Aim : 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");
```

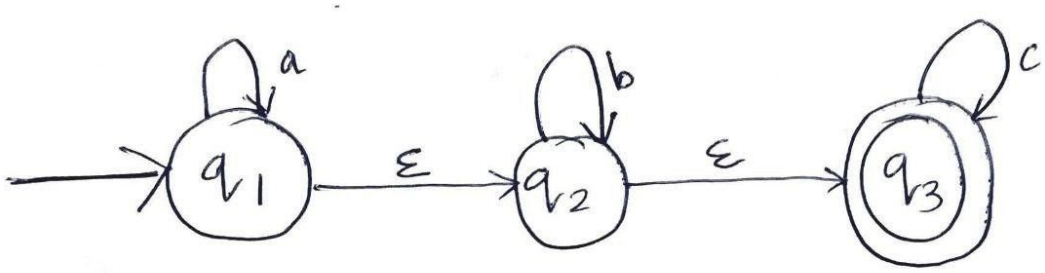
```
scanf("%d",&start);
printf("Enter the number of final states?\n");
scanf("%d",&nofinal);
printf("Enter the final states?\n");
for(i=0;i<nofinal;i++)
        scanf("%d",&finalstate[i]);
 printf("Enter no of transition?\n");
scanf("%d",&notransition);
printf("NOTE:- [Transition is in the form--> qno   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);
```

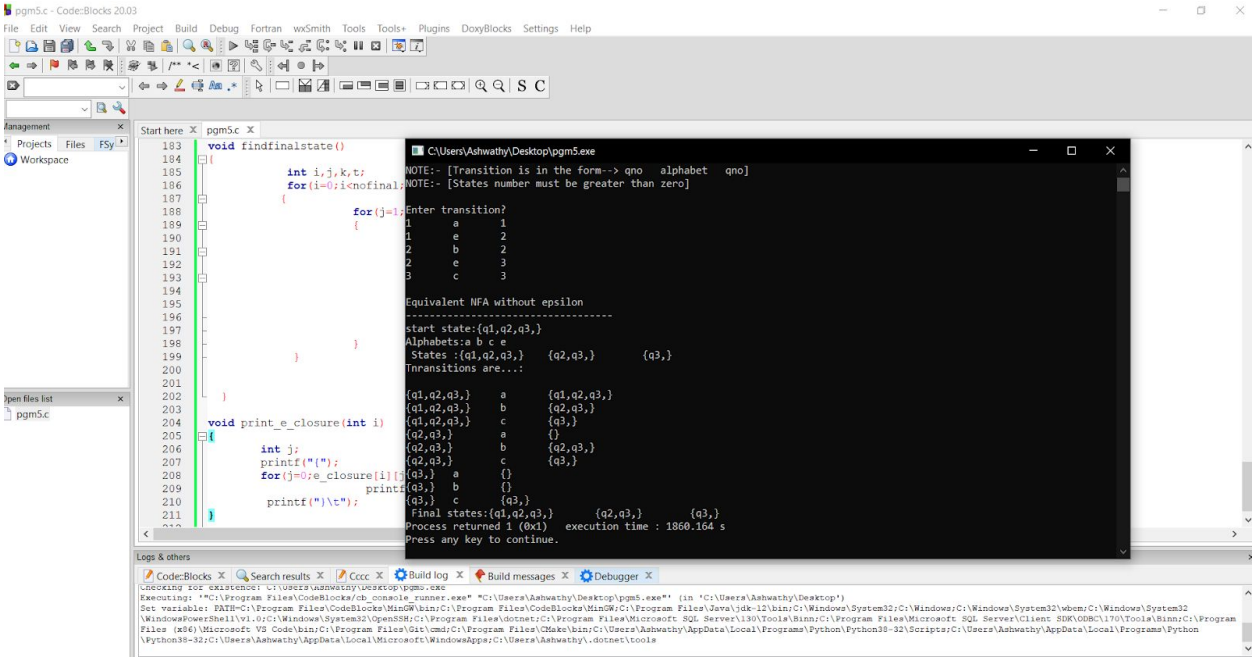
```
        printf("\nTnransitions are...:\n");

        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


a
b
c
ε
ε
q1
q2
q3


pgm5.c - Code::Blocks 20.03
File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help
Start here
pgm5.c
Projects
Files
Workspace
Open files list
pgm5.c
void findfinalstate()
int i,j,k,t;
for(i=0;i<nofinal;
for(j=1;
void print_e_closure(int i)
int j;
printf("{");
printf(")\t");
C:\Users\Ashwathy\Desktop\pgm5.exe
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,}
Process returned 1 (0x1) execution time : 1860.164 s
Press any key to continue.
Logs & others
Code::Blocks
Search results
Cccc
Build log
Build messages
Debugger