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Roll No: 39 Class- MSC CS Part I

Subject: Design and implementation of Modern Compilers

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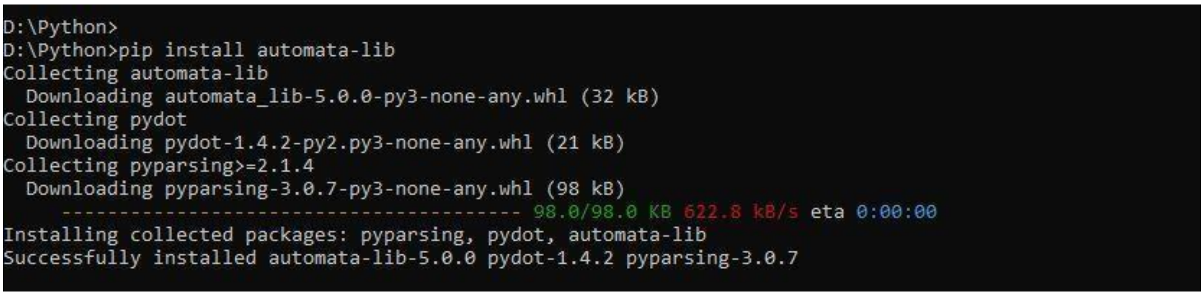
Practical NO 1

Aim : Write a program to construct NDFA Install

package automata-lib

By using the following command:

```
pip install automata-lib
```

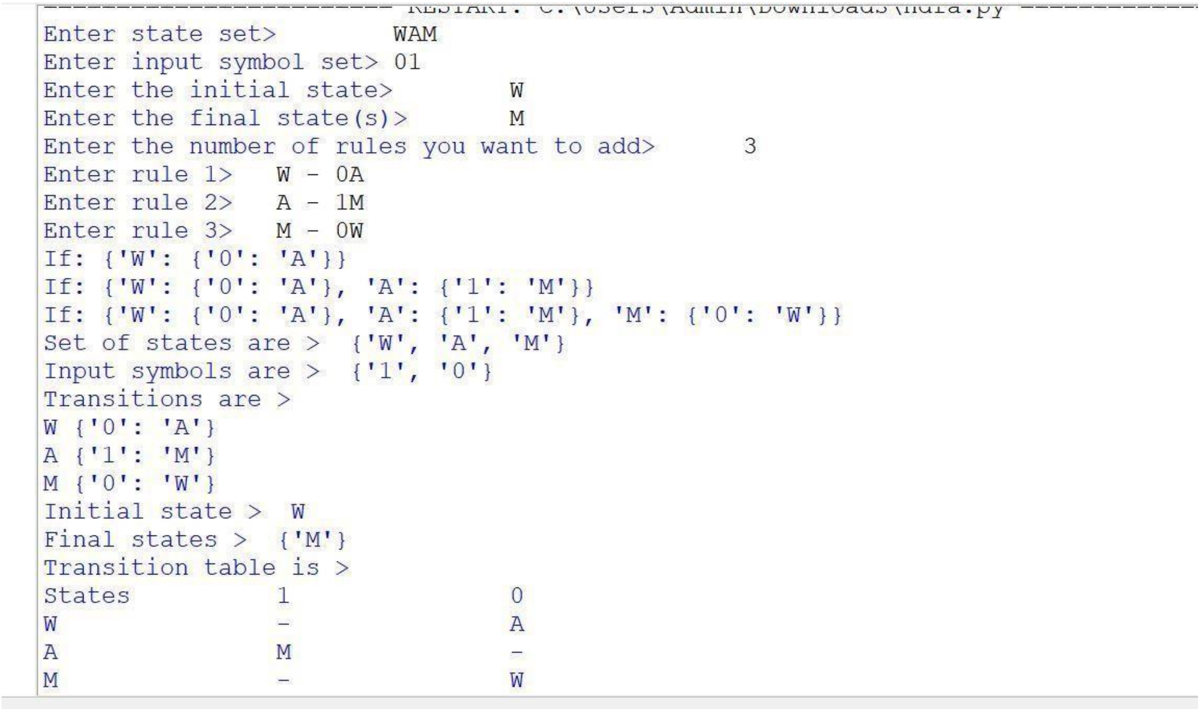


```
D:\Python>
D:\Python>pip install automata-lib
Collecting automata-lib
  Downloading automata_lib-5.0.0-py3-none-any.whl (32 kB)
Collecting pydot
  Downloading pydot-1.4.2-py2.py3-none-any.whl (21 kB)
Collecting pyparsing>=2.1.4
  Downloading pyparsing-3.0.7-py3-none-any.whl (98 kB)
     ---------------------------------------- 98.0/98.0 KB 622.8 kB/s eta 0:00:00
Installing collected packages: pyparsing, pydot, automata-lib
Successfully installed automata-lib-5.0.0 pydot-1.4.2 pyparsing-3.0.7
```

```
Code: from automata.fa.nfa

import NFA class NDFA:

   def__init __(self):

      state_set = set(input("Enter state set>\t"))

      input_symbols = set(input("Enter input symbol set>\t"))

      initial_state = input("Enter the initial state>\t")

      final_states = set(input("Enter the final state(s)>\t"))

      rule_count = int(input("Enter the number of rules you

want to add>\t")) rules

      = []
```

```
        for counter in range(rule_count):
            rules.append(input("Enter rule " + str(counter + 1) +
">\t").replace(" ", "")) rules =
        self.get_transitions(rules)


        self.nfa = NFA( states = state_set,
            input_symbols =
            input_symbols, transitions =
            rules, initial_state =
            initial_state, final_states =
            final_states
        )
        del state_set, input_symbols, initial_state, final_states,
rules.

    def get_transitions(self, rules):
        rules = [i.split("-") for i in rules]
        rules_dict = {}
for rule in rules:
            if rule[0] not in rules_dict:
                rules_dict[rule[0]] = {rule[1][1]:rule[1][0]}
                print("If:", rules_dict)
            else:
                rules_dict[rule[0]][rule[1][0]] = rule[1][1]
                print("Else:", rules_dict)
            return rules_dict


    def print_stats(self):
        print("\n\nSet of states are > ", self.nfa.states)
        print("Input symbols are > ",
        self.nfa.input_symbols) print("Transitions are > ")
        for transition in self.nfa.transitions:
            print(transition, self.nfa.transitions[transition])
        print("Initial state > ", self.nfa.initial_state)
        print("Final states > ", self.nfa.final_states)

def print_transition_table(self): input_symbols =
list(self.nfa.input_symbols)     transitions     =
self.nfa.transitions

print("\n\nTransition table is > ")


#print(f"States\t\t{input_symbols[0]}\t\t{input_symbols[1]}"
) print("States\t\t" + str(input_symbols[0]) + "\t\t" +
str(input_symbols[1])) for
    transition in transitions:
        for input_symbol in input_symbols:
            try:
                temp = transitions[transition][input_symbol] del
                temp
            except KeyError:
                transitions[transition][input_symbol] = "-"

#print(f"{transition}\t\t{transitions[transition][input_symbol
s
[0]]}\t\t{transitions[transition][input_symbols[1]]}")
        print(transition + "\t\t" +
transitions[transition][input_symbols[0]] + "\t\t" +
transitions[transition][input_symbols[1]]) del
input_symbols, transitions if_name_== "_main __":
ndfa = NDFA() ndfa.print_stats()
ndfa.print_transition_table()
```

Output:



```
======================== RESTART: C:\Users\Admin\Downloads\ndfa.py ============
Enter state set>        WAM
Enter input symbol set> 01
Enter the initial state>        W
Enter the final state(s)>       M
Enter the number of rules you want to add>      3
Enter rule 1>   W - 0A
Enter rule 2>   A - 1M
Enter rule 3>   M - 0W
If: {'W': {'0': 'A'}}
If: {'W': {'0': 'A'}, 'A': {'1': 'M'}}
If: {'W': {'0': 'A'}, 'A': {'1': 'M'}, 'M': {'0': 'W'}}
Set of states are >  {'W', 'A', 'M'}
Input symbols are >  {'1', '0'}
Transitions are >
W {'0': 'A'}
A {'1': 'M'}
M {'0': 'W'}
Initial state >  W
Final states >  {'M'}
Transition table is >
States          1               0
W               -               A
A               M               -
M               -               W
```

PRACTICAL NO

2

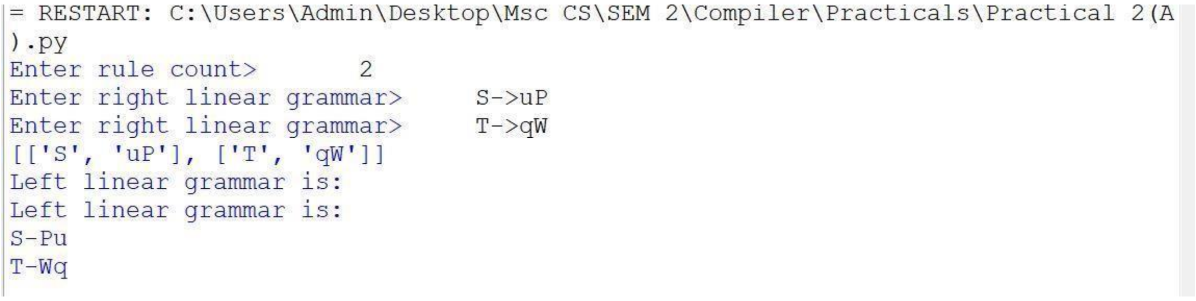
Aim: Write a program to convert the given Right linear grammar to Left Linear Grammar form.

CODE:

```
def get_transitions(rules):
    my_dict={}
    ld=''
    res=dict()
    r='' for i in
    rules:
       my_dict[i[0]]=[i[1][1],i[1][0]]
    for sub in my_dict:
      if isinstance(my_dict[sub],list):
        res[sub]=ld.join([str(ele) for ele in my_dict[sub]])
      print("Left linear grammar is:")
    for item in res:
       r+=item+"-"+str(res[item])+"\n"
    print(str(r))


rule_count=int(input("Enter rule count>\t"))
```

```
rules=[] for i in

range(rule_count):

    rules.append(input("Enter right linear grammar"+">\t"))

rules=[i.split("->") for i in rules]

print(rules) get_transitions(rules)
```

OUTPUT:



```
= RESTART: C:\Users\Admin\Desktop\Msc CS\SEM 2\Compiler\Practicals\Practical 2(A
).py
Enter rule count>       2
Enter right linear grammar>     S->uP
Enter right linear grammar>     T->qW
[['S', 'uP'], ['T', 'qW']]
Left linear grammar is:
Left linear grammar is:
S-Pu
T-Wq
```

3

Aim: Write a code to generate DAG for input arithmetic expression.

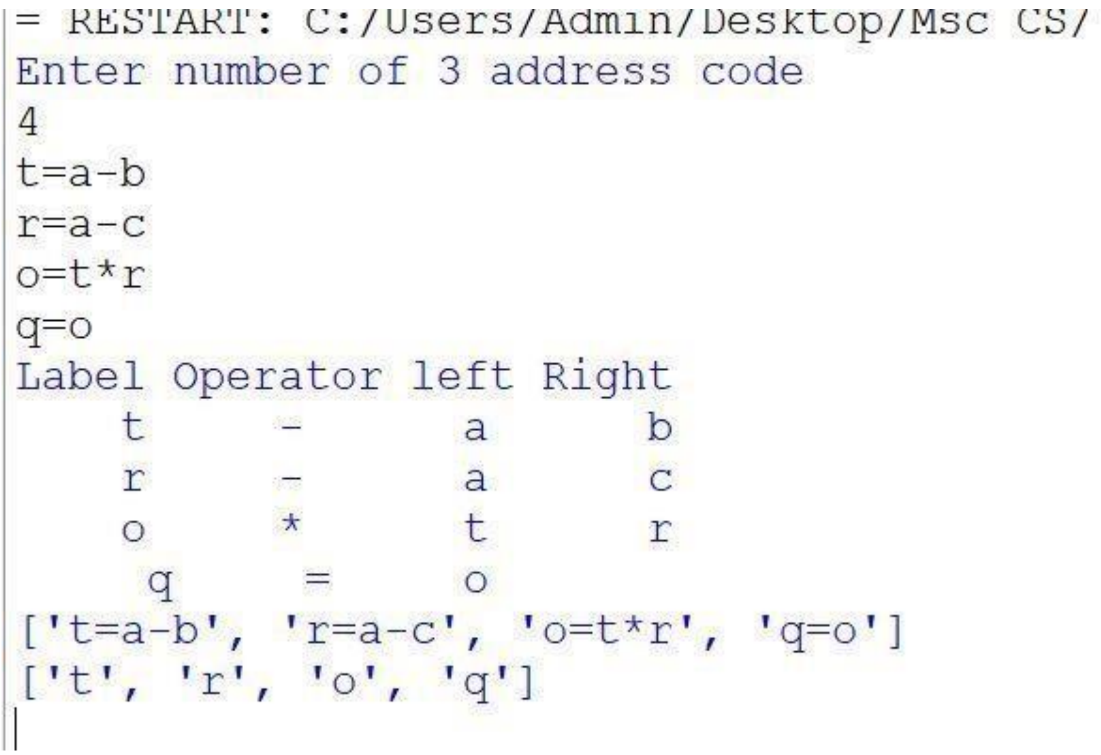
CODE:

```
def funct1(x):

   main=[] for i in

   range(0,x):

   y=input()

   main.append(y)
```

PRACTICAL NO

```
print("Label Operator left Right")

for i in range(0,x): q=main[i] if

q[0] not in res:

      res.append(q[0])

   if(len(q)>3):

       print(" ",q[0]," ",q[3],"       ",q[2]," ",q[4])

   else:

     print(" ",q[0]," ",q[1]," ",q[2]," ")

print(main) print(res)

print("Enter number

of 3 address code")

x=input() x=int(x)

res=[] funct1(x)
```

Output:



```
= RESTART: C:/Users/Admin/Desktop/Msc CS/
Enter number of 3 address code
4
t=a-b
r=a-c
o=t*r
q=o
Label Operator left Right
    t      -       a      b
    r      -       a      c
    o      *       t      r
     q      =      o
['t=a-b', 'r=a-c', 'o=t*r', 'q=o']
['t', 'r', 'o', 'q']
```

4

Aim: Write a code for triples.

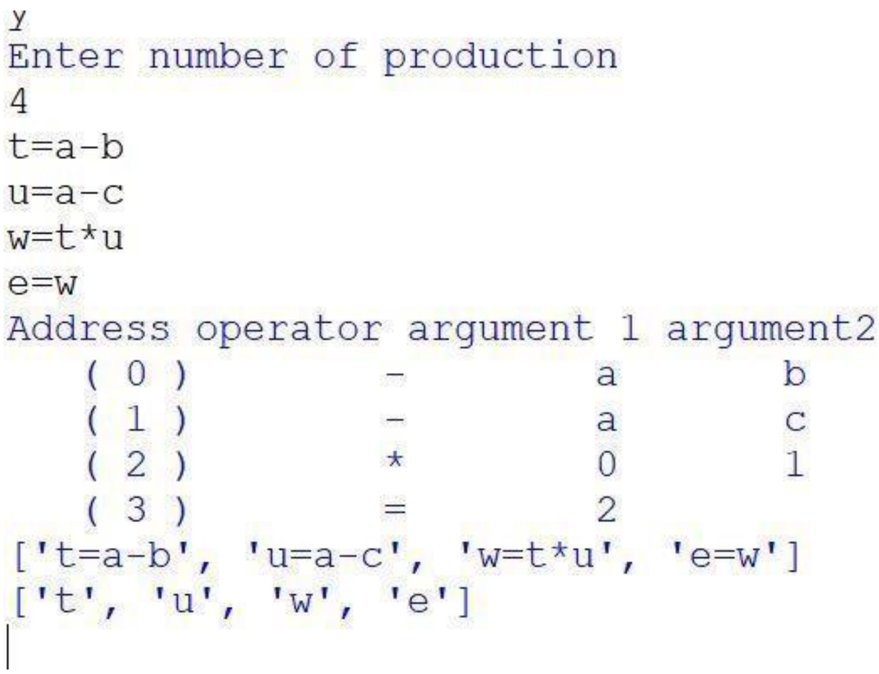
Code:

```
def funct1(x):
   main=[] for i in
   range(0,x):
   y=input()
   main.append(y)
   print("Address operator argument 1 argument2")
```

```
    for i in range(0,x):
        g=main[i] if g[0]
        not in res:
            res.append(g[0])
        e=funct2(g[2])
        if(len(g)>3):
        r=funct2(g[4])
             print(" (",i,")","       ",g[3],"      ",e,"     ",r)
        else:
             print(" (",i,")","       ",g[1],"      ",e,"     ")
    print(main) print(res)
def funct2(g): try:
        z=res.index(g)
    return(z) except:
        return(g)
print("Enter number of production")
x=input() x=int(x) res=[] funct1(x)
```

PRACTICAL NO

Output:



```
y
Enter number of production
4
t=a-b
u=a-c
w=t*u
e=w
Address operator argument 1 argument2
   ( 0 )        -        a        b
   ( 1 )        -        a        c
   ( 2 )        *        0        1
   ( 3 )        =        2
['t=a-b', 'u=a-c', 'w=t*u', 'e=w']
['t', 'u', 'w', 'e']
```

5

Aim: Write the code for Postfix Evaluation CODE:

```
def postfix_evaluation(s):
   s=s.split() n=len(s) stack=[] for i
   in range(n):
      if s[i].isdigit():
         stack.append(int(s[i]))
      elif s[i]=="+": a=stack.pop() b=stack.pop()
         stack.append(int(a)+int(b))
      elif s[i]=="*": a=stack.pop() b=stack.pop()
      stack.append(int(a)*int(b)) elif s[i]=="/":
          a=stack.pop() b=stack.pop()
          stack.append(int(a)/int(b))
       elif s[i]=="-": a=stack.pop() b=stack.pop()
          stack.append(int(a)-int(b))
    return stack.pop()


s="8 7 8 * + 4 -" val=postfix_evaluation(s) print(val)
```

PRACTICAL NO

OUTPUT:

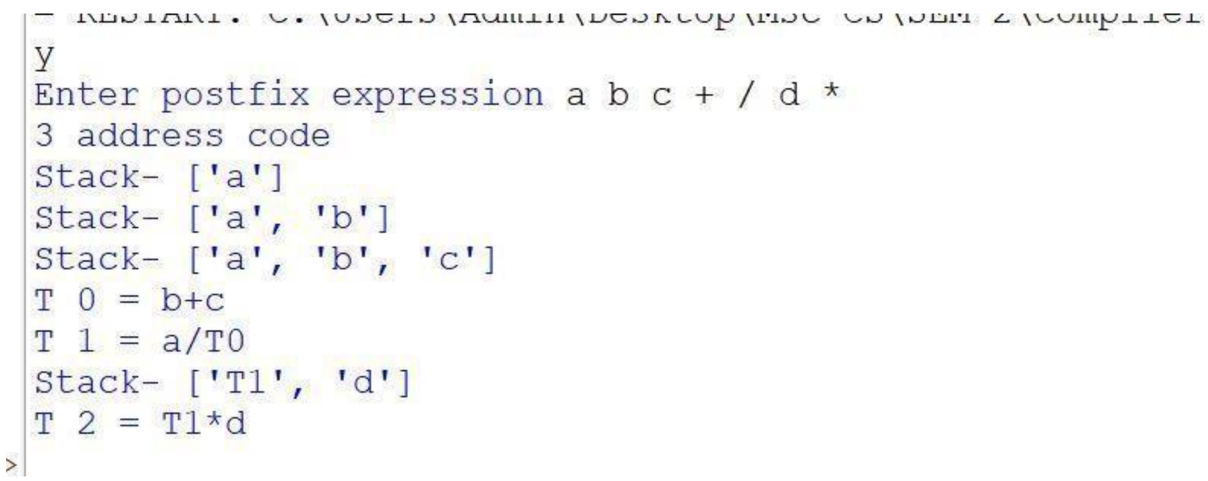
```
y
-60
```

6

Aim: Write a code to generate 3 address code Code:

```
postfix=input("Enter postfix expression").split()

operators=['+','-','/','*','^'] stack=[] result='' str1=''

count=0 print("3 address code")

for i in postfix:

   if i not in operators: stack.append(i)

   print("Stack-",stack) else:

      op1=stack.pop() op2=stack.pop()

      result=op2+i+op1 str1='T'+str(count)

      stack.append(str1)

      print("T",count,"=",result) count+=1
```

Output:



```
= RESTART: C:\Users\Admin\Desktop\MSc CS\SEM 2\Compiler
y
Enter postfix expression a b c + / d *
3 address code
Stack- ['a']
Stack- ['a', 'b']
Stack- ['a', 'b', 'c']
T 0 = b+c
T 1 = a/T0
Stack- ['T1', 'd']
T 2 = T1*d
>
```

PRACTICAL NO 7

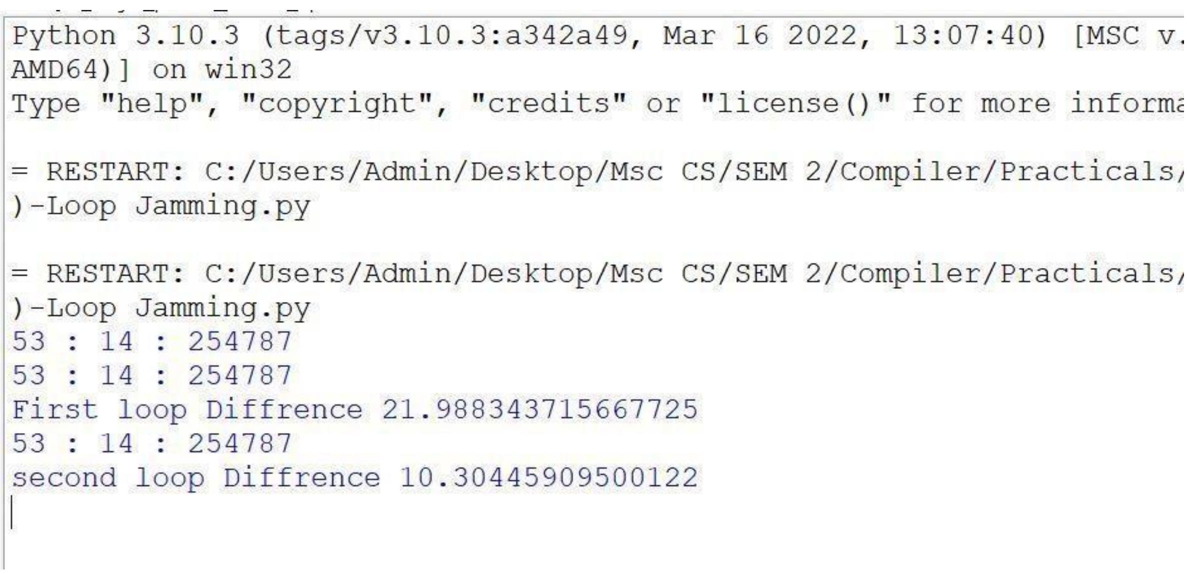
Aim: Write a program to demonstrate loop jamming for given code sequence containing loop. Code: Loop Jamming import time

```
from datetime import
datetime def
func1(arr1,arr2,arr3):
t1=datetime.now()
start=time.time()
    print(t1.minute,":",t1.second,":",t1.microsec
    ond) for i in range (0,10000000): sum=0 for j
    in range(0,len(arr1)): sum=sum+arr1[j]
        for k in
        range(0,len(arr2)):
        sum=sum+arr2[k] for
        l in
        range(0,len(arr3)):
```

```
      sum=sum+arr3[l]
   if(sum!=210): print(false)


tm=datetime.now()

done=time.time()

elapsed=done-start

print(t1.minute,":",t1.second,":",t1.microsecond

) print("First loop Difference",elapsed)


start=time.time() for i in

range(0,10000000): sum=0

for j in range(0,len(arr1)):

        sum=sum+arr1[j]

        sum=sum+arr2[j]

        sum=sum+arr3[j]

    if(sum!=210):

       print(false)

tn=datetime.now()
```

```
    done=time.time()

    elapsed=done-start

    print(t1.minute,":",t1.second,":",t1.microsecond

    ) print("second loop Diffrence",elapsed)


arr1=[10,20,30]

arr2=[20,10,30]

arr3=[40,40,10]

func1(arr1,arr2,arr3)
```

OUTPUT:



```
Python 3.10.3 (tags/v3.10.3:a342a49, Mar 16 2022, 13:07:40) [MSC v.
AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more informa

= RESTART: C:/Users/Admin/Desktop/Msc CS/SEM 2/Compiler/Practicals/
)-Loop Jamming.py

= RESTART: C:/Users/Admin/Desktop/Msc CS/SEM 2/Compiler/Practicals/
)-Loop Jamming.py
53 : 14 : 254787
53 : 14 : 254787
First loop Diffrence 21.988343715667725
53 : 14 : 254787
second loop Diffrence 10.30445909500122
```

PRACTICAL NO 8

Aim: Write a program to demonstrate loop unrolling for given code sequence containing loop.

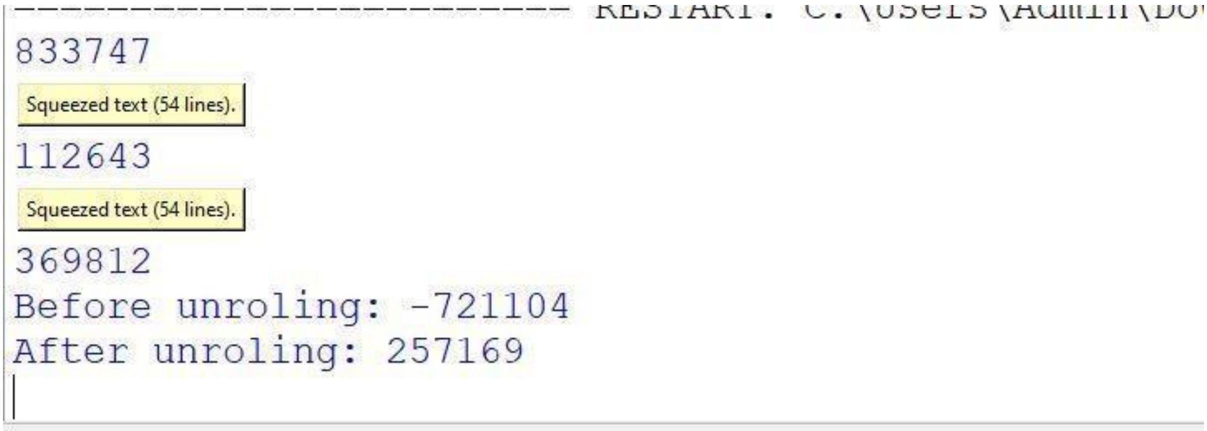
Loop Unrolling

Code: import

```
time

from datetime import datetime

def funct1(): arr=[] arr1=[]

t1=datetime.now()

start=t1.microsecond

print(start) for i in

range(0,1000):

        arr.insert(0,i)
```

```
  print(arr)

  t2=datetime.now()

  end1=t2.microsecond

  print(end1)

   for i in range(0,1000,4): arr1.insert(0,i)

      arr1.insert(0,i+1) arr1.insert(0,i+2)

      arr1.insert(0,i+3)

   print(arr1) t3=datetime.now()

   end2=t3.microsecond print(end2)

   print("Before unroling:",end1-start) print("After

   unroling:",end2-end1)

funct1()
```

OUTPUT:



```
------------------------ RESTART: C:\Users\Admin\Do
833747
Squeezed text (54 lines).
112643
Squeezed text (54 lines).
369812
Before unroling: -721104
After unroling: 257169
```