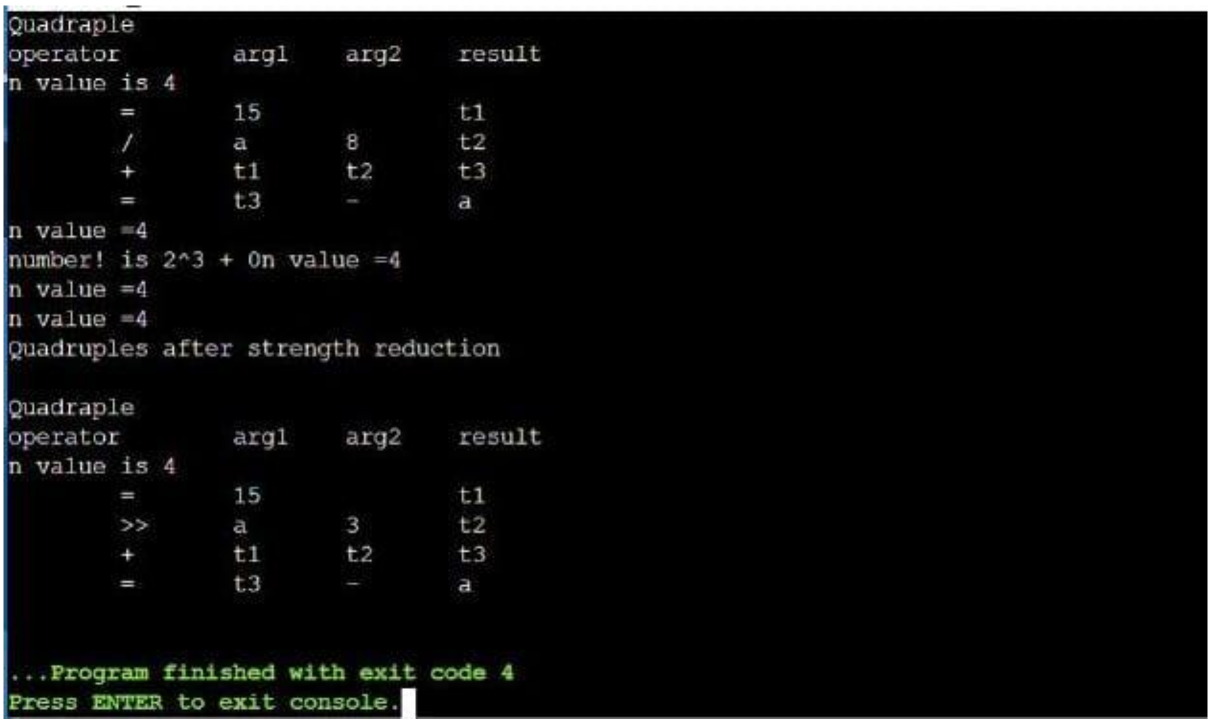
Lab 9: Write a program for code optimization.

```
#include<stdio.h>
#include<math.h>
#include<string.h>
# include<ctype.h>
#include<stdlib.h>

struct quad
 {
            char ope[5];
            char arg1[5];
            char arg2[5];
            char res[5];
 }QUAD[5];
int i=0,n,c=0;

void get()
{
            printf("\nEnter no of lines in a block");
            scanf("%d",&n);
            printf("enter ICG in form operator arg1 arg2 result:");
            for(i=0;i<n;i++)
            scanf("%s\n%s\n%s\n%s",&QUAD[i].ope,&QUAD[i].arg1,&QUAD[i].arg2,&QUAD[i].res);
}

void const_folding()
{
            int j,c1=0,d=0;
            char ch[5],ch1[5],num[10];
            int flag1 =1, flag2 =1;
                        for(i=0;i<n;i++)
            {
             flag1 =1;flag2 =1;
             for (j=0;j<strlen(QUAD[i].arg1);j++)
             {
               if(!isdigit(QUAD[i].arg1[j]))

               { flag1 = 0;printf("Operand1 is not contstant, Constant folding can not applied to quadruple
%d\n",i);
                 break;
               }

             }
              for (j=0;j<strlen(QUAD[i].arg2);j++)
             {
               if(!isdigit(QUAD[i].arg2[j]))

               { flag2 = 0; printf("Operand2 is not contstant, Constant folding can not applied to quadruple
%d\n",i);
                 break;
               }
             }
            if(flag1 == 1 && flag2 ==1)
            {
            c=atoi(QUAD[i].arg1);
            c1=atoi(QUAD[i].arg2);

            if(strcmp(QUAD[i].ope,"*")==0)
            {
                        d=c*c1;
                        //itoa(d,ch,10);
                        snprintf(ch, 10, "%d", d);
                        strcpy(QUAD[i].ope,"=");
                        strcpy(QUAD[i].arg1,ch);
                        strcpy(QUAD[i].arg2,"\0");
            }

            if(strcmp(QUAD[i].ope,"/")==0)
            {
                        d=c/c1;
                        //itoa(d,ch,10);
                        snprintf(ch, 10, "%d", d);
                        strcpy(QUAD[i].ope,"=");
                        strcpy(QUAD[i].arg1,ch);
                        strcpy(QUAD[i].arg2,"\0");
            }

            if(strcmp(QUAD[i].ope,"+")==0)
            {
                        d=c+c1;
                        //itoa(d,ch,10);
                        snprintf(ch, 10, "%d", d);
                        strcpy(QUAD[i].ope,"=");
                        strcpy(QUAD[i].arg1,ch);
                        strcpy(QUAD[i].arg2,"\0");
            }

            if(strcmp(QUAD[i].ope,"-")==0)
            {
                        d=c-c1;
                        //itoa(d,ch,10);
                        snprintf(ch, 10, "%d", d);
                        strcpy(QUAD[i].ope,"=");
                        strcpy(QUAD[i].arg1,ch);
                        strcpy(QUAD[i].arg2,"\0");
            }
            }
            }


}

void strength_reduction()
{
            int j=0,n1=0,m=0,c=0,tempo=0,t=0;
            char ch[5],cc[5],ct[2],pres[5];
```

```
int flag;
strcpy(ct,"s");
for(i=0;i<n;i++){
c=0;
if(strcmp(QUAD[i].ope,"*")==0||strcmp(QUAD[i].ope,"/")==0)
{   j = 1;
   if(strcmp(QUAD[i].ope,"*")==0)
   flag =0;
   else
   flag =1;
if((atoi(QUAD[i].arg2))>0)
            {
            m=atoi(QUAD[i].arg2);
            while(n1<=m)
                        {
                        n1=pow(2,j);
                        j++;
                        }
            j=j-2;
            n1=pow(2,j);
            c=m-n1;
            printf("number! is 2^%d + %d",j,c);
            if(c==0)
                        {
                        //itoa(j,ch,10);
                        snprintf(ch, 10, "%d", j);
                        if(flag==0)
                        strcpy(QUAD[i].ope,"<<");
                        else
                         strcpy(QUAD[i].ope,">>");
                  //    strcpy(QUAD[i].arg1,ch);
                        strcpy(QUAD[i].arg2,ch);
                  //    strcpy(QUAD[i].res,"t2");

                        }
            else

                        {
                        strcpy(pres,QUAD[i].res);
                        //itoa(j,ch,10);
                        snprintf(ch, 10, "%d", j);
                        if(flag==0)
                        strcpy(QUAD[i].ope,"<<");
                        else
                        strcpy(QUAD[i].ope,">>");
                        strcpy(QUAD[i].arg2,ch);
                        strcpy(QUAD[i].res,"t2");
                        i++;

                        for(t=0;t<c;t++)
                        {
                        for(j=n;j>=i;j--)
                        QUAD[j+1] = QUAD[j];
                        if(c==1)
                        {
                }


                        //itoa(c,ch,10);
                        snprintf(ch, 10, "%d", j);
                        if(flag==0)
                        strcpy(QUAD[i].ope,"+");
                        else
                        strcpy(QUAD[i].ope,"-");
                        tempo=i-1;
                        strcpy(QUAD[i].arg1,QUAD[tempo].res);
                        strcpy(QUAD[i].arg2,ch);
                        //itoa(i,cc,10);
                        snprintf(cc, 10, "%d", i);
                        strcat(ct,cc);
                        printf("CT is %s",ct);
                        strcpy(QUAD[i].res,ct);
                        }
                        else
                        {
                        strcpy(ct,"s");
                        //itoa(c-(c-1),ch,10);
                        snprintf(ch, 10, "%d", c-(c-1));

                        if(flag==0)
                        strcpy(QUAD[i].ope,"+");
                        else
                        strcpy(QUAD[i].ope,"-");
                        tempo=i-1;
                        strcpy(QUAD[i].arg1,QUAD[tempo].res);
                        strcpy(QUAD[i].arg2,ch);
                        //strcat("t",i);
                        //itoa(i,cc,10);
                        snprintf(cc, 10, "%d", i);
                        strcat(ct,cc);
                        strcpy(QUAD[i].res,ct);
                        }
                        i++;
                        n=n+1;
                        }

                    /*  itoa(c,ch,10);
                        strcpy(QUAD[i].ope,"+");
                        tempo=i-2;
                        strcpy(QUAD[i].arg1,QUAD[tempo].res);
                        tempo=tempo+1;
                        strcpy(QUAD[i].arg2,QUAD[tempo].res);
                        strcpy(QUAD[i].res,"t2");
                  */

                        }

            }

}
printf("n value =%d\n",n);
for(j=i;j<n;j++)
{
            if(strcmp(QUAD[j].arg1, pres) ==0)
            strcpy(QUAD[j].arg1,QUAD[i-1].res);
            else if (strcmp(QUAD[j].arg2, pres) ==0)
            strcpy(QUAD[j].arg2,QUAD[i-1].res);
            }
            if(c!=0)
            i = i-1;

}
}

void disp()
{
printf("\nQuadraple\noperator\targ1\targ2\tresult\n");
printf("n value is %d\n",n);
for(i=0;i<n;i++)
  printf("\t%s\t%s\t%s\t%s\n",QUAD[i].ope,QUAD[i].arg1,QUAD[i].arg2,QUAD[i].res);
}

void main()
{
get();
disp();
const_folding();
printf("Quadruples after constant folding\n");
disp();
strength_reduction();
printf("Quadruples after strength reduction\n");
disp();
}
```

OUTPUT:



```
Quadraple
operator        arg1    arg2    result
n value is 4
        =       15              t1
        /       a       8       t2
        +       t1      t2      t3
        =       t3      -       a
n value =4
number! is 2^3 + 0n value =4
n value =4
n value =4
Quadruples after strength reduction

Quadraple
operator        arg1    arg2    result
n value is 4
        =       15              t1
        >>      a       3       t2
        +       t1      t2      t3
        =       t3      -       a


...Program finished with exit code 4
Press ENTER to exit console.
```