SSN COLLEGE OF ENGINEERING, KALAVAKKAM

DEPARTMENT OF COMPUTER SCIENCE &ENGINEERING

UCS1602 - Compiler Design

Assignment-8 Implementation of code optimization techniques

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sec:CSE-A

source code:

```
#include <stdio.h>

#include <string.h>

#include <stdlib.h>

#include <ctype.h>

#define NOL 50

#define SOL 50

int main(){

char ch, fname[25];

FILE *fp;

char *line = NULL;

size_t len = 0;

ssize_t read;

printf("Enter name of a file: ");

gets(fname);

fp = fopen(fname, "r");

if (fp == NULL){

perror("Error while opening the file.\n"); exit(-1);

}

printf("Input file contents: ");
```

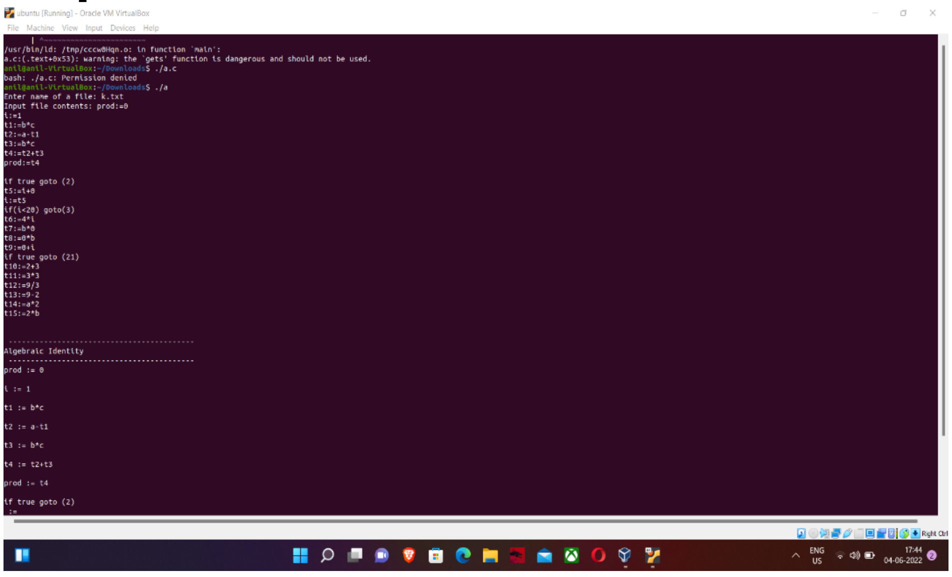
```
char **tac, **rhs, **lhs;
tac = malloc(NOL * sizeof(char *)); for (int i = 0; i < NOL; i++)
tac[i] = malloc((SOL + 1) * sizeof(char));
int loc = 0;
while ((read = getline(&line, &len, fp)) != -1){ printf("%s", line);
if (read > 2){
strcpy(tac[loc++],  line);
}
}
fclose(fp);
int *leaders;
leaders = malloc(loc * sizeof(int));
leaders[0] = 0;
int lnum = 0;
for (int i = 0; i < loc; i++){
char *gt = strstr(tac[i], "goto");
if (gt){
leaders[++lnum] = i;
leaders[++lnum] = i + 1;
}
}
char *token;
rhs = malloc(loc * sizeof(char *)); for (int i = 0; i < loc; i++)
rhs[i] = malloc((SOL + 1) * sizeof(char));
lhs = malloc(loc * sizeof(char *)); for (int i = 0; i < loc; i++)
lhs[i] = malloc((SOL + 1) * sizeof(char));
for (int i = 0; i < loc; i++){
token = strtok(tac[i], ":=");
```

```
if (token == NULL)

strcpy(lhs[i],  "\n");

else

strcpy(lhs[i],  token);

token = strtok(NULL, ":=");

if (token == NULL)

strcpy(rhs[i],  "\n");

else

strcpy(rhs[i],  token);

}

for (int i = 0; i < loc; i++){

int len = strlen(rhs[i]);

if (len == 5 && strstr(rhs[i], "0") != NULL){ if (rhs[i][1] == '+'){

if (rhs[i][0] == '0'){

rhs[i][0] = rhs[i][2];

rhs[i][1] = ' ';

rhs[i][2] = ' ';

}

else if (rhs[i][2] == '0'){

rhs[i][1] = ' ';

rhs[i][2] = ' ';

}

}

else if (rhs[i][1] == '*'){

if (rhs[i][0] == '0'){

char replace[] = "";

strncat(replace, "0", 1);

strcpy(rhs[i],  replace);
}

else if (rhs[i][2] == '0'){

char replace[] = "";

strncat(replace, "0", 1);

strcpy(rhs[i],  replace);

}

}

}

}

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

for (int i = 0; i < loc; i++){

printf("%s := %s \n", lhs[i], rhs[i]);

}

for (int i = 0; i < loc; i++){

int len = strlen(rhs[i]);

if (len == 5 && isdigit(rhs[i][0]) && isdigit(rhs[i][2])){ if
(rhs[i][1] == '+'){

int x = rhs[i][0] - '0';

int y = rhs[i][2] - '0';

rhs[i][0] = (x + y) + '0';

rhs[i][1] = ' ';

rhs[i][2] = ' ';

}

else if (rhs[i][1] == '-'){

int x = rhs[i][0] - '0';

int y = rhs[i][2] - '0';

rhs[i][0] = (x - y) + '0';

rhs[i][1] = ' ';
```

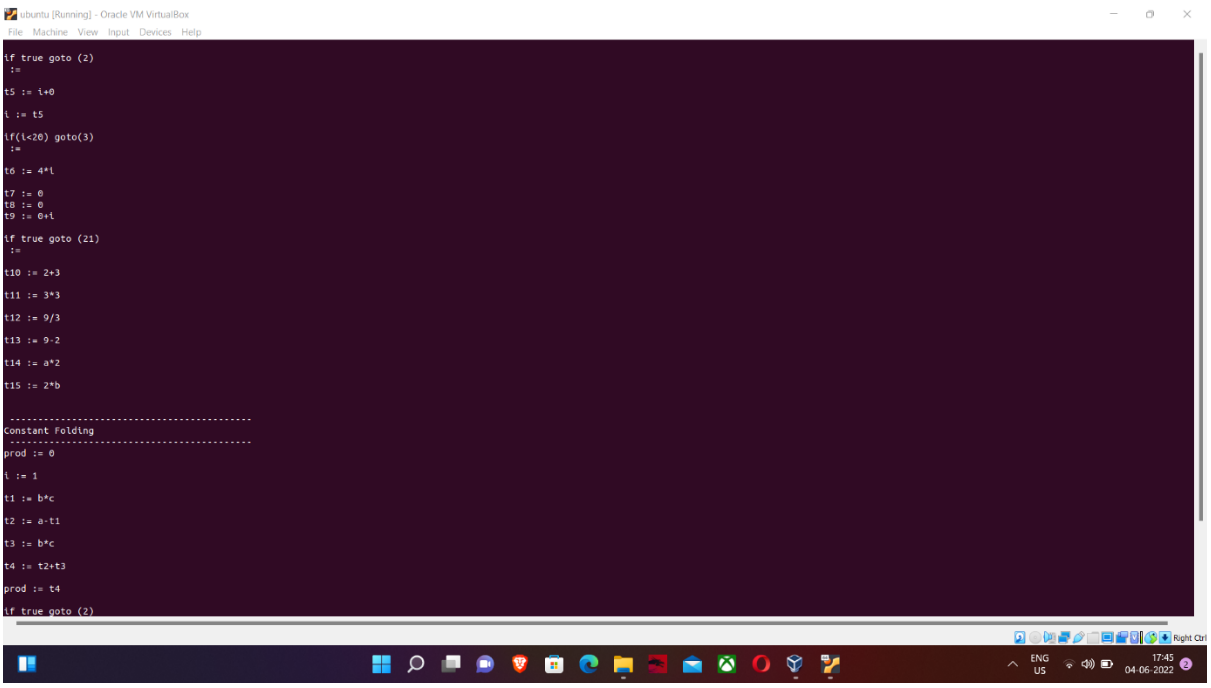
```
rhs[i][2] = ' ';

}

else if (rhs[i][1] == '*'){

int x = rhs[i][0] - '0';

int y = rhs[i][2] - '0';

rhs[i][0] = (x * y) + '0';

rhs[i][1] = ' ';

rhs[i][2] = ' ';

}

else if (rhs[i][1] == '/'){

int x = rhs[i][0] - '0';

int y = rhs[i][2] - '0';

rhs[i][0] = (x / y) + '0';

rhs[i][1] = ' ';

rhs[i][2] = ' ';

}

}

}

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

for (int i = 0; i < loc; i++){

printf("%s := %s \n", lhs[i], rhs[i]);

}

for (int i = 0; i < loc; i++){

int len = strlen(rhs[i]);

if (len == 5){

if (rhs[i][0] == '2' && rhs[i][1] == '*'){

if (rhs[i][2] >= 'a' && rhs[i][2] <= 'z'){ rhs[i][0] = rhs[i][2];
rhs[i][1] = '+';

}

}

else if (rhs[i][1] == '*' && rhs[i][2] == '2'){ if (rhs[i][0] >= 'a'
&& rhs[i][0] <= 'z'){

rhs[i][1] = '+';

rhs[i][2] = rhs[i][0];

}

}

}

}

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

for (int i = 0; i < loc; i++){

printf("%s := %s \n", lhs[i], rhs[i]);

}

for (int i = 0; i < loc; i++){

printf("line %d ====> %s := %s \n", i, lhs[i], rhs[i]);

}

printf("\nNumber of basic blocks: %d\n", lnum + 1);

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

printf("| Leader | Line |\n");

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

for (int i = 0; i <= lnum; i++){

printf("|  %d    |     %d    |\n",(i+1),leaders[i]);

}

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

for (int i = 0; i < lnum; i++){

char *gt = strstr(tac[leaders[i]], "goto"); char *t =
strstr(tac[leaders[i]], "true"); if (gt && t){
```

```
int goto_num_units, goto_num;

int last = strlen(tac[leaders[i]]); if
(isdigit(tac[leaders[i]][15])){

goto_num_units = tac[leaders[i]][15] - '0';

goto_num = tac[leaders[i]][14] - '0';

goto_num = goto_num * 10 + goto_num_units;

}

else{

goto_num = tac[leaders[i]][14] - '0';

}

if (goto_num < leaders[i]){

printf("If we consider line %s, dead code found from %d to line
%d\n", tac[leaders[i]], leaders[i], loc);

}

else{

printf("If we consider line %s, dead code found from line %d to line
%d\n", tac[leaders[i]], leaders[i], goto_num);

}

}

}
```

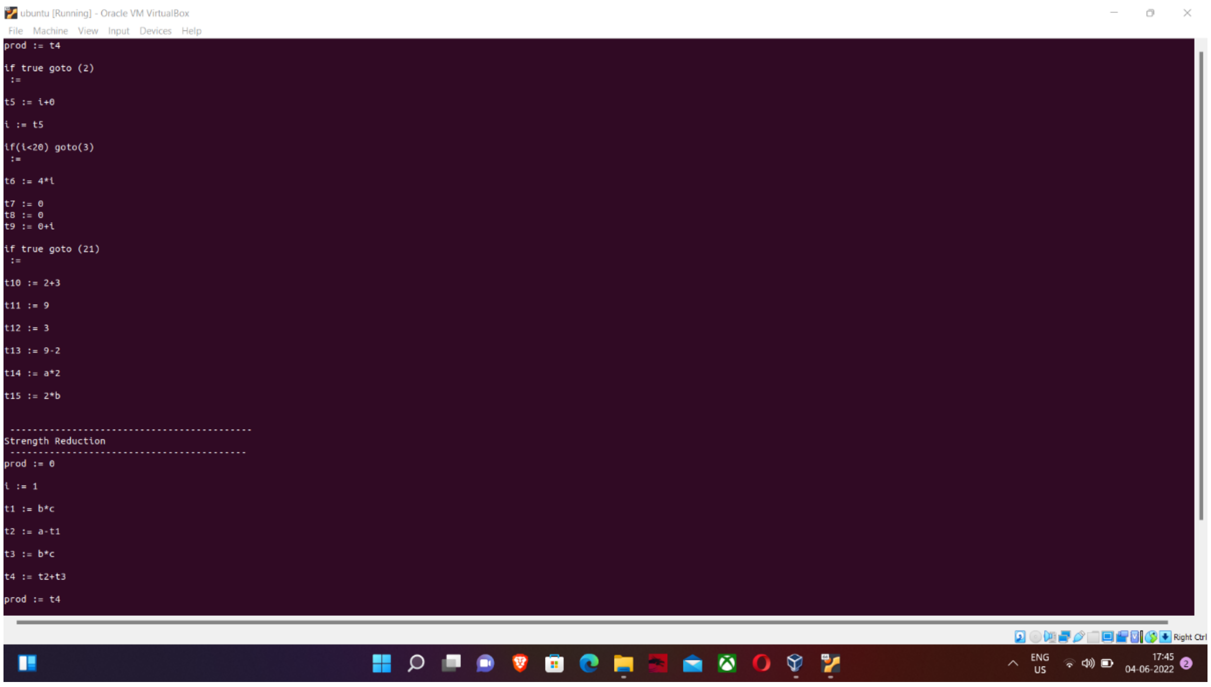
Output:


ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

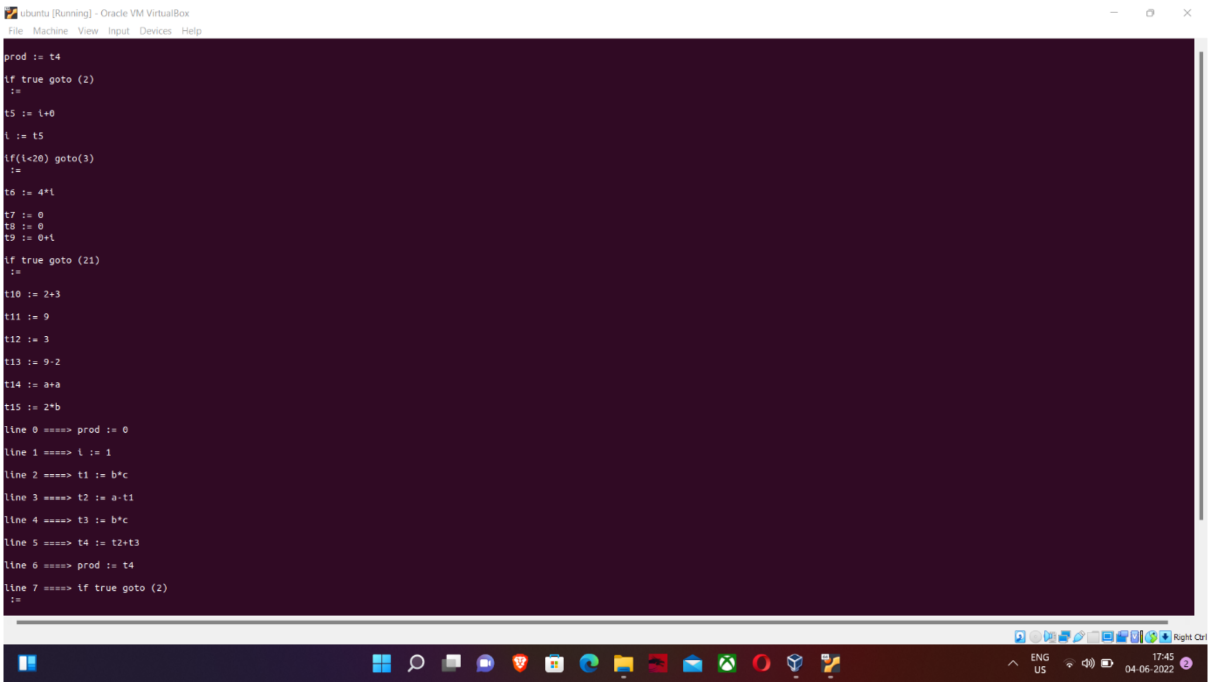
```
/usr/bin/ld: /tmp/cccw0Hqn.o: in function `main':
a.c:(.text+0x53): warning: the `gets' function is dangerous and should not be used.
anil@anil-VirtualBox:~/Downloads$ ./a.c
bash: ./a.c: Permission denied
anil@anil-VirtualBox:~/Downloads$ ./a
Enter name of a file: k.txt
Input file contents: prod:=0
i:=1
t1:=b*c
t2:=a-t1
t3:=b*c
t4:=t2+t3
prod:=t4

if true goto (2)
t5:=i+0
i:=t5
if(i<20) goto(3)
t6:=4*i
t7:=b*0
t8:=0*b
t9:=0+i
if true goto (21)
t10:=2+3
t11:=3*3
t12:=9/3
t13:=9-2
t14:=a*2
t15:=2*b


 -----------------------------------------
Algebraic Identity
 -----------------------------------------
prod := 0

i := 1

t1 := b*c

t2 := a-t1

t3 := b*c

t4 := t2+t3

prod := t4

if true goto (2)
 :=
```


ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Right Ctrl
ENG US
17:45
04-06-2022

```
if true goto (2)
 :=

t5 := i+0

i := t5

if(i<20) goto(3)
 :=

t6 := 4*i

t7 := 0
t8 := 0
t9 := 0+i

if true goto (21)
 :=

t10 := 2+3

t11 := 3*3

t12 := 9/3

t13 := 9-2

t14 := a*2

t15 := 2*b


 ------------------------------------------
Constant Folding
 ------------------------------------------
prod := 0

i := 1

t1 := b*c

t2 := a-t1

t3 := b*c

t4 := t2+t3

prod := t4

if true goto (2)
```

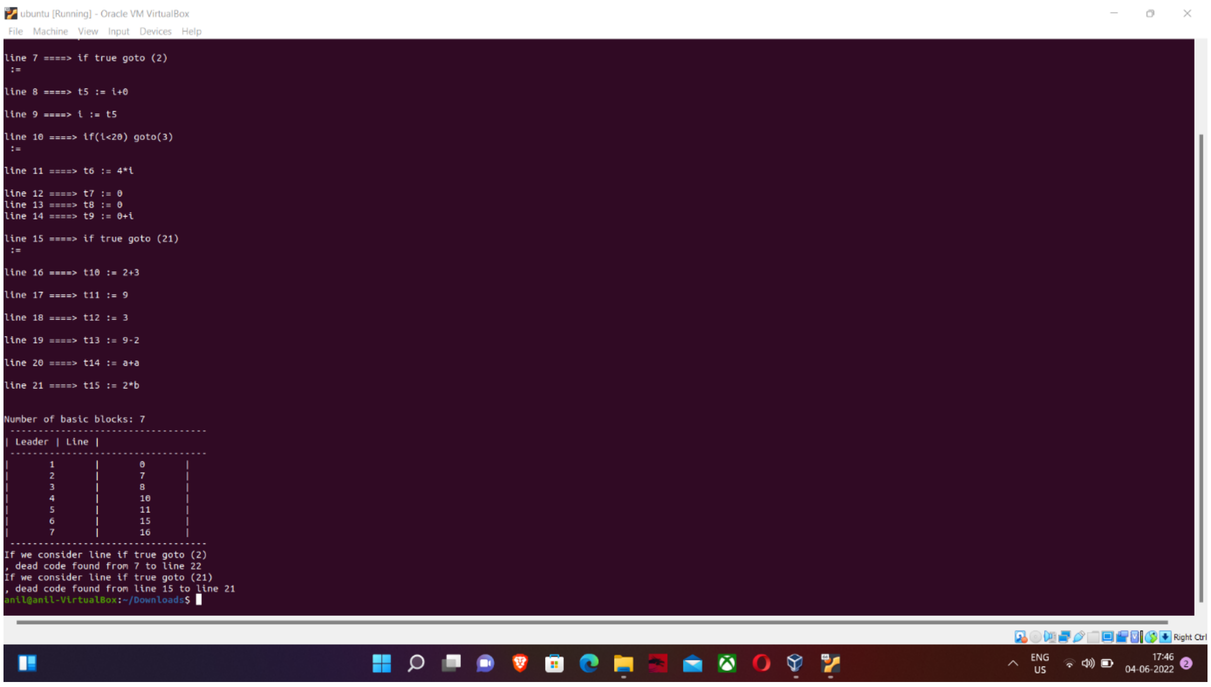

ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Right Ctrl
ENG US
17:45
04-06-2022

```
prod := t4

if true goto (2)
 :=

t5 := i+0

i := t5

if(i<20) goto(3)
 :=

t6 := 4*i

t7 := 0
t8 := 0
t9 := 0+i

if true goto (21)
 :=

t10 := 2+3

t11 := 9

t12 := 3

t13 := 9-2

t14 := a*2

t15 := 2*b


 ------------------------------------------
Strength Reduction
 -----------------------------------------
prod := 0

i := 1

t1 := b*c

t2 := a-t1

t3 := b*c

t4 := t2+t3

prod := t4
```



ubuntu [Running] - Oracle VM VirtualBox

```
prod := t4

if true goto (2)
 :=

t5 := i+0

i := t5

if(i<20) goto(3)
 :=

t6 := 4*i

t7 := 0
t8 := 0
t9 := 0+i

if true goto (21)
 :=

t10 := 2+3

t11 := 9

t12 := 3

t13 := 9-2

t14 := a+a

t15 := 2*b

line 0 ====> prod := 0

line 1 ====> i := 1

line 2 ====> t1 := b*c

line 3 ====> t2 := a-t1

line 4 ====> t3 := b*c

line 5 ====> t4 := t2+t3

line 6 ====> prod := t4

line 7 ====> if true goto (2)
 :=
```



ubuntu [Running] - Oracle VM VirtualBox

```
line 7 ====> if true goto (2)
 :=

line 8 ====> t5 := i+0

line 9 ====> i := t5

line 10 ====> if(i<20) goto(3)
 :=

line 11 ====> t6 := 4*i

line 12 ====> t7 := 0
line 13 ====> t8 := 0
line 14 ====> t9 := 0+i

line 15 ====> if true goto (21)
 :=

line 16 ====> t10 := 2+3

line 17 ====> t11 := 9

line 18 ====> t12 := 3

line 19 ====> t13 := 9-2

line 20 ====> t14 := a+a

line 21 ====> t15 := 2*b


Number of basic blocks: 7
 -----------------------------------
| Leader | Line |
 -----------------------------------
|       1       |       0       |
|       2       |       7       |
|       3       |       8       |
|       4       |       10      |
|       5       |       11      |
|       6       |       15      |
|       7       |       16      |
 -----------------------------------
If we consider line if true goto (2)
, dead code found from 7 to line 22
If we consider line if true goto (21)
, dead code found from line 15 to line 21
anil@anil-VirtualBox:~/Downloads$ 
```