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Roll No: 7 **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_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\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 given code sequence containing loop.

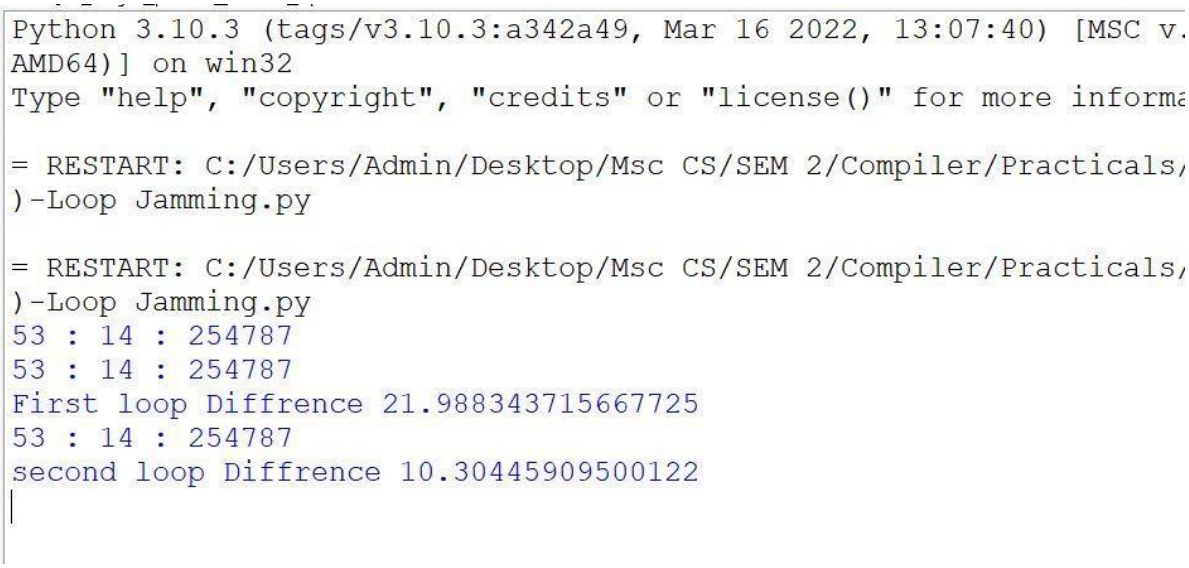
Code: Loop Jamming

```
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: