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Subject:

Design and implementation of Modern Compile

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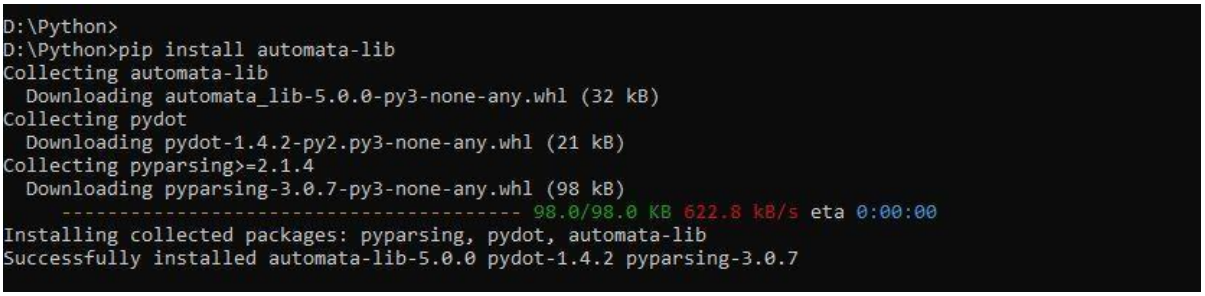
Practical NO 1

Aim : Write a program to construct NDFA

Install package automata-lib

By using the following command:

pip install automata-lib



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_symb
[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\nda.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
```

PRACTICAL NO 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)
   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']
```

PRACTICAL NO 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)
```

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']
```

PRACTICAL NO 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)
```

OUTPUT:

```
y
-60
|
```

PRACTICAL NO 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:

```
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 gi
code sequence containing loop.

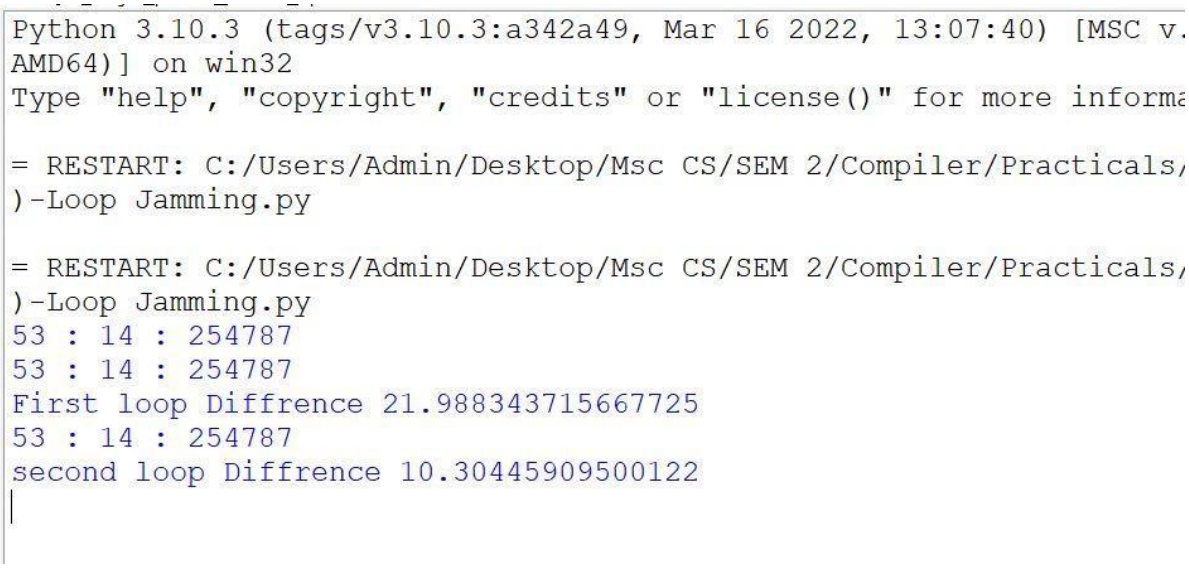
Code: Loop Jamming

```
import time
from datetime import datetime
def func1(arr1,arr2,arr3):
   t1=datetime.now()
   start=time.time()
   print(t1.minute,":",t1.second,":",t1.microsecond)
   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:



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: