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Roll No: 46 Class- MSC CS Part I

Subject:

Design and implementation of Modern Compilers

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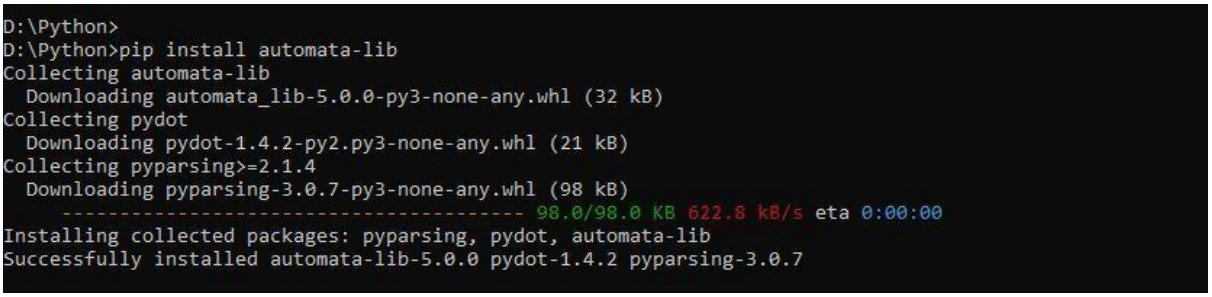
Practical NO 1

Aim : Write a program to construct NDFA

Install package automata-lib By

using the following command:

pip install automata-lib



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_symbols
[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\nda1.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 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.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)
```

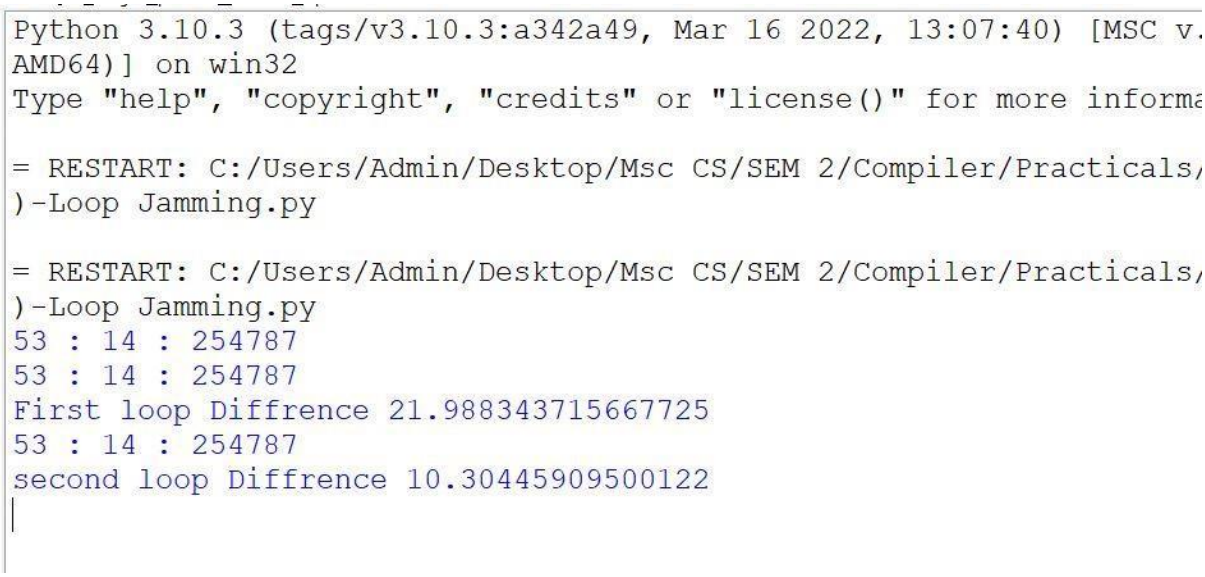
arr1=[10,20,30]

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: