
EXPERIMENT - XIII

CONSTANT PROPAGATION

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AIM

To write a program to perform constant propagation.

THEORY

Constant Propagation

Constant propagation is the process of substituting the values of known constants in expressions at compile time. Such constants include those defined above, as well as intrinsic functions applied to constant values. Consider the following pseudocode:

```
int x = 14;  
int y = 7 - x / 2;  
return y * (28 / x + 2);
```

Propagating x yields:

```
int x = 14;  
int y = 7 - 14 / 2;  
return y * (28 / 14 + 2);
```

ALGORITHM

Algorithm 1 Algorithm to perform constant propagation

```
1: Start
2: Read the input file.
3: Create an empty list x.
4: top=0
5: for line in file do
6:   if line is of the form variable=value then
7:     x[top++]= (variable,value)
8:   else if An operation is performed on variable in x then
9:     Update variable value in x.
10:  else
11:    for var in x do
12:      if var[0] present in line then
13:        Replace var[0] with var[1].
14:      end if
15:    end for
16:  end if
17: end for
18: Stop
```

SOURCE CODE

```
def newline(line, var, val):
    op=('+', '-', '*', '/', '%', '[', ']', '=', '<', '>', '(', ')')
    start=0
    for _ in range(line.count(var)):
        start=line.find(var, start+1)
        end=start+len(var)
        if line[start-1] in op:
            line=line[:start]+val+line[end:]
    return line

def constant_propagation(program):
    variable={}
    for line in program:
        x=line.split(":=");
        if len(x)==2:
            lhs=x[0]
            rhs=x[1].split(";")
            if '+' in rhs[0]:
                op=rhs[0].split("+")
                if op[0] in variable.keys():
                    op[0]=variable[op[0]]
                variable[lhs]=str(int(op[0])+int(op[1]))
            elif '-' in rhs[0]:
                op=rhs[0].split("-")
                if op[0] in variable.keys():
                    op[0]=variable[op[0]]
                variable[lhs]=str(int(op[0])-int(op[1]))
            elif '*' in rhs[0]:
                op=rhs[0].split("*")
                if op[0] in variable.keys():
                    op[0]=variable[op[0]]
                variable[lhs]=str(int(op[0])*int(op[1]))
            elif '/' in rhs[0]:
```

```
        op=rhs[0].split("/")
        if op[0] in variable.keys():
            op[0]=variable[op[0]]
            variable[lhs]=str(int(op[0])/int(op[1]))
    elif '%' in rhs[0]:
        op=rhs[0].split("%")
        if op[0] in variable.keys():
            op[0]=variable[op[0]]
            variable[lhs]=str(int(op[0])%int(op[1]))
    else:
        variable[lhs]=rhs[0]

#else:
for var in variable.keys():
    if var in line:
        val=variable[var]
        line=newline(line,var,val)
print(line,end="")

program=[]
print("The program is in the file p13.txt.\n")
f=open("p13.txt","r")
for line in f:
    program.append(line)
f.close()
constant_propagation(program)
```

SAMPLE OUTPUT

```
user@adithya-d-rajagopal:~/s7/cd$ cat p13.txt
x:=5;
f:=x+3;
if(a[f]%x==0)
printf("**");
user@adithya-d-rajagopal:~/s7/cd$ python3 p13.py
The program is in the file p13.txt.

x:=5;
f:=5+3;
if(a[8]%5==0)
printf("**");
user@adithya-d-rajagopal:~/s7/cd$
```

RESULT

A program to perform constant propagation has been implemented using Python and the outputs were verified.