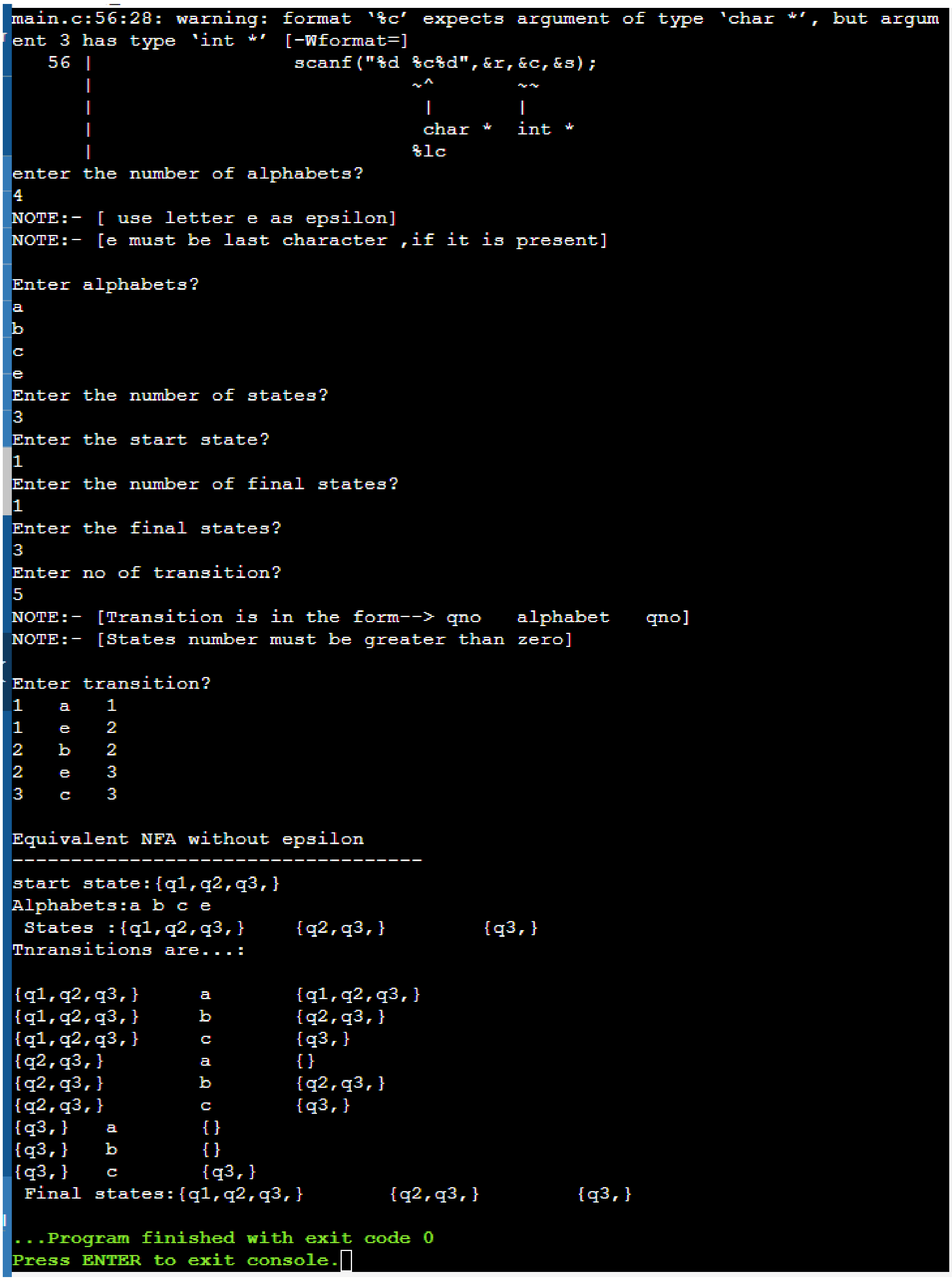
```
#include<stdio.h>
#include<stdlib.h>
struct node
{
	int st;
	struct node *link;
};

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 :**



```
main.c:56:28: warning: format ‘%c’ expects argument of type ‘char *’, but argum
ent 3 has type ‘int *’ [-Wformat=]
   56 |                   scanf("%d %c%d",&r,&c,&s);
      |                                  ~^        ~~
      |                                   |         |
      |                                   char *    int *
      |                                  %lc
enter the number of alphabets?
4
NOTE:- [ use letter e as epsilon]
NOTE:- [e must be last character ,if it is present]

Enter alphabets?
a
b
c
e
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?
5
NOTE:- [Transition is in the form--> qno   alphabet   qno]
NOTE:- [States number must be greater than zero]

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

Equivalent NFA without epsilon
-----------------------------------
start state:{q1,q2,q3,}
Alphabets:a b c e
 States :{q1,q2,q3,}    {q2,q3,}        {q3,}
Tnransitions are...:

{q1,q2,q3,}     a       {q1,q2,q3,}
{q1,q2,q3,}     b       {q2,q3,}
{q1,q2,q3,}     c       {q3,}
{q2,q3,}        a       {}
{q2,q3,}        b       {q2,q3,}
{q2,q3,}        c       {q3,}
{q3,}   a       {}
{q3,}   b       {}
{q3,}   c       {q3,}
 Final states:{q1,q2,q3,}       {q2,q3,}        {q3,}

...Program finished with exit code 0
Press ENTER to exit console.
```