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Roll No: 3 Class- MSC CS Part I

Subject:

Design and implementation of Modern Compilers

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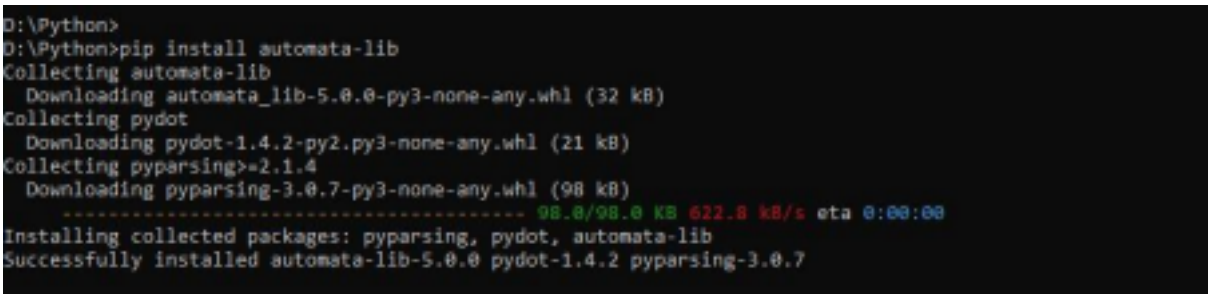
Practical NO 1

Aim : Write a program to construct NDFA

Install package automata-lib

By using the following command:

pip install automata-lib



Code:

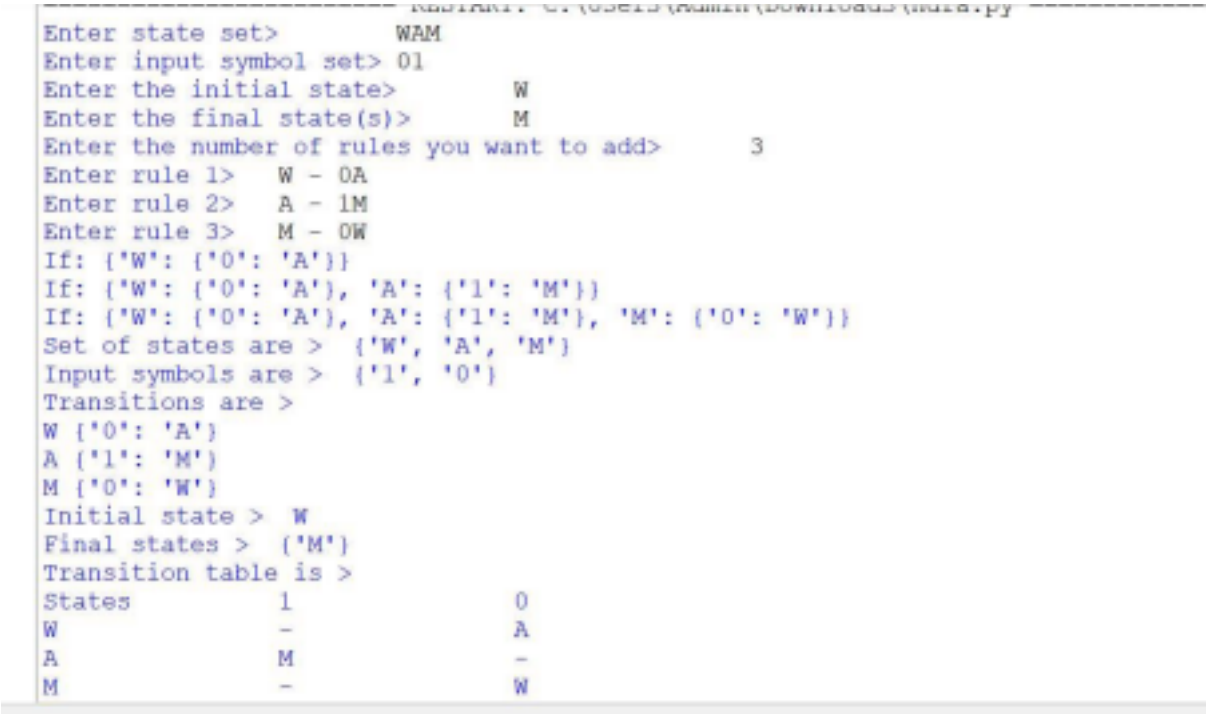
```
from automata.fa.nfa import NFA

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:



```
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:

```
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:

```
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 inform

= 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: